Site Specific Surveys for Pickering Nuclear and Darlington Nuclear REMPs

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What is a REMP Site Specific Survey?

- Information gathered on the local areas surrounding the nuclear station to support realistic assessment of human exposure due to operation of the station

Benefits of Performing a REMP Site Specific Survey

- Increases credibility of dose estimates and reduces unnecessary conservatism
- Builds public confidence in the programs
- Good public relations opportunity to provide awareness of our programs as well as invite participation, listen to feedback, answer questions, etc.

Purpose of a REMP Site Specific Survey

Information obtained is used to:

- Design the Environmental Monitoring Program
- Determine average critical group characteristics to generate more realistic public dose, public collective dose, and Derived Release Limit (DRL) calculations

Critical Group Concept for Dose

- Critical group = a relatively homogeneous group of people located off site whose characteristics (e.g. habits, location, etc.) cause them to receive the highest exposure
- Representative person = an average member of the critical group
- Dose is calculated for the representative person of several potential critical groups to determine the critical group receiving the highest dose

ICRP 101, CSA N288.1-08

When is the survey conducted?

- Site specific surveys are reviewed and updated every five years following the release of new census results from Statistics Canada.
- They may be reviewed sooner if there are significant changes affecting local characteristics.

Who is involved?

- Previous site specific surveys were conducted by OPG Environment staff and/or external contractors
- 2012 site specific surveys were conducted by two OPG Environment staff
- Public Affairs is consulted ahead of time; communications sent to public as appropriate

Where are they conducted?

- Generally in areas within a 5 km radius of the station
- Due to site-specific factors, some surveys are required beyond 5 km:
  - Few farms are within 5 km, therefore farms are surveyed to about 10 km and dairy farms to about 20 km out
  - Certain distinct residential pockets >5km out may be surveyed

Methodology

Information gathered for the OPG site specific surveys include:

- Data on the Potential Critical Groups
- Data from Potential Critical Group member surveys
- Data to support public collective dose calculations
- Data for assessment of aquatic dispersion of station effluents

Data on the Potential Critical Groups

- Any new potential critical groups?
- Any new representative locations for existing potential critical groups (i.e. new locations that may now be most exposed)?
- Any potential critical groups that should be discontinued (e.g. land is expropriated, building demolished, etc.)?

Information from:

- Municipal building permits as well as other organizations/contacts/internet

Data from Potential Critical Group Member Surveys

Survey information for:	Non-Residential Potential Critical Groups	Residential Potential Critical Groups
Information from:	▪ Representatives from industries, parks, and other facilities/organizations ▪ Creel surveys of time spent fishing near the stations and fish consumed	▪ Interviews of urban/rural residents, farmers, dairy farmers

Data for Public Collective Dose

- Population distribution within 30 km radius
- Estimated agricultural production within 30 km radius

Information from:

- Derived from census data

Data for Assessment of Aquatic Dispersion

- Updated local water supply plant (WSP) data
  - Length and depth of intakes, capacity, population served

Information from:

  - Municipal works departments

- Updated lake current data
  - Direction, frequency, speed

Information from:

  - OPG lake current monitoring systems

Residential Survey Interviews

- Residential survey information is obtained via door-to-door interviews
  - Response rate ~ 46% of homes visited in 2012
- Includes information such as:
  - Contact information
  - # adults/children/infants
  - # adults working within 5 km of stations
  - Water sources and use
  - % of food grown or bought from local sources
  - Information on livestock/feed/crops

Tips When Performing Interviews

- Wear identifiable clothing, name tags, and drive company-identified vehicle if possible
- Conducting interviews with two staff members is safer than one and provides a back-up driver
- Watch out for any hazards on properties and avoid aggressive outdoor/off-leash dogs
- All personal information is kept confidential and locations are reported using generic names, e.g. R15

2012 vs. Previous Survey Interviews

Survey Interviews*	1999-2001 Surveys	2004-2006 Surveys	2012 Surveys
Conducted by	2 OPG staff 8 external contractors (1-2 on a given day)	1 OPG staff member	2 OPG staff
# Days	39	47	20
# Interviews	550	208	169
Residential Potential Critical Groups Surveyed	PN – Local Residents PN – Farms PN – Dairy Farms DN – Oshawa/Courtice DN – Bowmanville DN – West-East Beach DN – Rural Residents DN – Farm DN – Dairy Farm	PN – Farms PN – Dairy Farms DN – West-East Beach DN – Rural Residents DN – Farm DN – Dairy Farm	PN – Local Residents PN – Farms PN – Dairy Farms DN – Oshawa/Courtice DN – Bowmanville DN – West-East Beach DN – Rural Residents DN – Farm DN – Dairy Farm

*Generally, one OPG staff member gathers all other required data, performs analysis, and prepares the final reports. This effort does not change significantly from survey to survey and therefore has been excluded from the table.

