Supplementary Information

Oral Presentation

Presentation from Jerry Cuttler

In the Matter of

Ontario Power Generation Inc.,
Pickering Nuclear Generating Station

Request for a ten-year renewal of its Nuclear Power Reactor Operating Licence for the Pickering Nuclear Generating Station

Commission Public Hearing – Part 2

June 2018
CNSC Public Hearing – Part 2
Pickering, Ontario, June 25-29, 2018
OPG application for renewal of operating licence for
Pickering NGS

Intervenor Presentation
Part A: Licence renewal application
Part B: Health effects of radiation
by
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Part A: Review of documents and presentations

- OPG application for renewal of operating licence
- OPG CMD submission: Request for 10-year licence
- CNSC Staff CMD submission: A licence renewal
- OPG presentation, Public Hearing Part 1
- CNSC Staff presentation, Public Hearing Part 1
- Commission members questions and the responses
Part A: Intervenor conclusions

- OPG application and CMDs are of high quality and detailed.
- Public Hearing presentations were effective and convincing.
- Pickering NGS design very safe; many barriers against release.
- Plant in good condition; well managed; CNSC is very watchful.
- Pressure tube fracture in 1983 showed calandria tube can take full HTS pressure. No public or worker safety concern.
- 3-inch pipe failure in 1994. No release of radioactive material.
- With on-going maintenance and pressure tube monitoring, Pickering NGS could operate safely beyond 2024.
Part A: Intervenor recommendations

- CNSC to approve of OPG application for 10-year licence.
- OPG to apply for licence to operate Pickering NGS beyond 2024, if economic conditions become favourable.
Part B: Health effects of radiation exposures

- X-rays and nuclear radiation used in medicine since 1896 --- for more than 120 years.
- Low doses treated many illnesses: cancers, infections, wounds, asthma, inflammations.
- *Tolerance dose limit* of 2 mSv/day in 1924 for rad protection.
- U.S. National Academy of Sciences started *radiation scare* in 1956 for political purpose of stopping atomic bomb testing.
- LNT model to calculate risk of radiation-induced cancer.
- No evidence presented to support the change from tolerance dose limit to ALARA.
- All government regulators accepted it without reviewing facts.
Stimulation dose-response model vs. LNT model

![Graph showing the comparison between stimulation dose-response model and LNT model. The graph illustrates the relationship between absorbed radiation dose or dose-rate and health effects. The stimulation model shows an optimum point where radiation-induced beneficial effects are maximized, followed by radiation-induced harmful effects as the dose increases. The LNT model, on the other hand, suggests a linear decrease in health effects with increasing dose. The graph also highlights the concept of a threshold or NOAEL (no observed adverse effects level).]
Part B: Modern understanding of radiation effects

• Aerobic metabolism (breathing air) produces reactive oxygen species (ROS) that damage biomolecules-DNA at very high rate.

• Organisms have many very powerful protection systems that: 1) produce antioxidants to prevent damage, 2) repair damage, 3) kill/remove unrepaired cells, toxins 4) immune system kills cancer cells and pathogens 5) replace cells, restore health.

• Low level radiation: a million times lower damage rate than naturally-produced ROS.

• Low radiation dose stimulates the protection systems.

• Small burst of hits/ROS causes beneficial health effects.

• Large dose inhibits protection, causing harmful effects.

• The thresholds for onset of harm are known.
Hiroshima leukemia threshold at 500 mSv (50 rem)

J-curve, not LNT model
\(\gamma\)-radiation dose-rate threshold > 700 mGy/year
Chernobyl NPP Workers April 26th 1986

• 134 workers were treated for acute radiation syndrome
• 28 of them died within 3 months (doses: 2 to 16 Gy)
• 106 remained alive.
• 22 died over 19 years; their mortality = 1.09% per year
• It’s lower than average mortality rate = 1.4% (in 2000).
• Their cancer mortality was 26% (in 2001), about the same as normal cancer incidence in Central Europe.
• No evidence of radiation-induced delayed effects.
Chernobyl NPP Residents April 26th 1986

• 116,000 residents were evacuated, within 30 km radius.

• Their average dose was 17 mGy, which is very low.

• Many suffered post-traumatic stress; many early deaths due to fear of “health effects”, i.e., risk of cancer.

• Screening for thyroid cancer. Average dose to thyroid gland = 1.4 Gy for 2,400 children 0 to 3 years old.

• Hyperthyroid patients receive average 300 MBq of I-131, which delivers 300 Gy dose to thyroid gland; no cancers.

• Screening results in large overdiagnosis of natural occult thyroid cancer nodules. These nodules are rarely fatal.

• Unnecessary thyroidectomies are harmful.
Fukushima-Dai-ichi NPP March 11th 2011

- Plant worker doses did not exceed 700 mSv/y limit (1924).
- 300,000 residents evacuated due to ICRP limit 1 to 20 mSv/y.
- By 2012 March 31st, 1632 died of disaster-induced stress, aggravation of existing illnesses; > 95% were > 60 years old.
- Highest total dose 1st year = 235 mSv; < 260 mSv in Ramsar.
- Precautionary evacuation did not prevent harm. Resulted in 1632 premature deaths and extreme hardship.
- More than 70,000 are still evacuated.
- Returning residents are fearful of “health effects”.

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91 µSv/h x 8766 h/y = 798 mSv/y ~ natural HBRAs
Cumulative dose City of Ramsar, Iran up to 260 mSv/year
Part B: Intervenor conclusions

• Regulators accepted tolerance dose of 2 mSv/day in 1924.
• Antinuclear political activity led to LNT model, ALARA in 1956.
• Fear of cancer cut dose limit from 700 down to 10 mSv/year.
• Now have biological explanations for low-dose stimulation of protection systems against high natural oxidative DNA damage.
• Nuclear regulators should return to dose thresholds and limits: 500 mGy acute and 700 mGy per year instead of LNT and ALARA
• Nuclear accidents do not harm residents; no evacuation needed
• Low doses should not be regulated; they are beneficial.
• Should study radiation-induced longevity instead of cancer.
• Fear blocks important applications of low-dose treatments.
Low-dose therapy to *prevent* cancer recurrence

150 mGy x twice per week x 5 weeks = 1500 mGy
Alzheimer’s dementia patient in hospice. Three CT X-ray scans of brain in July – Aug 2015. Quick recovery of appetite, cognition. Also Parkinson’s patient recovers after CT scan. No pills needed to control tremors.
Part B: Intervenor recommendations

• Nuclear regulators should examine the biological and medical evidence and study the mechanisms.
• Discuss this information in international meetings.
• Canadian authorities should find a way to inform Canadians about the real effects of ionizing radiation on their health.
• Then revise the radiation protection regulations.