NFLA New Nuclear Monitor Policy Briefing

Nuclear Free Local Authorities
Councils working for a renewable, safe and peaceful future

Edition Number 53

NFLA All Ireland Forum model submission to Irish Councils to respond to a transboundary environmental consultation of the potential impacts of the Hinkley Point C development

i. Overview of Policy Briefing

This edition of the NFLA's New Nuclear Monitor provides an updated and expanded NFLA All Ireland Forum's model submission for Irish Councils and interested groups to respond to the UK Government's transboundary consultation of the potential impacts on Ireland of the Hinkley Point C nuclear development. This directly responds to an earlier NFLA All Ireland Forum submission to an October 2017 consultation of the UK Government on the same matter.

At the time the UK Government was instructed by the UN Espoo Convention Secretariat to hold this consultation for neighbouring European states, groups and individuals to make their representation on transboundary issues of concern, should the Hinkley Point C site in Somerset be considered for development. At this time, the NFLA All Ireland Forum was disappointed that the Republic of Ireland Government had not been one of a number of EU states who had encouraged their citizens to take part in the UK consultation, and the Forum Co-Chairs wrote to the Irish Environment and Energy Minister Denis Naughten noting its disappointment.

Following further lobbying from groups like An Taisce (Irish National Trust) and the Friends of the Irish Environment, the Irish Government announced on the 20th February 2018 a local consultation on the same matter, seeking views directly via Irish Councils from interested groups and individual citizens. The Irish Government has spoken to the UK Government and agreed responses can be sent to the UK Government from the Councils up to the **17th April**.

To respond to the consultation - All Councils are collating responses from individuals and groups that come in via their Planning sections, and contact points for each Council can be found at -
http://www.housing.gov.ie/planning/other/transboundary-environmental-public-consultation-hinkley-point-c-nuclear-power-plant
- and they are then sending them on to the UK Government at the following email address beiseip@beis.gov.uk. The NFLA All Ireland Forum also encourages Irish Councils to send their own formal response of submissions or observations, using its expanded model response below.

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1. Core summary of NFLA All Ireland Forum response to the BEIS consultation

- Discharges from the proposed Hinkley Point C nuclear Power station could cause around 200 deaths across the globe over its 60-year lifetime.

- The radioactivity of spent fuel from Hinkley Point C would amount to around 80% of the radioactivity of waste already produced in the UK.

- This could be stored at the Hinkley Point C site until around the year 2185. A major fire in a spent fuel pond "*could dwarf the horrific consequences of the Fukushima accident*."

- Energy efficient improvements could reduce the energy consumed in UK households each year the equivalent to the output of six nuclear power stations the size of Hinkley Point C.

- Offshore wind and solar are now both able to generate electricity more cheaply than nuclear power. If the UK had continued renewable expansion at the same rate as between 2010 and 2015 it could have achieved an all-renewable UK electricity supply by 2025.

- In addition, a report from ESRI suggests, in the worst-case scenario, the economic cost of a nuclear accident impacting on Ireland could be as high as €161 billion.

- An additional recent submission by NFLA / KIMO to the OSPAR Commission outlines that a full proposed UK new nuclear programme will only compound these issues and threatens the OSPAR Treaty regulations of 'close to zero' discharges into the Irish Sea by 2020 and beyond.

2. Introduction

In its October 2017 submission to the UK Government, the NFLA All Ireland Forum noted that the Dutch nuclear regulator ANVS had started a similar procedure in the Netherlands (as now being initiated by the Irish Government through Irish Councils) under the Espoo Convention for public participation regarding the proposed Hinkley Point C (HPC) nuclear power station in the UK.

The consultation concerned the potential cross-border environmental impacts in the Netherlands caused by the proposed nuclear power station. NFLA noted that ANVS said the British competent authority has, so far, failed to carry out a cross-border environmental impact consultation, because it was concluded that there is no chance of potentially significant adverse environmental impacts in other countries. Whether this judgment is right or not is currently subject to a Complaint procedure with the Compliance Committees of the Espoo and Aarhus Treaties.

