

Individual Preparedness for Nuclear Power Plant Emergencies

by:

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Abstract

To prepare for nuclear disaster, risk reduction strategies such as the pre-distribution of potassium iodide (KI) pills are essential, along with education on KI pill usage and other emergency preparedness measures. This research study was conducted to explore the existing knowledge on individual preparedness for residents living in a low risk, high impact area of a nuclear power plant. Using a quantitative research methodology, a survey questionnaire was distributed to residents located in the Town of Amherstburg following an announcement to update emergency response plans which would include the future pre-distribution of KI pills. Effective communication and advance notice of the upcoming survey questionnaire elicited a higher than expected response rate among the participants. Although perception of the risk was high, individual knowledge on KI and preparedness for nuclear disaster was largely misunderstood. In conclusion, communication is an important factor in the provision of information in order to increase resilience amongst the public.

Keywords: nuclear power plant emergencies, Fermi 2, potassium iodide, KI, preparedness, resilience, risk communication.

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Acronyms and Terminology

CNL - Canadian Nuclear Laboratories

CNSC - Canadian Nuclear Safety Commission

EMO – Emergency Management Ontario

ERP – Emergency Response Plan

KI – Potassium Iodide

MOHLTC – Ministry of Health and Long Term Care

USNRC – United States Nuclear Regulatory Commission

WECHU – Windsor-Essex County Health Unit

Fermi 2 – Enrico Fermi Nuclear Generating Station, Monroe, Michigan, USA.

Pre-distribution – Refers to the distribution of (KI pills) prior to an event, so that the pills are readily available to individuals in the event of an emergency.

Primary zone – In Canada the primary zone is the most at risk area surrounding a nuclear power plant in a radius of 10 kilometers of the plant. In the United States the primary or emergency planning zone is currently set at a 10 mile (16.1 kilometer) radius from a nuclear power plant.

Secondary zone – In Canada the secondary zone is the second at risk area surrounding a nuclear power plant in a radius of 10 to 50 kilometers of the plant. In the United States the secondary zone is currently set at a 50 mile (80.5 kilometer) radius from a nuclear power plant.

Chapter 1 – Introduction

The devastating events at Three Mile Island, Chernobyl, and the Fukushima Daiichi nuclear power plants remind us of the potential gravity of a radiological accident at one of the world's more than one hundred operating nuclear reactors. For those living within a specified radius of a nuclear reactor, it is critical that every necessary step is taken to ensure the health and safety of the public through comprehensive emergency planning and preparation.

Nuclear disasters pose an extremely rare but significant risk to the community members living in close proximity to nuclear power plants. Several nuclear power plant accidents around the world over the past forty years, such as Three Mile Island, Chernobyl, and Fukushima, have highlighted the health risks, or potential of health risks, to the public. For example studies suggest the possibility that those exposed to plumes of radioactive iodine released as a result of nuclear power plant accidents, may have increased adverse effects to their health including thyroid cancer (Braverman, Blum, Loeffke, Baker, Kreuk, Yang & Hurley, 2014; Schneider and Smith, 2012; Takamura, Hamada, Yamaguchi, Matsushita, Tarasiuk, Ohashi, Aoyagi, Mine & Yamashita, 2003). To help mitigate such effects it is important to establish robust emergency response plans prior to an event. Primary protective actions include the prevention of release from within nuclear power plants, and evacuation or sheltering protocol within the surrounding communities. Secondary protective measures include the pre-distribution of potassium iodide pills (KI pills) to those residents most likely to benefit from its early administration.

The Canadian Nuclear Safety Commission has recently mandated the use and pre-distribution of potassium iodide pills to those residing in the primary zones of a nuclear power plant in Ontario, as well as the availability of tablets for those residing within the secondary zones. Literature addresses the importance of the benefits associated with the uptake of

potassium iodide in the event that radioactive iodine gases are released into the atmosphere following a nuclear reactor failure.

In the event of a nuclear emergency, potassium iodide acts as a thyroid blocking agent for the absorption of radioactive iodine, if taken in the correct doses and at the appropriate time (Becker, 1983; Canadian Nuclear Laboratories, 2015; Feng & Keller, 2006; Franic, 1999). While evacuation or sheltering are considered important protective measures, the immediate administration of potassium iodide is considered a critical step in treating those who have been, or may be, immediately exposed to radioactive iodine, to prevent thyroid cancer (Emergency Management Branch, Ministry of Health and Long-Term Care, 2014; Franic, 1999). While the efficiency of potassium iodide uptake is largely dependent upon the time of exposure to radioactive iodine and the time of intake of potassium iodide (Franic, 1999), the best results are obtained when potassium iodide is taken one to two hours before or immediately after exposure to radioactive iodine (Becker, 1983; Braverman, Blum, Loeffke, Baker, Kreuk, Yang & Hurley, 2014; Feng & Keller, 2006; Fowinkle, Sell & Wolle, 1983; Franic, 1999).

In order to prepare for a nuclear power plant emergency, pre-distribution plans for potassium iodide are necessary to reduce the known potentially harmful effects associated with the release of potentially harmful effects of radioactive iodine gases into the atmosphere.

Background

The Canadian Nuclear Safety Commission regulates the operation of nuclear power plants in Canada by ensuring the pre-distribution of potassium iodide pills including an educational program for community members that reside near a nuclear power plant (Canadian Nuclear Laboratories, 2015; Canadian Nuclear Safety Commission, 2016). In the province of Ontario this includes Bruce Power, Chalk River, and Pickering Nuclear Facilities. In the primary

zone the pre-distribution of potassium iodide pills and educational material is mandatory, and in the secondary zone educational material is mandatory and potassium iodide pills are available at no charge for those that request them (Canadian Nuclear Laboratories, 2015; Canadian Nuclear Safety Commission, 2016).

The primary zone for nuclear power plants in Canada is the most at risk area surrounding a nuclear power plant consisting of those within a radius of ten kilometers from the plant, and the secondary zone is the second at risk area, with a radius of ten to fifty kilometers from the nuclear power plant (Canadian Nuclear Laboratories, 2015; Canadian Nuclear Safety Commission, 2016). In the United States these zones differ, where the primary or emergency planning zone is currently set at a ten mile radius from a nuclear power plant which equals 16.1 km. The secondary zone is currently set at a ten to fifty mile radius or 16.1 km to 80.5 km.

Enrico Fermi Nuclear Generating Station (Fermi 2) is a nuclear power plant in Monroe, Michigan, in the United States, located on the shores of Lake Erie. In the event of a nuclear emergency the primary zone is a 10 mile or 16.1 kilometer radius from the plant, which includes a portion of the Town of Amherstburg known as Amherst Point, as well as the southern tip of Bob-Lo Island, in Ontario, Canada. The secondary zone for Fermi 2 includes all of Windsor Essex County.

Figure 1: Map showing Fermi 2 primary and secondary zones

The Town of Amherstburg, with a population of around 22,000 people (Statistics Canada, 2017), sits on the north shores of Lake Erie and includes Bob-Lo Island located in the Detroit River on the Canadian side of the border. Approximately 95% of the entire population of the Town of Amherstburg are considered usual residents, defined as those persons permanently residing in a private dwelling (Statistics Canada, 2017).

Once an amusement park, Bob-Lo Island has been developed into a resort community with approximately 100 homes and condominiums, and is serviced by a private ferry to the mainland. Approximately ten percent of both the Amherst Point and Bob-Lo Island residents have permanent addresses at alternate locations with the majority of those located in the United States.

Problem

The Canadian Nuclear Safety Commission does not regulate or enforce requirements for operation of nuclear power plants located in the United States, including the pre-distribution of potassium iodide pills or educational material for the area within Canada that could be affected in the event of a nuclear power plant emergency at Fermi 2, located in the United States.

Through the Town of Amherstburg Emergency Response Plans, it is recognized that the community needs to be best prepared for a nuclear power plant emergency. Principal protective actions such as evacuation and sheltering (Office of Radiation Programs, 1992) should be supplemented with pre-distribution plans for potassium iodide pills in the primary zone and including Bob-Lo Island, to reduce the known risks associated with the release of potentially harmful radioactive gases and particulate matter into the atmosphere. It is intended that Bob-Lo Island be included in the pre-distribution plans as evacuation of the island could present unique challenges due to accessibility of the island only by ferry.

The Town of Amherstburg Fire Department and the Windsor-Essex County Health Unit are committed to ensuring that the development and implementation of a potassium iodide pill distribution plan occurs in the Town of Amherstburg, and that this includes an effective communication and education strategy for the public to best prepare for a nuclear disaster.

Significance of the Research

The purpose of this study was to determine individuals' existing knowledge on potassium iodide pills, and their preferred method of receiving new information on emergency preparedness measures for nuclear disasters. The research study is being conducted prior to the distribution and education campaign of potassium iodide pills to the residents of the primary zone in Amherst Point, and to those on Bob-Lo Island, in the Town of Amherstburg. Through the use of a survey questionnaire hand delivered to each residence in the primary zone in Amherst Point and to those on Bob-Lo Island, we can determine the level of existing knowledge on individual emergency preparedness for the use of potassium iodide pills, and other emergency preparedness measures.

The results of the survey questionnaire depicting the existing knowledge and the desired methods of communicating information will be used by health professionals and emergency managers, including the Windsor-Essex County Health Unit and the Town of Amherstburg Fire Department, to prepare a pill distribution plan and an education program for the residents.

The research study will help to address the vulnerability of the residents living in close proximity of a nuclear power plant, and to generate awareness on emergency preparedness measures for individuals during a nuclear power plant emergency. It is intended that the knowledge gained from this study will assist the development of a pre-distribution plan for potassium iodide pills and educational component that in turn will increase this specific population's resilience in the event of a nuclear disaster.

Goals of the Research Study

The main goal of the research study was to identify knowledge gaps associated with the use of potassium iodide pills. The study also sought to explore acceptable methods of pill distribution that will benefit and be useful to the community members in increasing their

resilience associated with a nuclear power plant disaster. These goals were best achieved using a Survey Questionnaire, which was preceded by a Notice of Survey.

The research study also held significance by involving the community members in having a voice in the future plans for pill distribution. It is critical to gain acceptance from the community itself when forging new emergency management plans (Dynes, 1994). Providing input through the use of a survey questionnaire allowed the residents to be a part of the planning process, not only in assessing the pre-existing knowledge on potassium iodide pills and emergency preparedness measures, but on developing future distribution plans and determining the best educational path and methods of communication with the residents.

Framework for Study

Using a risk reduction framework, my research study seeks to determine if there are knowledge gaps with respect to potassium iodide pill use, and the best method to educate individuals. Disaster risk reduction aims to reduce hazard damage through prevention, where the responsibility lies with local government, the private sector, and other stakeholders (Aitsi-Selmi, A., S. Egawa, H. Sasaki, C. Wannous, and V. Murray, 2015). The four priorities for action in the Sendai Framework of Disaster Risk Reduction include: 1) Understanding Disaster Risk: vulnerability, hazard characteristics, and the environment; 2) Managing Disaster Risk: fostering collaboration and partnership; 3) Investing in Risk Reduction: enhance community resilience; and 4) Enhancing Preparedness: strengthening disaster preparedness for response (Aitsi-Selmi et al. 2015).

In achieving risk reduction for a nuclear power plant emergency, it is important to build an awareness of the use and benefits of potassium iodide pills. Through the lens of a pragmatic

worldview, the philosophical basis for research leads me to seek and to generate practical, real-world solutions, and to explore the consequences of actions (Creswell, 2014).