Note: Changes to potential critical groups/locations are made when known instead of waiting until the next survey.

2012 Site Specific Survey Results

- No new Potential Critical Groups nor change to current representative locations (compared to locations considered in 2010 DRL calculations)
  - A couple DN locations identified are slightly closer than ones previously considered in their wind sectors, but unlikely to be the most exposed overall
  - Discovered a closer publicly accessible beach near DN
- Obtained updated survey interview data
- Obtained updated population distribution, agricultural production, WSP, and lake current data

Example Summary of Survey Interviews

DN Rural Residents:

	# Adults (16+)	# Children (6-15)	# Infants/ Toddlers (0-5)	Total people	Adults working w/in 5km of Nuclear site	Adults at home during day
Totals	68	6	5	79	6	30.5

	Water Sources																
	Drinking Water				Bathing Water				Cooking Water				Garden Water				
	Deep Well	Shallow Well	Municipal	Bottled/ Spring/ Purchased	Deep Well	Shallow Well	Municipal	Bottled/ Spring/ Purchased	Deep Well	Shallow Well	Municipal	Bottled/ Spring/ Purchased	Deep Well	Shallow Well	Pond	Rain Barrel	Bottled/ Spring/ Purchased
Weighted Averages	66%	1%	4%	29%	85%	8%	4%	4%	82%	8%	4%	6%	86%	2%	0%	5%	7%
Well Depth wtd avg (m)	11.1	0.0			11.4	0.0			11.5	0.0			7.8	0.0			

	%Food Grown or Purchased Locally														Local Fish Consumed (kg/ person / yr)	Local Game/Lake Ontario Aquatic Plants Consumed (kg/ person / yr)
	Beef - grown	Beef - local	Poultry - grown	Poultry - local	Pork - grown	Pork - local	Eggs - grown	Eggs - local	Honey - grown	Honey - local	Fruit - grown	Fruit - local	Vegetables - grown	Vegetables - local		
Weighted Averages	0%	0%	0%	0%	0%	0%	4%	42%	0%	3%	2%	9%	9%	9%	0.0	0.0