As a mark of 'good will' the UK government offered non-UK residents, governments and groups in Europe the opportunity to make submissions and review the environmental impact report and the accompanying documents for possible cross-border environmental impacts. The NFLA All Ireland Forum welcomed this development, which it believes should have been made much sooner, given that early work on the Hinkley Point site has already begun.

The NFLA All Ireland Forum also noted that Germany, Luxembourg, the Netherlands and Norway have already participated in this procedure, and it assume that members of the public and interested groups from other countries will also be able to participate under Aarhus Article 3.9, where the UK recently was found in non-compliance regarding Hinkley Point C. As such the Forum responded in detail to outline its observations on the potential transboundary impacts of Hinkley Point to the island of Ireland.

3. Hinkley Point C Environment Impact Assessment

Research from around the globe, for instance and in most detail, the KIKK Study from Germany, has shown that there is unquestionably a strong link between proximity to nuclear power stations and childhood cancer. Independent consultant on radioactivity in the environment, Dr Ian Fairlie says:

"*I can think of no other area of toxicology (e.g. asbestos, lead, smoking) with so many studies, and with such clear associations as those between Nuclear Power Plants and child leukaemias.*" (1)

This must surely mean that if cleaner ways to generate electricity are available which do not discharge radioactive wastes into our atmosphere and seas or generate radioactive waste these should be used in preference.

4. Collective Doses

In 1991, the International Commission on Radiological Protection (ICRP) adopted a linear, no threshold model for radiation's effects. Thus no dose of radiation, no matter how small is without some added level of risk. Collective dose is an important measure of the total exposure of a population over time from a given release of radionuclides and it is an indicator of total detriment to health. The collective dose is, to a first approximation, the average individual dose in an exposed population multiplied by the size of the population. Collective dose represents an attempt to quantify the radiological impact of radioactive discharges to populations larger than the critical group. Collective doses are measured in person-sieverts (person Sv).

Collective doses are sometimes calculated for UK or European populations, but for radionuclides which have long half-lives and become globally dispersed, including tritium, carbon-14, krypton-85 and iodine-129, it is internationally accepted practice to calculate their global collective doses. Calculating the global collective dose can also be seen as morally important when one considers the fact that no-one outside the UK is receiving a countervailing benefit from discharges.

As with critical group doses, estimates of the risks associated with a particular collective dose are fraught with uncertainties and unknowns. The behaviour of radionuclides in the global environment must be predicted over long time-scales and the computer models used to do so are unlikely to be validated by comparison with sufficient data. Future human behaviour and the behaviour of each radionuclide in the human body must also be predicted and estimation of the dose-risk factor in itself involves a large number of assumptions and several models all with uncertainties attached which have to be multiplied together. Such risks from collective doses are underestimates as they do not include detrimental human health effects other than fatal cancers (e.g. skin cancers) and genetic effects.

Of course collective dose/risk estimates neglect detriment to ecosystems, organisms and species. It is sometimes argued that collective doses should be truncated to 500 years, because after that the uncertainty becomes too great. However, just because there is uncertainty does not seem to be a good enough reason to assign a zero risk.

To convert from collective doses to fatal cancers, the ICRP's absolute fatal cancer risk of 10% per Sv can be used, although some analysts apply a dose and dose rate reduction factor (DDREF) which reduces the number of estimated fatal cancers in Europe by a factor of 2, and in the US by 1.5. However, many epidemiology studies offer little support for the use of such a factor, certainly for solid cancers. Also, the recent WHO (2013) report on risks from Fukushima recommends that a DDREF should not be used for longer term exposures. (2)

The radiation protection community is usually reluctant to translate collective dose into numbers of deaths. This seems to stem from the Greenpeace campaign during the THORP public consultation in 1993-4 when it was argued that THORP would cause 600 deaths (calculated using a 5% risk factor). But NFLA notes that Sumner and Fairlie argue that radiation protection should be about protecting people, not the nuclear industry from criticism. (3)

The Environment Agency of England and Wales (EA) refer to an estimate made by EDF and AREVA of collective doses to UK, Europe and world populations truncated at 500 years using a computer model known as PC CREAM 98. These collective dose estimates were revised in the EA's Supplement to its Decision Document (4) but, in fact the collective dose to the world population remained at 16.9 person Sievert (Sv) per year. (See table below).