The quantitative survey questionnaire provided an understanding of the current state of knowledge within the community and will guide the design strategy to implement successful and well received distribution and education plans for potassium iodide pills. Emergency management professionals will strive to develop an education program for the members of the community regarding nuclear emergency preparedness measures through the use of early interaction with the staff of the Town of Amherstburg Fire Department and the Windsor-Essex County Health Unit, and the local populations. The survey allows the residents to have a voice in the future distribution plan and the educational campaign regarding potassium iodide pills and nuclear emergency preparedness.

Chapter 2 – Literature Review

The Pennsylvania United States Three Mile Island partial core meltdown in 1979 included some release of radioactive gases, but not enough to cause dose above background levels to local residents (Schneider & Smith, 2012). The Chernobyl reactor failure in the USSR in 1986 was a catastrophic accident involving the release of large quantities of radioactive particles into the atmosphere resulting in multiple deaths and long term health issues including thyroid cancer (Takamura, Hamada, Yamaguchi, Matsushita, Tarasiuk, Ohashi, Aoyagi, Mine, & Yamashita, 2003). In 2011 the Fukushima Daiichi nuclear power facility in Japan suffered severe damage following a 9.0 earthquake and ensuing tsunami, which disabled the reactor's cooling systems and caused an explosion leading to environmental releases of radioactivity from one of the reactors (Dauer, Zanzonic, Tuttle, Quinn & Strauss, 2011). Following the Fukushima Daiichi nuclear accident, an excess of thyroid cancer has been detected by ultrasound among children and adolescents in Fukushima Prefecture within 4 years of the release (Tsuda, Tokinobu, Yamamoto, Suzuki, 2016).

Potassium iodide (KI) is currently used as one of the protective measures for the general public against the harmful effects of exposure caused from a release of radioactive iodine in the event of a nuclear reactor failure.

Pre-distribution of potassium iodide (KI) pills is important in the protection of local community members, however several factors must be considered in the formation of a pre-distribution plan. Consideration must be given to legislation governing the distribution of potassium iodide pills in the primary and secondary zones surrounding the nuclear power plants, the intended use and effects of potassium iodide pills, and the effectiveness of pre-distribution versus stockpiling including the method of distribution and educational campaigns.

Legislation

The emergency mandate of Canadian Nuclear Laboratories is to protect life and minimize loss, ensure a state of readiness, limit the effects of an emergency, and protect the health and safety of the public, the workers, and the environment (Canadian Nuclear Safety Commission, 2016).

The Canadian Nuclear Safety Commission has mandated within the last two years that nuclear power plants must pre-distribute KI pills in the primary zones and make them available in the secondary zones in order to obtain their operating licenses (Canadian Nuclear Safety Commission, 2016). A primary zone is determined as that area which surrounds a nuclear power plant within a 10 km radius, and the secondary zone extends to a radius of up to 50 km for the province of Ontario. Although nuclear power plants have been in operation for years, it is in the last two years that legal obligation has dictated the supply and distribution of KI pills in Ontario. The power plants located in Ontario created the plans themselves and have funded the distribution of KI tablets to the potentially affected areas over the past two years.

The Canadian legislation surrounding the pre-distribution of KI pills does not currently include those areas which may be affected by nuclear power plants located within the United States, with primary and secondary zones located inside Canadian borders. There are two nuclear power plants in the United States located on the northern borders of Michigan (Fermi II) and Ohio (Davis-Besse) which have primary and secondary zones extending into southwestern Ontario and affecting the Town of Amherstburg and surrounding municipalities, and Pelee Island in the Town of Leamington.

In the United States current legislation requires all areas within the primary zone or a 10 mile (16 km) radius of a nuclear power plant to have KI related policies including the decision

on whether to store the KI at distribution sites or to pre-distribute to households and other key locations (Schneider & Smith, 2012). These policies do not include Canadian households and businesses that reside within the primary zones of nuclear power plants located within the United States.

Around the world several countries have implemented pre-distribution plans, while other countries stockpile at various locations to be distributed by emergency services personnel as required.

Potassium Iodide: Use and Effects

In the event of the release of radioactive iodine gases and other particulate matter due to reactor failure within a nuclear power plant, there are several methods of protection to be considered including air filtration or masks, sheltering, food and milk control, and evacuation (Becker, 1983). The most efficient measure in personal protection and thyroid blocking is the administration of potassium iodide. Potassium iodide (KI) is a salt of stable iodine (non radioactive) which is an essential nutrient to ensure proper thyroid gland function. As a protective measure and for those directly exposed to internal radiation from the absorption of radioactive iodine into the body, oral consumption of KI blocks the uptake of radioactive iodine isotopes by the thyroid gland to help prevent thyroid cancer due to internal exposure (Wada, Yoshikawa, Hatashi & Aizawa, 2012). When a sufficient quantity of potassium iodide is given immediately before and during exposure the thyroid gland becomes saturated and the uptake of radioactive iodine can be reduced to almost zero (Becker, 1983).

In 1989 a committee for the World Health Organization (WHO) determined that KI should be administered to all population groups in the immediate vicinity of a nuclear reactor, and also to pregnant and nursing women and children under the age of sixteen even at sites that

are not in close proximity to the reactor (Takamura et al, 2003). Taking KI is not as high a priority for individuals over the age of 40 because studies show that the young are more sensitive to the effects of radiation. (Wada, Yoshikawa, Hatashi & Aizawa, 2012).

A critical component of the effective use of KI is the time at which it is taken. The best protective results are obtained when KI is taken one hour prior to or immediately following exposure. KI taken one hour after exposure provides a reduction to 85% protection of the thyroid gland, and six hours after exposure has negligible protective effects (Francic, 1999). It's important to note that KI pills are not anti-radiation pills, they will only block the uptake of radioactive iodine and not provide protective measures against other isotopes of elements found in radioactive releases.

While Three Mile Island had some release of radioactive gases, there were no levels recorded off site of the reactors to indicate any danger to residents. In contrast, both Chernobyl and Fukushima Daiichi involved the release of radioactive iodine gases into the environment and affecting those residents in the areas surrounding the nuclear power plants.

Pre-distribution of KI pills had not occurred in any of the zones prior to the nuclear accidents at Three Mile Island, Chernobyl, or Fukushima Daiichi. Following the accident at Three Mile Island in 1979 it was found that there was not an adequate supply of KI pills in the pharmacies and the majority of those in the affected areas did not receive KI pills. The confusion and misinformation in the hours and days following the event led to mass evacuation of the area, and fortunately the level of radioactive iodine released into the atmosphere was consistent with background doses. Distribution of KI following the release of radioactive iodine gases and particulate matter was carried out following the Chernobyl accident to a portion of residents but due to poor communication and general secrecy regarding the accident KI distribution was not

conducted effectively (Takamura et al, 2003). In the years following Chernobyl there was an increase in thyroid cancer in young children (Takamura et al, 2003). Subsequent to the nuclear disaster at Fukushima Daichii, KI was not administered to the general population, with a few exceptions of military and emergency personnel (Schneider & Smith, 2012). Other measures were put in place such as evacuation, control of the food chain, and monitoring of those attending shelters. Due to the effective use of these measures the dose threshold for the administration of KI was not met (Schneider & Smith, 2012).

Factors Affecting Pre-distribution of Potassium Iodide

Stockpiling available tablets or liquid forms of KI is not an effective measure in the event of a nuclear accident. Possible safety precautions may include sheltering in place, which would preclude the need to venture out of doors to receive KI pills from a stockpile distribution location. The distribution of KI at evacuation centers is also likely to be chaotic (Fowinkle, Sell & Wolle, 1983).

In an attempt to make preparations to respond to foreseeable nuclear accidents, the pre-distribution of KI would provide prompt access to those most likely to benefit by its early administration (Fowinkle, Sell & Wolle, 1983). In testing the radiation emergency plan for a nuclear power plant in Tennessee, the distribution of potassium iodide door to door or at a distribution center was determined to be too slow to protect people effectively (Fowinkle, Sell & Wolle, 1983). If the release of radioactive iodine is prolonged or there is a delay in evacuation far enough away to prevent exposure, then the pre-distribution of KI will provide the greatest mitigating effects to exposure.

Several factors should be considered in a KI pre-distribution plan including the availability of KI, population target size, number of households, number of other facilities

(schools, industries, community centers), geographic characteristics, evacuation plans, availability of professional staff for distribution and consultation, and public acceptance.

Methods of pre-distribution of KI tablets include registered mail packages with information for pick up at a distribution site, or door to door distribution by health care professionals. Fieldwork including distribution and the provision of information by professionals should be precluded by a training session so that staff can respond to general questions (Fowinkle, Sell & Wolle, 1983). The inclusion of news media in the training session is important in the promotion of an effective nuclear preparedness campaign. Local news media has proven important in terms of getting information out to people (Blando, Robertson & Bresnitz, 2008).

Both methods require the provision of basic information and fact sheets to support questions and answers, and general information on nuclear technology. Clear and simple instructions must accompany the packages of KI tablets, including information on restocking upon approaching the expiry date.

Demographics must be carefully considered including the size of population to be reached, education and interest level, and the general acceptance of a distribution campaign (Blando, Robertson & Bresnitz, 2007).

An educational campaign is the easiest form of communicating in advance the information required and providing an awareness to residents of the risks associated with living in close proximity to a nuclear power plant, as well as the protective measures put in place to limit the effects of an emergency and to promote life and health safety. Educational efforts must be continued and supplemented at regular intervals to address changes in residence, and to ensure retention of information (Becker, 1983).

Although pre-distribution may be undertaken for an area, there are likely to be residents that do not wish to take or to store the KI pills, or who misplace them, and additional measures must be put in place for site distribution at the time of a nuclear emergency in order to promote life safety to everyone in an affected area.

It is also of importance to address the method by which notification will be given to the public if an emergency has been declared and the decision is made for the use of KI. Sirens, radio, television, and social media will each reach only a portion of the at risk population. The Three Mile Island and Chernobyl incidents raised questions of credibility of the authorities as a result of misinformation and poor communication.

Pre-distribution of Potassium Iodide

Pre-distribution of potassium iodide (KI) pills is important in the protection of local community members, however several factors must be considered in the formation of a pre-distribution plan. Consideration must be given to legislation governing the distribution of potassium iodide pills in the primary and secondary zones surrounding the nuclear power plants, the intended use and effects of potassium iodide pills, and the effectiveness of pre-distribution versus stockpiling including the method of distribution and educational campaigns.

Response to a nuclear incident that includes the release of and exposure to radioactive iodine requires rapid organization of large numbers of people (Francic, 1999). While quickly distributing potassium iodide in the event of a disaster poses challenges, pre-distribution is also a possibility. Several factors should be considered where pre-distribution of potassium iodide is not mandatory, including the availability of KI, the size of the target population, the number of households and other types of facilities in the area, public acceptance, evacuation plans, and geographic and meteorological conditions (Fowinkle, Sell & Wolle, 1983).

A study was conducted in the area surrounding a nuclear power plant in Tennessee to evaluate the radiation emergency plans that would provide protection to citizens from radiation exposure at the time of a nuclear event (Fowinkle, Sell & Wolle, 1983). During two drills, the distribution of potassium iodide to residents was simulated in the pathway of a plume of radiation. The distribution of potassium iodide during the drills was determined to be too slow to provide adequate protection to residents (Fowinkle, Sell & Wolle, 1983). The study concluded that the pre-distribution of potassium iodide would be worthwhile, providing prompt access of potassium iodide to the residents that would most likely benefit from its early administration (Fowinkle, Sell & Wolle, 1983). Furthermore, the study found that the pre-distribution of potassium iodide pills to residents by face to face visits was widely accepted by approximately 66% of homes within 5 miles of the Tennessee nuclear power plant.