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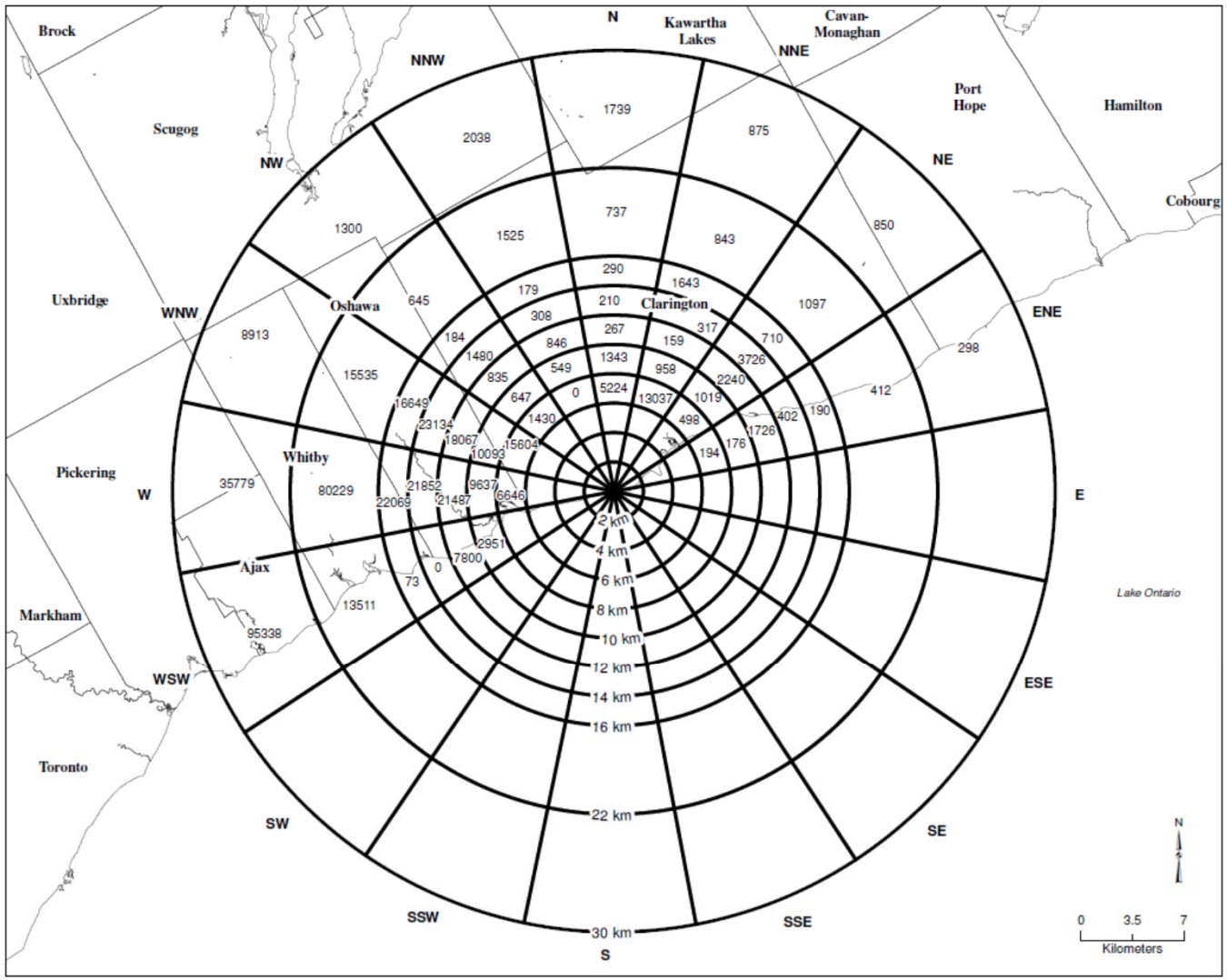
Example of DN Population Distribution

Demographic Distribution Around Darlington - 2011



Direction	Total Population	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0-2 km	5	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
2-4 km	3,356	1,295	1,934	0	0	0	0	0	0	0	0	0	0	0	10	102	15
4-6 km	13,166	2,200	8,466	797	0	0	0	0	0	0	0	0	0	455	494	324	430

Source: Statistics Canada, Advisory Services-Toronto
Source: Statistique Canada, Services Consultatifs-Toronto

Example of DN WSP and Lake Current Data

Water Supply Plants in the DN REMP

		Distance of Intake from Shore (m)	Intake Depth (m)	Capacity (m^3/day)	Population Served	Estimated Distance of Intakes from DN (km)
Oshawa WSP	East Intake	920	10	134,000	175546	7.8 km W
	West Intake	830	8.5			
Bowmanville WSP		1,260	11	36,368	35,803	6.8 km ENE
Newcastle WSP		1,070	11	8,173	11,152	13 km ENE

Current Speed and Direction from 2007 to 2011

	Depth averaged direction	Depth averaged speed - ALL	Depth averaged speed - 'E'	Depth averaged speed - 'W'
	deg from N	cm/s	cm/s	cm/s
Jan	144	9.0	9.9	8.3
Feb	139	9.1	10.1	9.0
Mar	163	8.5	8.3	10.0
Apr	168	7.9	8.5	8.3
May	172	5.9	5.7	7.1
Jun	165	6.2	6.6	7.0
Jul	200	7.2	6.8	8.1
Aug	189	10.4	11.1	11.0
Sep	174	9.7	10.8	10.0
Oct	177	9.7	10.2	10.2
Nov	174	9.2	10.7	9.0
Dec	148	10.1	11.2	9.4
Average of monthly averages		8.6	9.2	9.0

Lake Current Data from 2007 to 2011

Direction "To"	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Easterly	Westerly
Total Number of Measured Hours	0	35	1117	6309	4507	2022	1657	1584	1607	1770	2857	9225	2917	204	16	2	13955	15203
Percent of Total Measured Hours	0.0%	0.1%	3.1%	17.6%	12.6%	5.6%	4.6%	4.4%	4.5%	4.9%	8.0%	25.7%	8.1%	0.6%	0.0%	0.0%	38.9%	42.4%
Average Speed (cm/s)	N/A	4.54	5.93	9.53	10.21	6.92	5.99	5.80	5.62	5.88	6.78	9.25	9.77	5.95	5.66	2.51	8.15	7.94
Maximum Speed (cm/s)	N/A	8.89	27.54	41.76	44.87	25.60	21.60	22.46	22.18	18.61	27.13	42.40	36.86	26.07	15.29	2.61	44.87	42.40