Knowledge Retention

In New Jersey, an evaluation was conducted several years after a potassium iodide distribution program that was carried out for residents living in the vicinity of nuclear power facilities. The surveys were developed to assess the effectiveness of education provided for those that had previously attended a distribution clinic. Mailed surveys resulted in a 49% response rate, with 58% of respondents reporting having obtained potassium iodide pills during a mass distribution campaign and knew how to use the potassium iodide pills in the event of a nuclear emergency (Blando, Robertson, Pearl, Dixon, Valcin and Bresnitz, 2007b). The study by Blando et al (2007b) further explored expected behaviors during an emergency, and found that 52% of the survey respondents did not know their evacuation route, but 85% would evacuate if told to do so by a government agency.

The Canadian Nuclear Safety Commission set new regulatory requirements in 2015 for the mandatory pre-distribution of potassium iodide pills to residents of the primary zone, together with instructions on their proper administration (Canadian Nuclear Laboratories, 2015; Canadian Nuclear Safety Commission, 2016). These requirements have been met by three nuclear power plants located in Ontario including Bruce Power, Chalk River, and Pickering Nuclear Facilities (Bruce Power, 2015; Canadian Nuclear Laboratories, 2015).

The pre-distribution of potassium iodide pills is essential in preparing individuals for a nuclear power plant failure, along with information on its use and benefits (Franic, 1999). Follow up studies have not been carried out at the nuclear power plants in Ontario to assess general knowledge on the proper use and administration of potassium iodide pills, at the time this research study was conducted.

Blando, Robertson, and Bresnitz (2008) conducted a study to assess information retention on knowledge about emergency preparedness resulting from the mass distribution of potassium iodide pills at nuclear power plants in New Jersey. This study concluded that training and information fact sheets delivered directly to recipients were the most effective at enhancing knowledge, as opposed to commercial media sources. Furthermore, Blando and colleagues (2007b) argued that a significant education and outreach component is required in order for potassium iodide pill distribution to be effective. Despite these findings, an additional study by Blando et al, (2007a) revealed that communities had incomplete knowledge on potassium iodide use and emergency preparedness procedures several years after a mass pill distribution and education campaign. For mitigation efforts to be most effective during a nuclear emergency, it is important that citizens receive ongoing education on potassium iodide use and emergency preparedness.

Literature Review Summary

The literature review examined key concepts associated with this research study, as well as identified specific gaps in the existing literature.

Although current legislation in Canada does not address those affected by United States based nuclear power plants, it is unfair to ignore the risk to the public located in these areas. There is currently debate on the size of both the primary and secondary zones surrounding nuclear power plants, where most advocate for an extension to the existing radiuses, thereby affecting a greater portion of the population.

When potassium iodide is administered in a timely fashion, at the correct intervals and doses, the harmful effects of exposure to radioactive iodine isotopes can be averted. This can only be achieved through a comprehensive emergency preparedness and protection plan which includes pre-distribution and educational instruction. The selection of a distribution method may vary based on multiple factors, and the promotion of an educational program must be ongoing to update and inform new residents.

In addressing the concept of acceptable risk where the best combination of advantages and disadvantages are chosen (Derby & Keeney, 1990), the pre-distribution of potassium iodide pills provides reasonable protection in the promotion of risk reduction, along with evacuation. Risk perception is an important concept to understand individuals' reactions to emergencies and disasters, and therefore to understand their level of preparedness and 'interest', and impacts their participation and acceptance. Risk communication is also a critical component to understanding a perceived risk, and to implementing new emergency preparedness measures. Communication ended up playing a valuable role during my research study in receiving acceptance and interest in completing the survey questionnaire.

The employment of risk reduction techniques such as an educational campaign and the pre-distribution of potassium iodide pills will effectively reduce individual vulnerability to the risks associated with nuclear power plant reactor failures.

There appeared to be little or no research done in advance of an emergency preparedness campaign such as a mass pill distribution. The importance of doing research in advance is to predetermine knowledge and acceptance. The main study completed by Blando et al (2007b) occurred a few years following a mass pill distribution campaign, and explored the effectiveness of education provided and knowledge retained after a pill distribution clinic. A similar study should be carried out around the nuclear power plants in Ontario that completed the pre-distribution of potassium iodide pills with educational component a few years ago. It will be important for the future to evaluate the different methods of mass pill distribution and education that were used by each nuclear power plant, and to assess which method proved to be the most effective in obtaining knowledge retention over time.

Research Objectives

The following two questions along with sub questions were used to guide my research:

- 1) What do the community members currently know about potassium iodide pills, nuclear events, and emergency preparedness measures?
 - a) Are the residents prepared for a nuclear disaster?
- 2) How can we best educate individuals in the community to prepare for and respond to a nuclear emergency?
 - a) What is their preferred method of receiving new information?
 - b) Do they want to receive this new information?

Through the use of a survey questionnaire I will test the following hypotheses: living in close proximity (primary zone) to a nuclear power plant (risk) equates to understanding the risk and therefore being prepared; Age, gender, language, and education levels are predictors of correct responses (on potassium iodide use); Mailed surveys will elicit more correct responses (on potassium iodide use) due to people researching the correct answers.

Chapter 3 – Methodology

Through the use of quantitative methods, a survey questionnaire was used to establish a numeric number for trends, attitudes, or opinions of a population (Creswell, 2014). From the survey questionnaires I was able to determine if individuals are prepared for a nuclear power plant emergency, and if they are in acceptance of the new mass pill distribution of potassium iodide pills that will take place in the near future.

This chapter provides an overview of the steps taken to answer the research questions, including the design of the survey questionnaire, the data sources utilized, the methods of data collection, the analysis, and other considerations and limitations of the research study.

Overview

My survey questionnaire established numeric trends for Amherst Point, and Bob-Lo Island populations. Attitude and belief questions were included to determine the best methods of delivering information and distributing potassium iodide pills. Aligned with a pragmatic worldview the philosophical basis for research leads me to seek and to generate practical, real-world solutions, and to explore the consequences of actions (Creswell, 2014). Pragmatism allows for data to be collected using measures completed by the participants (Creswell, 2014). Through the use of a survey questionnaire I will test the hypothesis that living in close proximity to a nuclear power plant (risk) equates to understanding the risk and therefore being prepared.

The quantitative research was conducted in the form of a survey using a questionnaire with closed questions in order to gain a perspective on the current knowledge of potassium iodide use and on other emergency preparedness measures, as well as to prepare for the future distribution and educational campaign. The survey utilized close ended questions with a predefined set of options which covered the most logical answers or provided an ‘other’ response

alternative (Keeter, 2005). Foundations of reliable sampling stated by Guthrie (2010) include a clearly defined population which is the primary zone Amherst Point residents and the Bob-Lo Island residents in the Town of Amherstburg. For the survey questionnaires, I attempted to contact all 234 residents of the primary zone or Amherst Point, and all 94 residents of Bob-Lo Island. This approach most closely resembles a census, which is the most complete type of survey, with an aim of acquiring responses from everyone in the identified population areas (Guthrie, 2010; Keeter, 2005; O'Leary, 2014). While this type of study can be expensive, my research involved a reasonably sized population as a whole, and further reduction was not required to achieve a reasonable sample size. Although I expected to get less than 50% response rate, the personal interaction and advance communication afforded me an overall 77% survey completion rate in Amherst Point and 61% for Bob-Lo Island, of total residents.

The research study utilized hand delivered and mailed survey questionnaires for all of the residents located in the Amherst Point primary zone of the Fermi 2 nuclear power plant, and for all of the residents of Bob-Lo Island, as indicated on maps in Appendix A and Appendix B. Questionnaires with structured questions were used in the data collection, with the intent of applying the analysis from the sample that complete the response survey to the population of the entire area (Guthrie, 2010). The survey has been conducted prior to the intended future pre-distribution of potassium iodide pills and educational material, in order to assess the current existing knowledge of potassium iodide pills and of nuclear preparedness measures for individuals, including the location of emergency shelters and evacuation routes.

Design

The survey questionnaire was designed in part based on a similar study conducted by Blando et al (2007b), with the authors permission. That survey was conducted several years

following a mass pill distribution, and took place in the United States. Variations to the survey were implemented including timing components (residents have not yet received their pills), and some terminology was utilized that is more common in Canada. The survey questionnaire was titled Individual Preparedness for Nuclear Power Plant Emergencies, and incorporated three parts including Part 1) General Information (on emergency preparedness), Part 2) Potassium Iodide (KI) Use, and Part 3) About You (general demographic information). The Windsor-Essex County Health Unit provided input on various questions that would elicit useful information in their distribution planning for the future. The survey questionnaires were cross sectional, with the data collected at one point in time (Creswell, 2014) but taking place over a period of several weeks.

The questionnaires used in the study by Blando et al (2007b) were validated and pilot tested prior to use. Having been granted permission to use any components of the questionnaire, I replicated most of the questions that were used that pertain specifically to general emergency preparedness and potassium iodide use.

Piloting a survey involves selection of an acceptable sample size with a similar background to the intended participants, and then seeking feedback (O'Leary, 2014). There are approximately twenty employees at the Town Hall which provided an acceptable number for a pilot test. It was known in advance that none of these participants lived within the primary zone (Amherst Point area) or on Bob-Lo Island. The aim was to seek informal feedback on the clarity of questions and ease of instructions.

The pilot group of Amherstburg staff at the Town Hall were given the survey to complete and hand in on their own. Feedback was then provided regarding clarity of the questions, and alternate responses prompting minor revisions to the questionnaire. The Town proposed to add

two additional questions to seek feedback from the public on who responsibility should lie with for potassium iodide pill distribution, and the protection of residents during a nuclear emergency. Appendix F contains the final survey questionnaire that was used for this research study. The questionnaires contained no personal identifiers so that answers remained completely anonymous.

Approximately one week prior to distribution of the survey questionnaires and conducting face to face interviews, a Notice of Community Survey (Appendix C) was hand delivered to each property located in the primary zone in the Amherst Point area, and on Bob-Lo Island, and mailed to permanent addresses. The intent of the letter was to provide advance notice of the upcoming survey (Guthrie, 2010). The distribution of the advance notice letter was timed immediately following a meeting of Town Council to discuss updating the Town's current Emergency Nuclear Response Plans and future plans for developing a potassium iodide distribution and education plan. The council meeting prompted an article in the Windsor Star, a local newspaper, which mentioned the upcoming research and made reference to the Notice of Community Survey. Appendix D contains the Windsor Star article.

The week following the notice, the survey questionnaire was distributed with a Survey Questionnaire Consent (Appendix E) to be kept by the residents, which contained background information, instructions on completing the survey, and follow up contact information regarding questions on the survey, potassium iodide pills, and emergency response.

Data Sources

The survey included all of the residents of the primary zone in Amherst point area, and all of the residents on Bob-Lo Island, in the Town of Amherstburg. In order to determine the exact parameters of the primary zone, maps were created and provided from the Town of

Amherstburg geographic information systems department outlining an overview of the areas including individual properties. These properties were then identified by driving through the area to confirm that a structure existed on the property. Less than five percent of the properties contained no existing structure and no property owner listed. Approximately ten percent of the mailing addresses were different from the property addresses located in the primary zone, indicating possible rental properties or seasonal users of the properties. Surveys were mailed to these alternate addresses if we received no response at the Amherstburg addresses.

There are two hundred and thirty four individual property owners located in the primary zone in the Amherst Point area, and ninety four individual property owners on Bob-Lo Island, with no businesses, schools, or institutions located in either area. Implementation of the surveys included face to face interaction as much as possible in order to provide the most reliable and complete results (Guthrie, 2010; O'Leary, 2014).

Data Collection

I chose to use a combination of three modes to reach as many residents as possible which included myself (the researcher) conducting the survey through face to face interaction, an assistant who dropped off the survey and returned for collection at a later time, and self-administered surveys where the questionnaire was sent by mail with a self addressed postage paid envelope for those that we were unable to reach. Response rates are thought to be highest with face to face interviews, and likely very low with mail interviews (Guthrie, 2010, Keeter, 2005). I decided to omit telephone interviewing in place of personal interaction, and internet interviewing due to the fact that the availability of internet service to both areas would rely on homeowners having permanent connections.

Approximately one week following the distribution of the advance notice, I attended an annual meeting of the Amherst Point (primary zone) group on the beach, in an effort to leverage awareness and buy in to complete the survey questionnaires. I was able to reach a large number of residents that day, and completed 29 surveys with all in attendance. These residents provided their addresses so they were crossed off a list to eliminate duplication when we started door to door surveying. Residents had read the Windsor Star article and were interested in the survey questionnaire that would shape their future. Residents were strongly encouraged to follow up with the Town of Amherstburg Fire Department for questions on emergency response, and the Windsor-Essex County Health Unit for questions on potassium iodide pills, as outlined in the Survey Questionnaire Consent.

The remaining survey questionnaires were hand delivered to each individual residence within the primary zone of Amherst point and on Bob-Lo Island, in the Town of Amherstburg, with the option to complete the survey immediately with myself, or to complete the survey independently for pickup at a later time. Only one person per household completed the survey, although it is possible multiple members of one household provided input. Attempts were made to make contact with residents during the daytime hours and in the evening hours, as well as during the weekdays and on the weekends. For those that were not home, or the permanent address indicated an alternate place of residence, a copy of the survey questionnaire and consent form were mailed out with a self addressed postage paid envelope for return.

It is likely that this portion of the population group had less interest in the survey, and were therefore less likely to complete the questionnaire. Of the total 48 mailed surveys in Amherst Point for those that were not home, and for those with permanent addresses at an

alternate location, 19 were returned (39.5% of the total mailed) and of the 42 mailed surveys on Bob-Lo Island 12 were returned (28.5% of the total mailed).

Each property address was attended by either myself or a member of the Town of Amherstburg Fire Department in order to conduct the survey in person using a paper copy of the questionnaire. The Town staff assisting in the data collection were trained prior to the distribution of the surveys to maintain quality control and eliminate potential bias and leading answers. Appendix G contains Survey Distribution Instructions. Those assisting in the data collection were not permitted to read the survey questions to the residents, but were permitted to provide background information on the research study, and leave the survey to be filled out and either picked up at a later time that day or on an alternate date.

One benefit to using a survey is the ability to reach a large percentage of the intended population (Guthrie, 2010). This was a time consuming process to conduct the surveys face to face, however with the assistance of the Town of Amherstburg Fire Department staff it was possible to individually survey each residence. There are approximately two hundred and thirty-four residences in Amherst Point, and ninety-four residences on Bob-Lo Island. This was a reasonable number to survey to provide complete data for further analysis. A typical rate of return is less than ten percent, however my rate of return was much higher at 77% for Amherst Point and 61% for Bob-Lo Island, based on the small community atmosphere and the door to door personal interaction to conduct the survey. Many residents had read the Windsor Star article and were 'waiting' for me to come to their home to administer the survey. There was a great deal of interest in the research study and satisfaction in knowing their responses would drive the planning process for the future distribution and education.

Blando et al (2007b) conducted a survey in 2007 for the general public living near nuclear power plants in New Jersey, and received a return rate of 49% for mailed surveys which included a \$10 Walmart gift card as an incentive. While there was no incentive to complete the survey, the personal interaction and advance communication elicited a higher than normal rate of response.

During the door to door survey I was prepared to address anyone that could not read, by completing the paper copy of the survey and reading the questions aloud. I received at least 50 requests to read the questions and complete the survey together, and spent a great deal of time engaging with these residents after the surveys were completed.

I was fortunate to not encounter any language barriers and did not have a need to translate the questionnaire into any other language. Approximately 97% of private dwelling occupants reported that english is the primary language spoken at home (Statistics Canada, 2012). The mailed survey provided a phone number for anyone requiring assistance or further clarification. I did not receive any phone calls during the specified survey period requesting assistance.

The questionnaires that were mailed out were assumed to have a much lower rate of return due to lack of interest and direct involvement (Guthrie, 2010). Creswell (2014) suggests a four phase administration process for the mailed surveys, but due to postage costs and time limitations I only completed two phases which included phase one as an advance notice delivered to each address and the second phase which was the actual survey. The reminder and additional copy of the survey comprising phases three and four were omitted due to cost restrictions and time limitations.

All data collected from the surveys in the form of paper copy questionnaires were kept in a secure location locked in a cabinet in my home. As there are no personal identifiers on the

surveys or within any of the questions there was very low risk of personal security or compromise of the information.

Data Analysis

Following the data collection, the survey questionnaires directed to the primary zone Amherst Point and Bob-Lo Island residents provided a demographic accounting of the residents, as well as to offer insight into the level of existing knowledge, and the preferred methods of receiving new information. A further summary of the results can be found in Chapter 4.

The aim of the survey questionnaire is to answer my first research question: What do the community members currently know about potassium iodide, nuclear events, and preparedness measures? And to address the second question: How can we best educate individuals in the community to prepare for and respond to a nuclear emergency?

Using a quantitative research method approach required a variety of analytical methods. The two distinct groups of residents were comprised of those living in the primary zone (Amherst Point) and those living on Bob-Lo Island, where evacuation in case of an emergency will present unique challenges. The quantitative survey component included graphical analysis in the form of spreadsheets and diagrams, forming a descriptive analysis to indicate the means, standard deviations, and range of scores for the variables (Creswell, 2014). Knowledge based questions contained in Part 2 of the survey were analyzed using Ksum score distribution which is a score based on the number of correct answers. Chi Square tests and Analysis of Variance (ANOVA) were used to analyze the data and to determine if there is a significant relationship between variables. This analysis is further explained in Chapter 5.

The summary of responses has been shared in the form of a written report with both the Town of Amherstburg Fire Department and the Windsor-Essex County Health Unit. Both

agencies are interested in the existing knowledge of the community as well as how the residents would like to receive the potassium iodide pills and further information. Both agencies are also interested in the platform for the provision of information that is most likely to be accepted, retained, and understood.

Through the participation of individuals in the survey questionnaire, the community itself will guide the development for their own desired methods of receiving new material and information, ultimately allowing for greater retention and understanding of the information.

Validity and Reliability

To acquire validity in the quantitative research the questions on the survey questionnaire should measure what they are intended to measure, as well as to predict specific criteria (Creswell, 2014) including a knowledge gap on potassium iodide use, irrespective to participants' proximity to a Nuclear Power Plant. The questionnaire used in this survey was replicated with permission from the survey by Blando et al (2007b) that were validated and pilot tested prior to use.

Variables were measured using a survey questionnaire with predefined responses in a multiple choice format covering the most logical answers as well as an 'other' alternative, in order to answer the research questions. Some questions on the survey were used as an opportunity to collect information useful from a planning perspective and not for hypotheses.

The individuals from the Town of Amherstburg Fire Department that assisted with the distribution of the surveys were provided with background information and instructions to maintain consistency and to avoid providing information for the answers. The individuals assisting were instructed to only provide the survey questionnaire and consent form, and not to administer the survey by reading the questions during their visit. Survey distribution instructions

can be found in Appendix G. Surveys were then collected from mailboxes or returned by mail to myself and were kept separate and evaluated to determine if there are inconsistencies in the answers provided, such as comprehensive knowledge of potassium iodide use which may indicate the use of other sources to complete the survey. There were no indications of inconsistencies in the responses provided by mail.

Ethical Considerations

As a researcher my role is to gather and analyze the data from the survey questionnaires, and then provide a summary to the Town of Amherstburg and the Windsor-Essex County Health Unit. I have been invited to carry out this research study by both organizations

I do not reside in the primary zone or in the Town of Amherstburg, and I would not be affected in any way by the results of this study. There is no personal benefit to myself in conducting this research study other than to satisfy the requirements of my Masters degree, through which I am motivated to provide a worthwhile contribution to the region in which I live, and to work alongside respected community organizations.

It is important to maintain confidentiality for those completing the survey questionnaires. There will be no personal identifiers contained within the questionnaire and no records kept of which residents answered the questionnaire and which did not. Informal verbal consents will be used for participants together with a consent form they can retain which will outline the risks, benefits, and contact information. A sample of the Survey Questionnaire Consent form is attached as Appendix D. The participants will be required to be over the age of 18 in order to participate and no parental consents will be required.

The individuals from the Town of Amherstburg Fire Department that are assisting with the distribution and face to face completion of the surveys will be provided with background information and instructions to maintain confidentiality.

Moving forward it will be necessary to maintain a reputable source that those involved or others hearing of the research study can rely on to provide additional information as well as a follow up of the results. Some of the information may instill fear of nuclear disaster in residents and as part of the research I will provide contact information for the Town of Amherstburg Fire Department for questions regarding the survey questionnaire as well as the Windsor-Essex County Health Unit for questions regarding the upcoming potassium iodide distribution. Both organizations have agreed to work together with administrative staff to prepare for questions and response from the public.

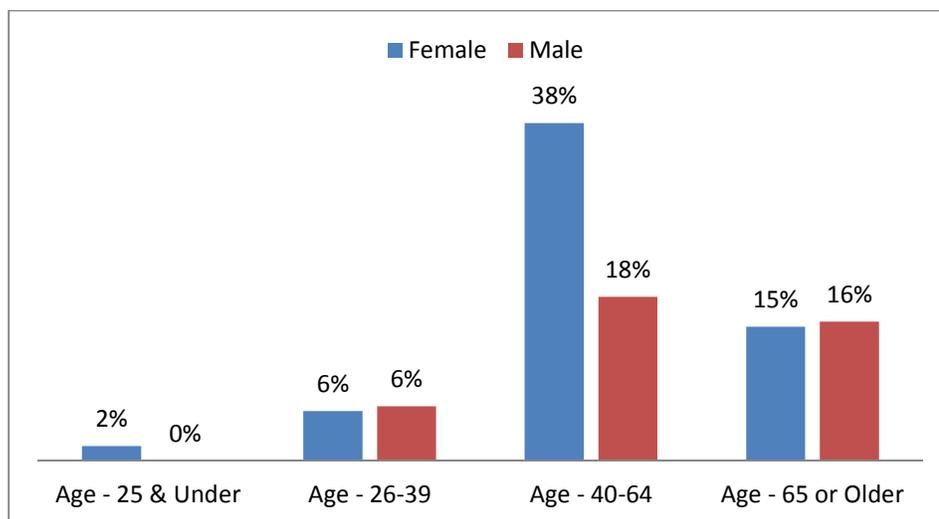
Chapter 4 – Results

This Chapter provides the demographics of the populations that completed the surveys, along with summaries of their responses to questions contained within the surveys.