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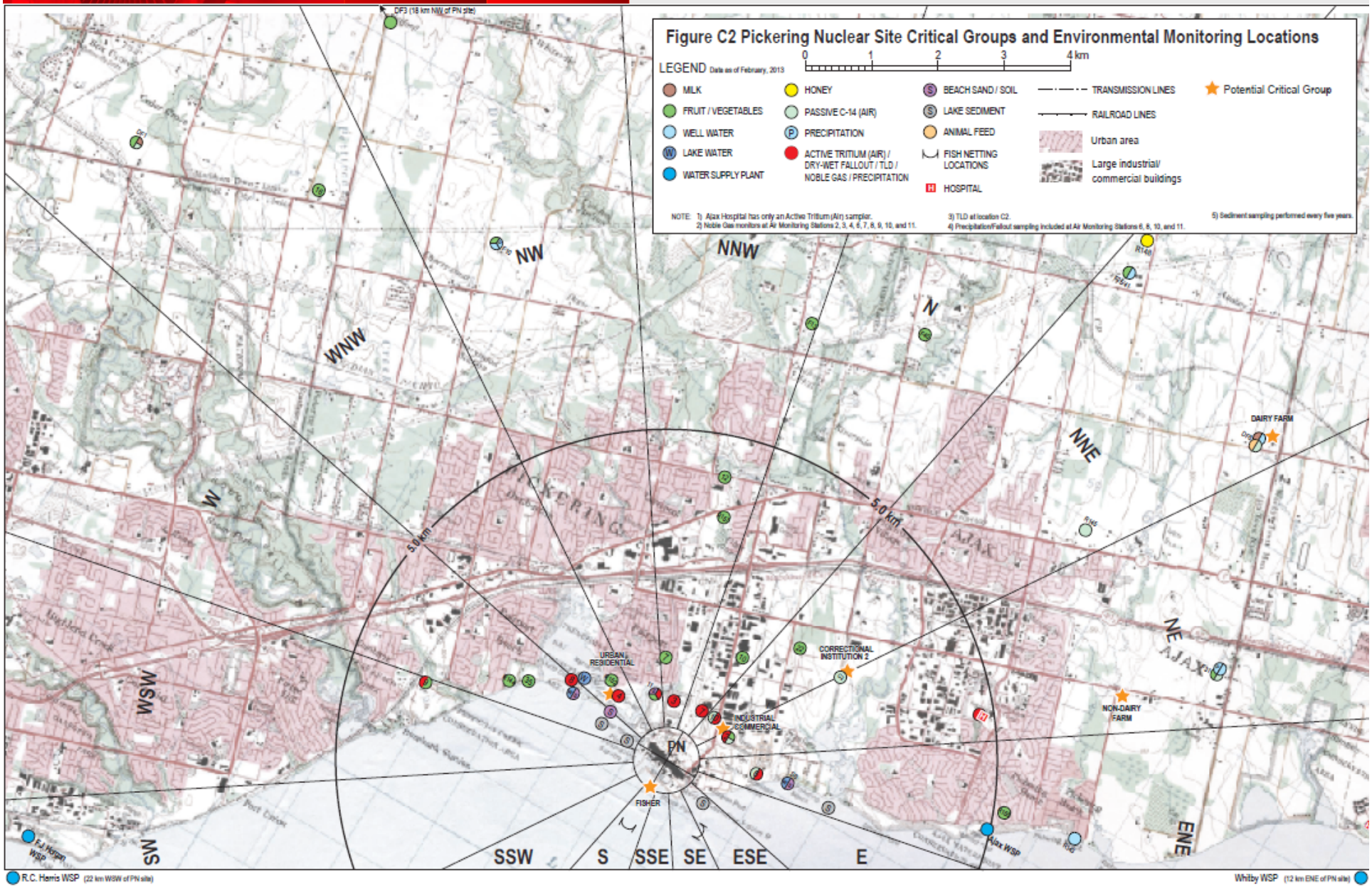