Demographic Information

In the primary zone of Amherst Point there were a total of 234 residences, and a total of 180 or 77% completed the survey questionnaire, through personal contact and mail. A total of 161 surveys were completed at the individuals' property out of a total of 185 that we made contact with at their homes. For those that we made contact with the rate of refusal or disinterest in completing the survey questionnaire was very low, at less than 13%. During my time knocking on doors I found the participants to be very interested in completing the surveys and interested in the prospect of receiving new information regarding nuclear emergency preparedness. A total of 49 (21%) out of the total 234 surveys were mailed for those that we could not make contact with, and of those mailed 19 surveys or 39% were completed and returned. The majority of participants that responded (56%) fall in the 40 to 64 year old category, and of the total participants 60% were female.

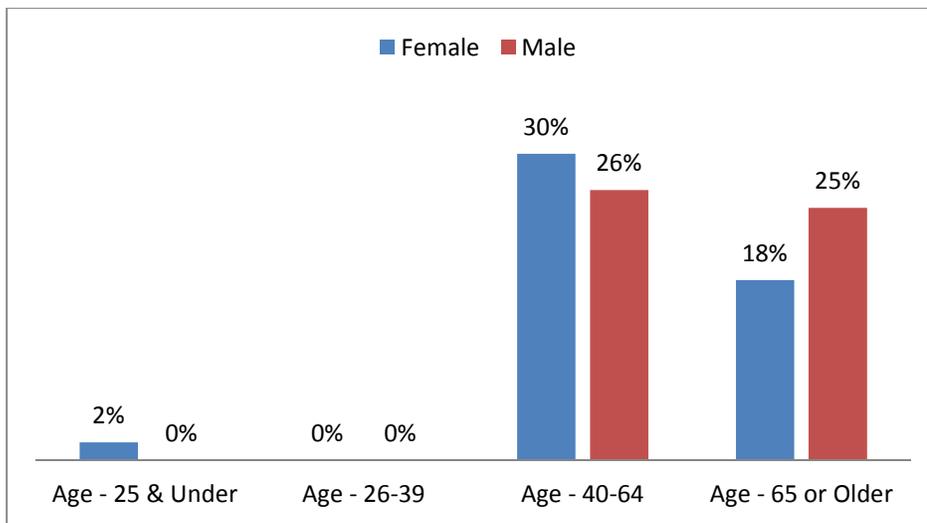
Table 1: Participants from Amherst Point



On Bob-Lo Island there were a total of 94 residences, and a total of 57 or 61% completed the survey questionnaire. A total of 45 surveys were completed at the individuals' property out of a total of 52 that we made contact with at their homes. The rate of refusal or disinterest in completing the survey questionnaire was also low, at 13.5% (7 out of 52). During my time knocking on doors on Bob-Lo Island I found the participants to be somewhat interested in completing the surveys. The remaining 42 of 94 surveys were mailed out which amounts to 45% of the total, and of those only 12 or 28.5% were returned.

The majority of participants that responded (56%) fall in the 40 to 64 year old category, and of the total participants 50% were female.

Table 2: Participants from Bob-Lo Island



For all participants except 2, English was cited as the primary language spoken at home. Highest level of education achieved and post secondary classes in engineering and science varied. Chapter 5 will discuss these elements as predictors of advanced knowledge on potassium iodide, or other emergency preparedness measures.

General Information

Through assessing the responses provided in Part 1: General Information, 97% of participants from the primary zone Amherst Point indicate that they live within the primary zone of a nuclear power plant. On Bob-Lo Island almost 80% believe they live within the primary zone, but in fact they are outside of the 10 mile radius, at just over 12 miles from Fermi 2.

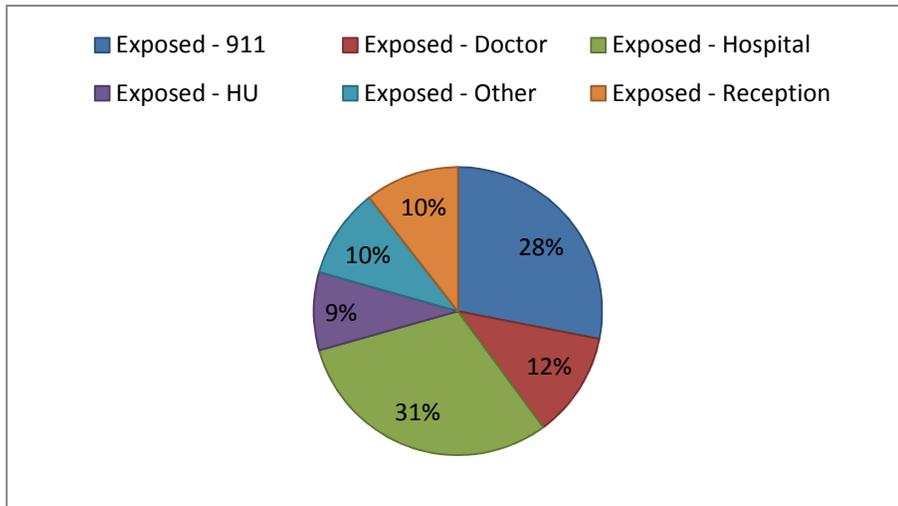
Several questions pertained to individual emergency preparedness including knowing the location of the reception center. For the Amherst point group over 80% stated they did not know the location, and of the 6% that said they knew, all indicated an incorrect location. On Bob-Lo Island almost 90% stated they did not know the location, or were unsure. If told to evacuate, over 90% of both groups indicated they would do so, with less than 10% indicating they were unsure. Only 40 to 50% of residents in either group know what the emergency siren sounds like, and over 80% in both groups do not have a 72 hour emergency preparedness kits in their homes or cars.

This information is important for the Town of Amherstburg as they renew and update the Nuclear Emergency Response Plans, and strongly indicates a need for a public education campaign on basic emergency preparedness measures, including such things as evacuation routes, location of emergency shelters, testing of the emergency siren and possible relocation if it cannot be heard in all areas, and the importance of having a 72 hour personal preparedness kit. It is the responsibility of individuals to take care of themselves for up to 72 hours in the event of an emergency, if emergency services cannot get to them (Public Safety Canada, 2011).

In Amherst Point 39% of responses indicate that residents would drive to the nearest hospital if they felt they had been exposed to radioactive materials as a result of a nuclear power plant emergency, and 34% would call 911 first. The remaining responses include contacting the

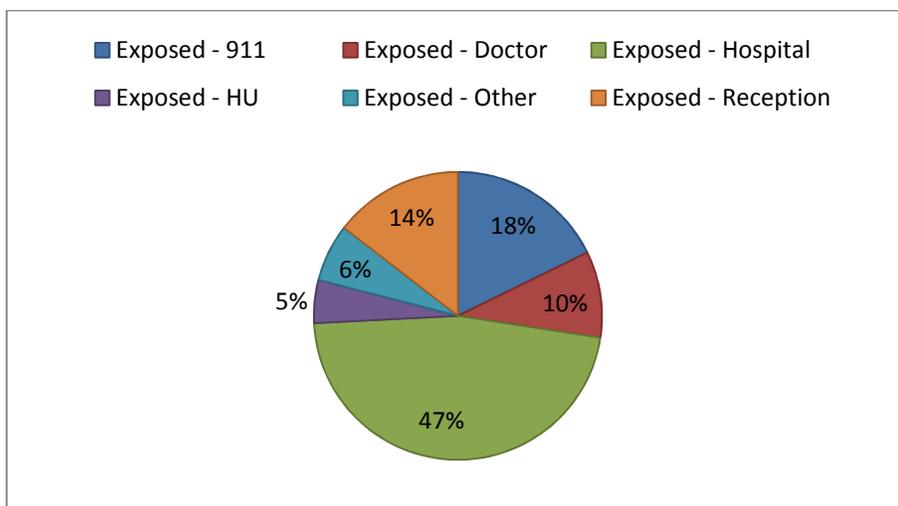
Health Unit, contacting a Doctor, going to a reception center, or other (such as drive far away) and each received between 11 and 15% selection.

Table 3: Amherst Point reaction to exposure



On Bob-Lo Island 51% indicated they would go to the nearest hospital if they thought they had been exposed to radioactive material, 19% would call 911 first, and 16% would go to a reception center. It's important to note here that 90% of responses from Bob-Lo island indicated they did not know where the reception center is located. The remaining responses elicited between 5 and 10% selection.

Table 4: Bob-Lo Island reaction to exposure



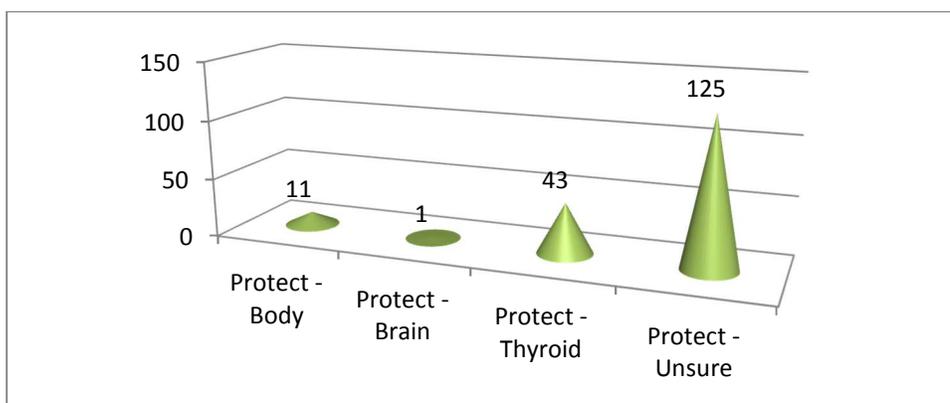
Potassium Iodide Use

The series of questions related to potassium iodide use elicited a very low rate of correct answers, with 50% or more participants having heard of potassium iodide, and close to 40% had never heard of potassium iodide or other variations such as iodine thyroid blocking agents, KI pills, anti-radiation or rad-block. The most common terminology used in Canada is potassium iodide or KI.

The questions on specific use of potassium iodide pills included pregnant women, those with thyroid disease, allergies to iodine, and people over the age of 40. Between 65% and 95% of responses from both Amherst Point and Bob-Lo Island indicated they were unsure if people in those groups should take KI pills, with the highest rate of uncertainty linked to pregnant women, and the lowest rate with those that have thyroid disease.

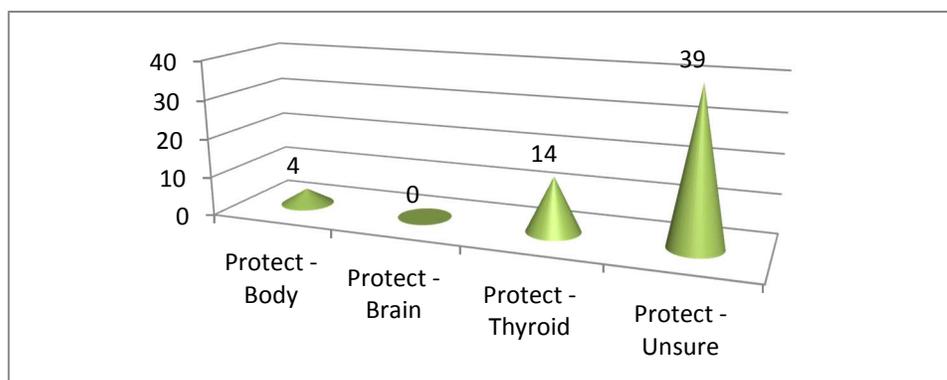
When asked what (part of the body) KI pills or tablets protect, the Amherst Point and Bob-Lo Island groups had similar results. For Amherst Point 125 or 70% were unsure, 43 or 23% selected the thyroid as the correct answer, 11 or 6% thought KI would protect the whole body, and one respondent selected the brain.

Table 5: Amherst Point



For Bob-Lo Island 39 or 68% were unsure, 14 or 25% selected the thyroid, and 4 or 7% thought KI would protect the whole body.

Table 6: Bob-Lo Island



The next four questions were related to dosage of KI pills including when to take the first dose, how long protection would last, dosage amounts for adults vs children, and if a person should take multiple doses at one time. A total of 70 to 90% in both groups surveyed selected unsure as their response, and less than 28% in both groups marked the correct responses for each question regarding dosage. In Amherst Point and on Bob-Lo Island 21% and 37% of responses respectively indicated if they heard there had been a significant accident at Fermi they would take a KI pill regardless of an official announcement. 34% and 25% respectively said they would not take a KI pill with no official announcement, and 46% and 38% were unsure of their action.

During an emergency almost 50% of both groups indicated they could obtain KI pills at a shelter, close to 30% would look to a hospital emergency room for KI pills, and the remainder selected various options such as family Doctor, pharmacy, Health Unit, clinic, or unsure. Currently KI pills are available at the Health Unit upon request, and would be made available at an emergency shelter from stockpile locations when required.

Potassium Iodide Pills

The remaining three questions in this section were intended to assist the Health Unit in developing future distribution plans. In Amherst Point 86% confirmed their intention to keep the KI pills that would be provided, 13% were unsure, and 1% said they would not keep the pills. On Bob-Lo Island results were similar with 93% keeping the pills, 5% unsure, and 2% not keeping them. Although there was a great deal of uncertainty with preceding answers regarding potassium iodide use, it would appear that a significant number of respondents understand the importance of keeping the pills. The top 3 responses for delivery of potassium iodide pills include the mail, a pharmacy, and a designated pick up location. Additional information on nuclear emergency preparedness is likely to be best received using written material such as brochures and fact sheets, email correspondence, or media such as newspapers and radio announcements.

Questions Related to Responsibility

The final two questions on the survey questionnaire asked who responsibility lies with 1) for potassium iodide pill distribution, and 2) for the protection of residents during a nuclear emergency. Five options were provided for each question including the Town of Amherstburg, Windsor-Essex County Health Unit, Ministry of Health and Long Term Care, Provincial Government, or Federal Government. Participants selected multiple options for these questions.

For responsibility of potassium iodide pill distribution the primary zone Amherst Point group and the Bob-Lo Island group both selected the Windsor-Essex County Health Unit at 39% and 40% , both groups also selected The Town of Amherstburg (36% and 37%) and the Provincial Government (34% and 37%) as close second and third choices. Responsibility for KI pill distribution throughout Ontario would normally fall to the Nuclear Power Plants.

Responsibility for the protection of residents is believed to fall in the hands of the Town at 57% and 60% with both groups selecting the Provincial and Federal Governments in the mid range 36% to 49%. It is interesting to note that both groups held similar results. The protection of residents would typically fall on the Town and Fire Department, however in this situation additional tools, equipment, and education are needed from other sources in order to have the capability for effective response.

Summary

Based on the results of the survey questionnaires it is evident that residents are predominantly in acceptance of receiving potassium iodide pills, however the current level of knowledge on use and dose is very uncertain. It will be important to emphasize the educational component during pre-distribution of the pills, using simple and clear instructions.

Chapter 5 – Discussion

Findings and Analysis

I had initially anticipated having a high rate of completion for the surveys above normal expected rates, due to the fact that the study involved two very small groups of residents with direct contact involved. I was successful in acquiring 77% response from all residents in Amherst Point and 61% response from all residents on Bob-Lo Island.

Data was analyzed using Chi Square for data that contained frequency counts, Analysis of Variance (ANOVA) was used for continuous data with categories to compare means of more than 2 groups, and T-tests were used to see if 2 sets of data were statistically significant.

Method of Data Collection

Three methods were used for the collection of data including 1) administration by myself (the researcher) where I read the questions and marked down responses, 2) distribution of the surveys for self administration and collection by an assistant, and 3) mail and return through pre-addressed and stamped envelopes.

Based on demographics sorted by the mode or method of collection, the Chi Square statistic shows that in each case the differences in response are not statistically significant because the Chi Square probability value is always well above 0.05.

The knowledge scores or Ksum score distribution, which is a score based on the number of correct knowledge based questions contained in Part 2 of the survey, also did not differ by the mode of data collection, and was not statistically significant, suggesting that the mode of data collection did not impact the data. Any differences observed can be attributed to random fluctuation.

Knowledge Based Questions on Potassium Iodide

As expected, the survey revealed an insufficient general knowledge on potassium iodide pill use and on individual emergency preparedness measures, thereby confirming that living in the primary zone does not equate to better preparedness. The potassium iodide knowledge based questions are contained in Part 2 of the survey, questions 2 through 12. In summarizing the data I found that 36% of those surveyed in both Amherst Point and Bob-Lo Island, did not get any correct answers.

ANOVA tests found that age, gender, and level of education were not significant predictors of outcome and correct answers. The language variable is significant, however only 2 surveys indicated a language other than English spoken at home, and so this is not a valid comparison and should be omitted. Completion of post secondary classes in engineering or science is shown to be a significant predictor of the Ksum score with a P value of 0.01. Those with post secondary education in engineering or science had a mean Ksum score of 2.7, whereas those without post secondary education in engineering or science had a mean of 1.8 Ksum score. This difference is statistically significant for the knowledge based questions on potassium iodide.

It is well reflected in the data that people did not do well on these questions, and it will be critical to educate people and provide outreach support during the pill distribution campaign.

Knowledge Based on Location

Analysis revealed that the distribution of Ksum scores did not differ by demographic grouping. Based on demographics and sorted by the mode or method of collection, the Chi Square statistic shows that in each case the differences in response are not statistically significant because the Chi Square probability value is always well above 0.05. Any differences observed can be attributed to random fluctuation.

Summary

In summary, based on demographics and knowledge the method of data collection did not provide a difference in the results. A significant percentage of surveys revealed that residents have no knowledge on potassium pills and their use, irrespective of living in the primary zone or living outside of the primary zone. The main predictor in correct response to the knowledge based questions on potassium iodide use was post secondary classes in engineering and science.

This information will help to guide and develop an educational component that ensures a comprehensive knowledge base on KI pills is established for residents in the community. It emphasizes the need for an outreach program that residents can rely on for valid information.

Chapter 6 – Limitations, Recommendations, and Conclusion

Study Limitations

The entire project was very time sensitive, and the survey questionnaire was to be completed prior to the approval for funding by the Ministry of Health and Long Term Care, and the subsequent potassium iodide pill distribution. Funding and approval was granted in December of 2017, and the Windsor-Essex County Health Unit is currently working to implement the mass distribution of the potassium iodide pills and to develop and promote the educational component County wide.

The study will not be able to project any knowledge retention based on the methods of receiving new information as no prior education has been provided to date. Periodic reviews should be carried out to assess the effectiveness of pre-distribution programs at intervals following the pre-distribution (Canadian Nuclear Safety Commission, 2016). Ideally a follow up study should be completed two to five years after the potassium iodide distribution to assess knowledge retention on potassium iodide (KI) use, and attitudes towards KI in general including if people kept the pills, or recall where they have stored them. This would be a very interesting study to compare distribution methods and knowledge retention, and acceptance at all three locations of nuclear power plants across Ontario, and including the area potentially affected by Fermi 2 – Amherst Point and Bob-Lo Island.

It was likely that the seasonal residents with permanent addresses in other locations including Michigan had limited interest and lower response rates as they spend less time in the area, and may not have been aware of the local news reports.

Close working relationships amongst departments and organizations helped to complete this research study through the use of staff to go door to door in the primary zone to provide a

copy of the survey questionnaire. Time constraints and lack of additional funding was a deterrent in seeking follow up reminders to complete the surveys, and mailing out additional copies of the surveys.

Recommendations

This research study brought to light the lack of knowledge on potassium iodide, a lack of knowledge on emergency procedures, and a lack of knowledge on personal preparedness measures. Based on the research study, recommendations are provided below as a result of the summary of survey responses.

Information for Emergency Response Plans

This research study is an important investment in the community to ensure preparedness measures are in place that compliment the Town of Amherstburg Nuclear Emergency Response Plan and align with Provincial Regulation surrounding Nuclear Power Plants. The role of emergency management professionals is to reduce risk to the public based on the hazards that are identified as potentially affecting a specific area. Understanding the risks associated with living in the primary zone of a nuclear power plant, and being aware of personal protective measures in the event of an emergency such as the uptake of potassium iodide pills, or evacuation procedures, are steps in reducing vulnerability of the populations that are the most at risk of being affected in the event of an emergency.

While the Health Unit will address the use of potassium iodide pills, other protective measures should be addressed including the location of the reception center, evacuation routes, and testing of the siren including relocating it if required. Almost half of the residents reported either they had never heard the siren or were unsure if they had heard it. The siren is not currently located within the Amherst Point primary zone area and relocation may need to be

considered to protect those most at risk. Almost 95% of those surveyed stated they do not know the location of the reception center, and the 5% that reported knowing the location provided an incorrect response. One resident wrote a comment on the survey sheet: “I know where to vote but I don’t know what to do in case of an emergency”. In the event of an emergency, knowing the location of the reception center will be critical for the protection of residents.

More than 90% reported they would evacuate if told to do so by a government authority because of a nuclear emergency, with the remainder unsure and only one resident stated they would not evacuate. This is a strong indicator that generally residents understand the severity and significance of a nuclear emergency. Many residents of Bob-Lo Island expressed concern that the ferry service is privately owned and operated, and this is their only means to evacuate the island.

The research study had significant results with respect to personal emergency preparedness, where at least 75% of residents do not have a 72 hour emergency preparedness kit. A campaign directed to residents citing the importance and significance of having a 72 hour kit in case of emergency would be beneficial not only to those affected by the emergency but also to the emergency responders. A 72 hour kit is important for any type of emergency.

Procedures should be established for those that are new to the area with respect to KI pill distribution, educational material, and emergency procedures. Working with real estate agents would be beneficial to ensuring anyone new to the area is aware of the potential danger associated with a nuclear power plant emergency. There will be a strong argument that this will reduce property value and deter people from living in the area. During the time period the surveys were being conducted, one potential buyer for property on Bob-Lo island stated he was

unaware of the dangers associated with living near a nuclear power plant, and did not purchase property for this reason.

To the WECHU for the pre-distribution of KI pills

The Windsor Essex County Health Unit will be responsible for the distribution of KI pills and associated educational material in 2018. The research study showed that residents primarily want to receive potassium iodide pills in the mail, at a pharmacy, or at pick up location. A very small percentage were interested in a group meeting for pill distribution. The Health Unit may want to consider the process of mailing a voucher to residents that they would be able to redeem for KI pills at a local pharmacy or drugstore. A strong majority of residents have stated they will keep the pills provided, and those that were unsure or that did not want to receive pills can simply retain their voucher for future consideration, or discard it.

The packages of KI pills must be accompanied with an educational component including clear instructions on use, dosage, and effects. A simple brochure or fact sheet should be provided, including web sites or instructions on obtaining further valid information. Residents predominantly chose to receive additional information on nuclear emergency preparedness through written material such as fact sheets, followed by email, internet, face to face with a health care professional, and social media. It's unsure if social media would be an optimal choice as the demographic group of both areas isn't known for using social media. A very small percentage selected a group meeting to receive additional written information.