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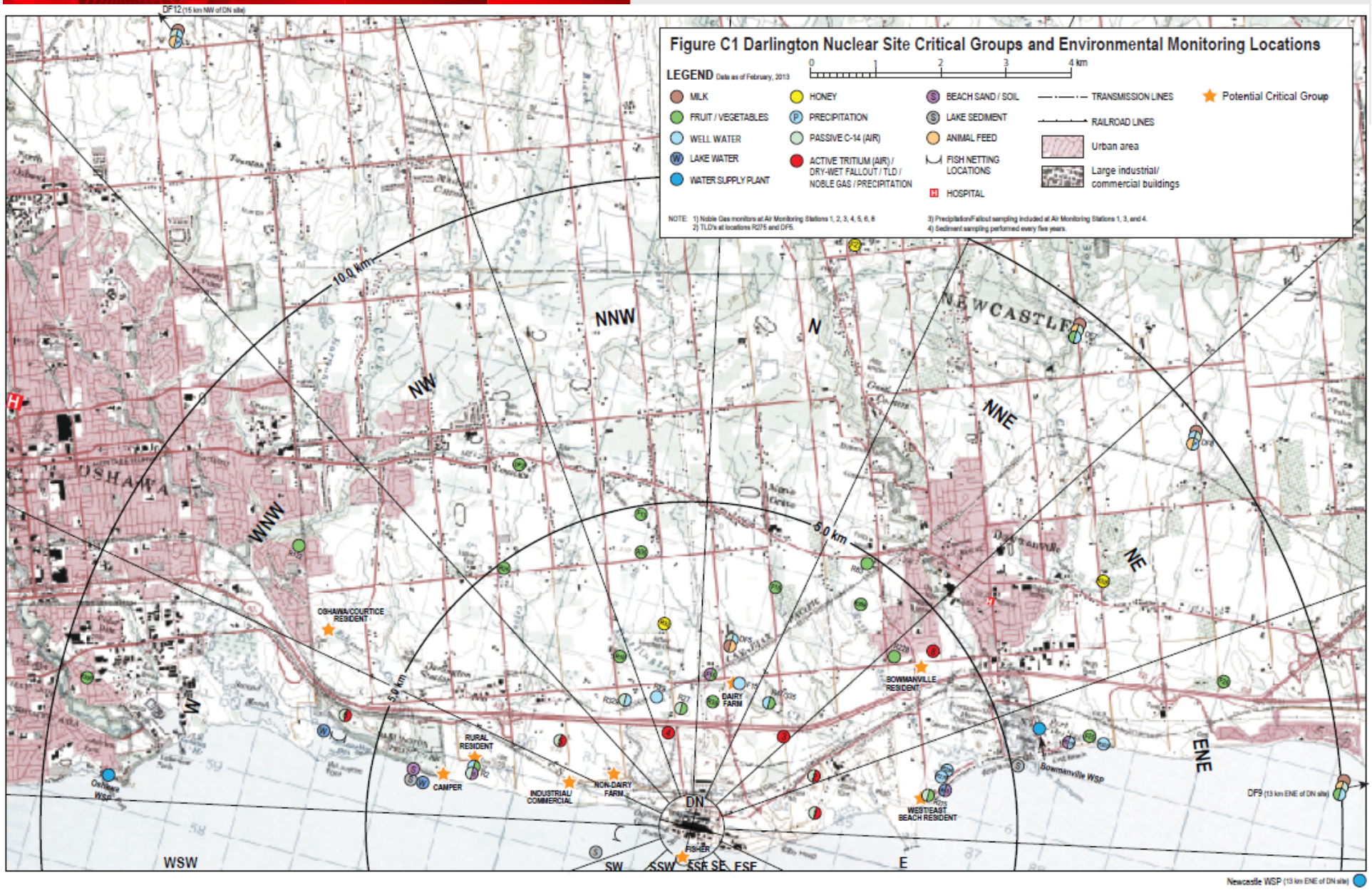

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Next Steps

- Use updated potential critical group characteristics and consider any newly identified locations in the next DRL/pathway analysis/dose calculations
- DN and PN Environmental Monitoring Program design reviews will be conducted in 2013 and will incorporate results of the site surveys and pathway analyses
- Use updated population distribution and agricultural production data for next public collective dose
- Use updated WSP and lake current data for aquatic dispersion/dilution factors and IMPACT model water plume characteristics for DRL/dose/abnormal waterborne release calculations

- Questions?
- Any suggestions?