It would be wise for the Health Unit to provide more detailed information on potassium iodide pills to the doctors and pharmacies locally and within the Town of Amherstburg. Focus should be on the selected distribution center and staffing levels will have to be considered as the campaign begins and pills are distributed. Residents are likely to ask questions when picking up

their packages of pills, and many will make appointments with their family Doctors for follow up especially considering those with allergies to iodine and those with thyroid disease.

In general there has been significant interest generated regarding potassium iodide pills and nuclear preparedness in all of Windsor-Essex County, and an information session would be beneficial to educate the public in each Municipality.

To Windsor Regional Hospital

Windsor Regional Hospital should explore the development of an emergency response plan in the event of a nuclear emergency to treat or quarantine those that may have been exposed to radioactive material. It's important to note that a significant number of residents responded that if they thought they had been exposed to radioactive materials as a result of a nuclear power plant emergency, they would go to the nearest hospital as opposed to the nearest reception center. This may impact other services provided at the hospital and create some measure of confusion with such a large influx of potential patients at one time, including the possibility of a large number that have been exposed to radioactive material.

The hospital will need to have a supply of KI pills on hand for those that do not have KI pills in their homes, and for those that evacuated without taking their pills. Redirection to the reception center may be important if it is set up with equipment and testing for exposure to radioactive materials.

Future Research

Distribution campaigns for potassium iodide pills have taken place in areas surrounding nuclear power plant facilities around the province of Ontario over the past three years, however no studies have been conducted of the population groups, and no follow up studies have been completed to date to determine if the educational material was understood or retained. It would

also be of interest to determine if those that received KI pills kept them and know where they are currently stored. A future research study could be conducted in Amherst Point in three to five years to determine the effectiveness of the current KI pill campaign by the Health Unit.

Educational campaigns conducted by Enrico Fermi Nuclear Generating Station (Fermi 2) have not been extended to Canadian soil in recent years, although one resident recalled that at least 30 years ago a “gentleman who said he was from Fermi stopped by my house with a packet of pills and said you might need these one day”.

During the surveys that were administered face to face, it was noted that some areas of Amherst Point have a very high rate of cancer occurrences. There was one street where every single household (a total of 10) had a member currently with cancer, or passed away within the past year from cancer. It would be interesting to further interview these households to determine how long they have lived in the area, as well as the type of cancer. The Amherst Point group was found to have a large number of long term residents spanning many generations, whereas the Bob-Lo Island residential area was first developed less than 20 years ago.

Conclusion

The objective of my research study was to determine the knowledge base on potassium iodide pills and how best to educate the public so that individuals have an increased level of awareness and knowledge on preparedness measures they can take, reducing the level of vulnerability as a result of nuclear disaster in our communities. With the support of two large organizations including the Town of Amherstburg and the Windsor Essex County Health Unit I was successful in completing my research, and helped to create an atmosphere of reassurance in the community through the promotion of community involvement in preparing for a nuclear emergency.

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Appendix A - Map of Town of Amherstburg Primary Zone



Appendix B – Map of Bob-Lo Island



Appendix C – Notice of Community Survey

NOTICE OF COMMUNITY SURVEY ON NUCLEAR PREPAREDNESS

Expected Start Date: May 24th, 2017

Expected Completion Date: June 29th, 2017

The Windsor-Essex County Health Unit in conjunction with the Town of Amherstburg is planning the pre-distribution of potassium iodide pills to residents located within a 16.1 km radius of Enrico Fermi Nuclear Generating Station (Fermi 2) in Michigan, including the Amherst Point area and Bob-Lo Island, in Amherstburg, Ontario. A research study is being conducted to assist these organizations in determining individuals' existing knowledge and preferred methods of receiving information on potassium iodide pills (KI pills) and emergency preparedness measures for nuclear emergencies.

It is important to note that the risk has not changed at Fermi 2 and the pre-distribution of KI pills is simply a precautionary measure in the *unlikely* event of a nuclear emergency.

The significance of this research is to identify knowledge gaps associated with the use of potassium iodide pills during a nuclear emergency, and to design educational strategies that will benefit the community in reducing risk associated with a nuclear incident. This research project is being conducted by Donna Desantis through graduate studies in Disaster and Emergency Management at Royal Roads University. The Town of Amherstburg is aware of this survey, observing its delivery, and will benefit from its results.

If you have received this Notice of Community Survey, your home is located within the identified research areas (please see maps below).

MAPS OF THE SURVEY AREAS:

Amherst Point Area



Bob-Lo Island



BACKGROUND INFORMATION

One of the goals of nuclear emergency planning, preparedness, and response is the protection of the public from immediate and delayed health effects as a result of a nuclear incident. In the unlikely event of a nuclear incident at Fermi 2 in Michigan, emergency response authorities will be required to introduce countermeasures to reduce radiation doses received by the public.

The Nuclear Safety and Control Act (NSCA) and the Canadian Nuclear Safety Commission (CNSC) regulate the Canadian nuclear industry in order to prevent unreasonable risk to the health and safety of persons. **New regulatory requirements set in 2015 include the mandatory pre-distribution of potassium iodide pills together with instructions on their proper administration.**

Although Fermi 2 is located in the United States and not governed by the CNSC, the Town of Amherstburg and the Windsor-Essex County Health Unit plan to follow the new regulatory requirements for pre-distribution of KI pills in the 16.1 km primary zone and on Bob-Lo Island, and to have KI pills made available for the remainder of residents in the Town of Amherstburg who request them.

COMMUNITY SURVEY DETAILS

| | |
|---|---|
|  | <p>The survey will take place throughout the week during regular business hours as well as in the evenings. The survey will take approximately 5 to 10 minutes of your time to complete.</p> |
|  | <p>The survey will consist of a paper copy which may be filled out while a representative of the Town of Amherstburg assisting in this survey is at your property, or can be filled out and returned in a postage paid envelope.</p> |
|  | <p>No personal information or identifiers will be collected during this survey. Participation is voluntary. The information gathered will assist in the development of a distribution and education plan for potassium iodide pills and nuclear preparedness.</p> |

NEED MORE INFORMATION?

If you have questions regarding Emergency Response and Nuclear Incidents, please contact:

The Town of Amherstburg Fire Department: 519-736-6500

If you have questions about the upcoming potassium iodide distribution, please contact:

The Windsor-Essex County Health Unit: 519-258-2146 ext 1445

Appendix D – Windsor Star news article

<http://windsorstar.com/news/local-news/nuclear-iodine-pills-headed-to-amherstburg-homes>

Amherstburg residents to get potassium iodine pills in case of nuclear emergency



[Mary Caton](#)

[More from Mary Caton](#)

Published on: May 26, 2017 | Last Updated: May 26, 2017 7:50 PM EDT



The Enrico Fermi Nuclear Generating Station is seen over Lake Erie across from Amherstburg on May 26, 2017. Jason Kryk / Windsor Star

Amherstburg residents living within a 16-kilometre radius of Michigan's Enrico Fermi nuclear plant will receive potassium iodine (KI) pills as a protective measure in the event of a nuclear emergency.

According to a new regulation by the Canadian Nuclear Safety Commission, KI pills must be distributed to those living within what's defined as the primary zone of a nuclear facility.

“There is no immediate risk,” Dr. Wajid Ahmed, the associate medical officer with the Windsor-Essex Health Unit, said Friday. “Nothing new is happening but this is an important thing for our community. It’s something people need to be aware of and they need to co-operate with us and help us with the distribution plan.”

Potassium iodine is approved by the American Thyroid Association as a treatment for exposure to radioactive iodine.

According to the ATA’s website, taking potassium iodine prevents the thyroid gland from absorbing radioactive iodine which can be released into the air during a nuclear fallout.

Residents in the area commonly known as Amherst Point and on Boblo Island received a hand-delivered flyer this week outlining the KI pill distribution and a forthcoming community survey on nuclear preparedness.

Graduate student researcher Donna Desantis delivered 250 flyers in an area south of County Road 20 and another 100 on Boblo Island.

“It is important to note that the risk has not changed at Fermi 2 and the pre-distribution of KI pills is simply a precautionary measure in the unlikely event of a nuclear emergency,” the notice reads.

Pill distribution is still weeks or months away since the health unit is in negotiations with the Ministry of Health and Long Term Care over who will pay for it all.

“They’re reviewing our proposal and we’re waiting on the ministry to give us the go-ahead,” Ahmed said. “We want our citizens to receive the same level of care as any other jurisdiction in Ontario. We’re hoping to hear from them fairly soon.”

For other Canadian communities with a nuclear facility, providing and distributing KI pills is the financial responsibility of the nuclear installation.

“Our situation is very unique because the nuclear plant we come under is not on Canadian soil,” Ahmed said. “It makes the situation more complicated.”

Providing KI pills to Amherstburg residents is not mandated by existing Canadian regulations.

Ahmed was out of town Friday and did not know the exact cost of the plan. He did say each pill costs \$20-\$25 with a shelf life of either five or 10 years.

Two maps showing Boblo Island and a shoreline area south of County Rd. 20 were included in the flyer. The Amherst Point area is listed as falling inside Fermi’s 10-mile (16.1-km) primary zone.

Boblo does not fall within the primary zone but was included in the pill distribution plan because of its unique geographical location with access only by boat or ferry.

“We are just trying to develop our plan in the very small event that something happens,” said Lee Tome, the town’s deputy fire chief who’s leading the effort to update Amherstburg’s nuclear emergency procedures.

“The KI pills are another tool in our tool box.”

Earlier this week, council received a report from Tome on the town’s nuclear emergency procedures which haven’t been updated since 1998.

DTE Energy operates Fermi 2 and annually gives the town \$25,000 toward a response plan.

Tome said developing an updated plan will cost more than double that amount. Town officials have been working with the provincial and federal levels of government to acquire the necessary funding for training, equipment and personnel.

Under provincial regulations, nuclear installations in Ontario must provide funding for the emergency response plans in neighbouring communities.

“What we’re looking for is the same type of response capabilities that exist elsewhere in Ontario,” Tome said. “Fermi gives us \$25,000 but they don’t have to. They’re being good corporate citizens. We’re looking for the province to work with us on our resource needs.”

Mayor Aldo DiCarlo has been dealing with this issue for several years now.

“The last time I checked, we were the only municipality in Canada with nuclear exposure from another country,” DiCarlo said. “Here we are with possible exposure from the U.S. and there’s nothing that our own country is doing about it.

“I don’t blame Fermi. They’ve done their part. We’ve gotten more from them than our own country. “

DiCarlo believes the province should fund the town’s nuclear emergency response plan or negotiate for more money from the U.S.

“We need the province to step in and do something,” he said. “I don’t think it’s up to the town of Amherstburg to start negotiating with the United States of America to fund our emergency plan.”

John Byard is a co-ordinator for the Durham Region’s emergency management office. He said the response plan for a region that includes the Pickering Nuclear Station and the Darlington Nuclear Station is updated annually and a “substantial part” is funded by those two facilities.

Tome wants what he sees elsewhere in Ontario.

“We’ve identified a number of gaps and we’re working on fixing those gaps and funding is one of those issues,” Tome said. “We’ve made a lot of progress since we started in November of

2015 and the provincial government has assisted us in moving forward. The biggest challenge is determining the funding mechanism for this.”

A spokesperson for the Ministry of Community Safety and Correctional Services said his office has not provided any financial support but is investing significant staffing resources and time to assist the town.

“Work is ongoing to support planning, training, public education and emergency exercise enhancements within the town of Amherstburg to ensure that adequate resources and capabilities to provide for a nuclear emergency response are available,” Brent Ross said.

Desantis and members of the Amherstburg fire department will start conducting the door-to-door survey in the affected areas next week.

mcaton@postmedia.com

Appendix E – Survey Questionnaire Consent

SURVEY QUESTIONNAIRE CONSENT

Introductory Statement:

The purpose of this research project is to better understand individual levels of emergency preparedness, and how to further educate the public in the event of a nuclear power plant emergency that could affect the Town of Amherstburg. This research project is being conducted by Donna Desantis through graduate studies in Disaster and Emergency Management at Royal Roads University, under Academic Supervisor Dr. James Blando, jblando@odu.edu, and Royal Roads Program Head Dr. Robin Cox, Robin.Cox@RoyalRoads.ca. The Town of Amherstburg is aware of this survey, observing its delivery, and will benefit from its results.

You have been invited to participate in this study because you reside within the identified research areas, including Bob-Lo Island and the primary zone for the Enrico Fermi Nuclear Generating Station (Fermi 2) located in Michigan. Your participation in this research study is voluntary and there is no penalty if you chose not to participate.

IT IS IMPORTANT TO NOTE THAT THE RISK HAS NOT CHANGED AT FERMI 2 AND THE PRE-DISTRIBUTION OF POTASSIUM IODIDE PILLS IS SIMPLY A PRECAUTIONARY MEASURE IN THE *UNLIKELY* EVENT OF A NUCLEAR EMERGENCY.

Your completion of the survey questionnaire invites your input in this process.

Instructions for the Participant:

You have been provided with a survey questionnaire containing general information questions with respect to your knowledge on potassium iodide use and on individual nuclear emergency preparedness, including your preferences for learning and for receiving new information.

The survey will take 5 to 10 minutes of your time, and all results will remain anonymous. No personal identifiers will be recorded on any of the surveys. Only one person per household, over the age of 18, should complete the survey. You are asked to complete the survey within one week, and no later than June 29th, 2017.

If at any point during this survey you are asked a question that you don't wish to answer you are free to skip that question and continue, or to withdraw from the research study. Submission of this questionnaire assumes consent has been given to participate in this research project. The data collected from this study will be kept for a period of one year and then destroyed. The final thesis will be published in RRU's Digital Archive, Pro-Quest and Library and Archives Canada.

If you have questions please contact the following:

Survey Related Questions – Donna Desantis – 519-796-6496

Potassium Iodide Pills - Windsor-Essex County Health Unit - 519-258-2146 ext 1445

Emergency Response and Nuclear Incidents – Town of Amherstburg – 519-736-6500

Demographic Information:

The participants for this study include all residents in the Town of Amherstburg that are within the primary zone of Enrico Fermi Nuclear Generating Station (Fermi 2) in Michigan, which has been designated as a 10 mile or 16.1 km radius from the plant, as well as all residents of Bob-Lo Island.

Appendix F – Survey Questionnaire

SURVEY QUESTIONNAIRE

CONFIDENTIAL!

All information you provide will be kept strictly confidential and analysis will be conducted in a manner that assures your answers will remain anonymous. This survey will be destroyed after this study is completed.

IT IS IMPORTANT TO NOTE THAT THE RISK HAS NOT CHANGED AT FERMI 2 AND THE PRE-DISTRIBUTION OF POTASSIUM IODIDE PILLS IS SIMPLY A PRECAUTIONARY MEASURE IN THE *UNLIKELY* EVENT OF A NUCLEAR EMERGENCY.

INSTRUCTIONS:

- Estimated completion time: 5 – 10 minutes.
- Please complete survey at your earliest convenience, and no later than June 29th, 2017.
- Only one person per household, over the age of 18, should complete the survey.
- Please return the questionnaire in the self-addressed, postage paid envelope.
- Please take this survey on your own, do not use any other sources (written material, internet etc) to take this survey.
- Please DO NOT GUESS. If you do not know the answer mark UNSURE.
- We are trying to improve future educational material regarding nuclear power plant emergencies and individual preparedness measures.
- **For questions on this survey please contact Donna Desantis at 519-796-6496.**

Thank you!

PART 1: GENERAL INFORMATION:

1. **Do you live within the primary zone (16.1 kilometers) of a nuclear power plant?**
 - Yes
 - No
 - Unsure

2. **Which is the closest nuclear power plant to your residence?**
 - Bruce
 - Pickering
 - Fermi
 - Unsure

3. **For your home located in the Town of Amherstburg, do you:**
 - Reside at this location on a full time basis
 - Rent this property
 - Seasonal use
 - Operate a business (such as a daycare) out of your home

4. **What is the current number of people who reside at this home?**
 - Infant: 1 month to 3 years old _____
 - Child: 3 to 12 years old _____
 - Adolescent: 13 to 18 years old _____
 - Adult: 19 to 39 years old _____
 - Adult: 40 years and over _____

5. **If you were told to evacuate, do you know the location of your reception center?**
 - Yes (*describe*) _____
 - No
 - Unsure

6. **Would you evacuate your home if told to do so by a government or other authority because of a nuclear emergency?**
 - Yes
 - No (*if not, why?*) _____
 - Unsure

7. **Do you know what the emergency siren sounds like?**
 - Yes
 - No
 - Unsure

8. **If you thought you were exposed to radioactive materials as a result of a nuclear power plant emergency, you would:**
 - Contact your Doctor
 - Contact the Health Unit
 - Call 911
 - Go to a reception center
 - Go to the nearest hospital or clinic
 - Other (*specify*) _____

9. If you heard the emergency siren, you would: (check all that apply)

- Listen to the radio
- Watch the news on TV
- Check social media
- Seek shelter in your basement
- Go to an emergency shelter
- Drive as far away as possible
- Call 911
- Other (*specify*) _____
- Unsure

10. Do you have a 72 hour emergency preparedness kit

- In your car
- In your home
- Other (*specify*) _____

PART 2: POTASSIUM IODIDE (KI) USE:

Please answer these questions on your own and do not use any other sources (written material, internet etc) to take this survey. The survey results will help to improve future educational material regarding nuclear power plant emergencies and individual preparedness measures.

1. Have you ever heard of:

- Potassium iodide pills or tablets
- Iodine Thyroid Blocking agents (ITBs)
- KI pills or tablets
- Anti-radiation or rad-block pills or tablets
- None of the above

FOR THE REMAINDER OF THE SURVEY, WE WILL USE ‘KI’ TO REFERENCE “POTASSIUM IODIDE PILLS OR TABLETS” OR “KI PILLS OR TABLETS”.

2. Radioactive iodine is present during all nuclear power plant emergencies.

- True
- False
- Unsure

3. KI pills provide protection from all types of radiation.

- True
- False
- Unsure

4. In general, pregnant women may safely take a KI pill.

- True
- False
- Unsure

- 5. Persons who have had or currently have thyroid disease should ask their doctor before taking a KI pill.**
- True
 - False
 - Unsure
- 6. Persons allergic to iodine can safely take a KI pill.**
- True
 - False
 - Unsure
- 7. In general, persons above the age of 40 should take KI if they are exposed to a very small amount of radioactive iodine.**
- True
 - False
 - Unsure
- 8. KI pills or tablets protect “_____”.**
- The whole body
 - The brain only
 - The thyroid only
 - Unsure
- 9. When should someone take their first dose of a KI pill or tablet?**
- As soon as KI pills are received regardless of exposure to radioactive material
 - Within hours before or after exposure to radioactive material
 - Only if they feel sick after exposure to radioactive material
 - Unsure
- 10. The recommended dose for adults vs. children is: (1 tablet = 65 milligrams)**
- Adults and children take the same amount
 - Children take more than adults
 - Adults take more than children
 - Unsure
- 11. How long does effective protection last for a single dose?**
- 24 hours
 - One full month
 - One full year
 - A lifetime
 - Unsure
- 12. Would taking several doses of KI at one time provide more immediate protection than just one dose?**
- Yes
 - No
 - Unsure

13. If you heard that there had been a significant accident at Fermi nuclear power plant, would you take a KI pill or tablet regardless of an official announcement from a government agency?

- Yes
- No
- Unsure

14. Where could someone without KI pills or tablets get KI during an emergency?

- Evacuation shelter
- Health Unit
- Internet (on-line order)
- Supermarket
- Pharmacy
- Clinic
- Family Doctor
- Hospital Emergency Room
- Other (*specify*) _____

15. How would YOU like to receive potassium iodide pills?

- In the mail
- Medical clinic
- Pharmacy
- Group meeting
- Pick-up location
- Other (*specify*) _____
- I don't

16. Do you intend to keep and store (in your home) the KI pills provided to you?

- Yes
- No (*if not, why?*) _____
- Unsure

17. How would YOU like to receive additional information on nuclear emergency preparedness?

- Written material (brochures, newsletters, fact sheets)
- Group meetings
- Media (newspapers, radio announcements)
- Social media
- Videos
- Face to face with a health care professional
- Email
- Internet
- Other (*please specify*) _____

PART 3: ABOUT YOU:

The following questions will help to describe the group that answered the questionnaire. All questionnaires are anonymous and kept strictly confidential.

1. **What is your age?**
 - Under 25
 - 26 – 39
 - 40 – 64
 - 65 or older

2. **What is your gender?**
 - Male
 - Female

3. **What is the primary language you speak at home?**
 - English
 - French
 - Other (*please specify*): _____

4. **What is your highest level of education completed?**
 - Up to grade 8
 - 9th through 11th grade
 - Graduated High School
 - Graduated College
 - Graduated University
 - Advanced degree (e.g., Masters, Doctorate)

5. **Have you completed any post secondary classes in engineering or science?**
 - Yes
 - No

6. **Who do you believe the responsibility for potassium iodide pill distribution lies with?**
 - The Town of Amherstburg
 - Windsor-Essex County Health Unit
 - Ministry of Health and Long Term Care
 - The Provincial Government
 - The Federal Government

7. **Who do you believe the responsibility for the protection of residents during an emergency lies with?**
 - The Town of Amherstburg
 - Windsor-Essex County Health Unit
 - Ministry of Health and Long Term Care
 - The Provincial Government
 - The Federal Government

End of Survey.

Appendix G – Survey Distribution Instructions

SURVEY DISTRIBUTION

Instructions for the Survey Distribution:

You have been provided with a list of properties and copies of a consent form and a survey questionnaire.

After identifying yourself, indicate that you are attending the property to **ASSIST** in distributing a survey questionnaire for an independent research project regarding the future distribution of potassium iodide pills and nuclear preparedness education (by the Windsor Essex County Health Unit). A Notice of Community Survey was distributed last week. The survey is completely anonymous and will contain NO personal identifiers, such as name or address.

The research project is being conducted by Donna Desantis through Royal Roads University, Program Head Dr. Robin Cox, and under the supervision of Dr. James Blando. Contact information for all can be found on the Survey Questionnaire Consent. The results of this research will be published.

As stated in the Notice delivered last week: **It is important to note that THE RISK HAS NOT CHANGED at Fermi 2 and the future pre-distribution of potassium iodide pills is simply a precautionary measure in the *unlikely* event of a nuclear emergency. Completion of the survey questionnaire invites residents' input in the process.**

Provide the resident (only those over the age of 18) with a copy of the consent form which they are to read and keep. The survey can be completed while you are at the residence and they can fill it out and hand it back to you. Remind them not to guess for a response, but to mark 'unsure'. They are free to skip any questions or to withdraw at any time without penalty. **It is important to note that this research study is voluntary and there is no penalty if they chose not to participate.**

Do not place any personal identifiers on the survey forms, such as name, address etc. Place all of the completed surveys into an envelope. Mark off each address you have attended where a resident is home and either completed or declined to complete the survey. (I will return at a later date to the residences where there is no one at home).