Bearing in mind that EDF Energy is proposing to build two EPR reactors at HPC, the total collective dose would be in the region of 33.8 person Sv per year of discharge. By applying the risk factor of 10% per sievert we can calculate that this means there will be around 3.4 deaths somewhere in the world for every year the station operates. Over 60 years, the total would be 204 deaths.

5. Uncertainties

There are many uncertainties in current estimates of radiation doses and risks and larger uncertainties exist with internal radiation. These arise mainly from the many steps used to derive doses, and partly from lack of statistical precision in deriving risks from epidemiology studies. The size of these uncertainties has been estimated by a number of expert dosimetrists: for some nuclides these are very large. A report by the UK Government's Committee Examining Radiation Risks of Internal Emitters (CERRIE) recommended that uncertainties should be acknowledged and dealt with by the government. Its parent committee, the Committee on Medical Aspects of Radiation in the Environment COMARE, backed these findings. (5) A 2001 Consultation Paper from the Department for Environment Food and Rural Affairs summed up the view which prevailed at the time:

"*The unnecessary introduction of radioactivity into the environment is undesirable, even at levels where the doses to both humans and non-human species are low, and on the basis of current knowledge are unlikely to cause harm*" (6)

Table 13.4b EDF and Areva's revised estimate of collective doses and per person dose from one year's discharges at maximum expected annual discharges

(revised after the consultation)

Population	Collective dose manSv (for one year of discharge)	Per person dose Nsv (for one year of discharge)
UK	0.31	5.6
Europe	2.46	3.5
World	16.9	1.7

6. Nuclear Waste

Spent nuclear waste fuel from Hinkley Point C (HPC) could be stored in wet storage ponds on the site in Somerset for up to 160 years. By the time the station closes around 2085 the radioactive content of the waste will amount to the equivalent of 80% of the waste which already exists in the whole of the UK. The consequences of a fire in the Hinkley storage ponds could dwarf the accident at Fukushima.

There has been virtually no discussion about what will happen to the nuclear waste, despite the fact that the UK still has no concrete plan for the waste its nuclear industry and weapons programme has already created. After more than 60 years of a civil nuclear power programme, the UK is still seeking a long-term solution for dealing with its higher activity radioactive waste. Government policy is that higher activity waste (HAW) should be buried deep underground in what is known as a Geological Disposal Facility (GDF). But in January 2013 Cumbria County Council rejected plans to undertake preliminary work on an underground radioactive waste dump somewhere in the west of the County. That rejection sent the plans back to the drawing board and left the UK once again without even a potential site for a GDF.

In the absence of any concrete plans it is not clear what the transboundary impacts of waste generated by the proposed HPC will be.

Unlike the spent fuel from Hinkley Point B (HPB) which is transported by train to Sellafield in Cumbria for reprocessing, the Government does not expect spent fuel from HPC to be treated that way. In fact the Thermal Oxide Reprocessing Plant (THORP) at Sellafield which reprocesses the spent fuel from HPB is due to close in 2018, and there are no plans to replace it. (7)

A GDF is not expected to be ready to receive waste until around 2040 (and probably later than that). Waste from new reactors like HPC is not expected to be emplaced in the GDF until after all currently existing waste has been. Emplacement of the waste is expected to take around 90 years – around 2130. This means that spent fuel from HPC could remain on the site in Somerset for at least the next 100 years, remaining a real local and wider environmental risk. (8) The other factor which needs to be taken into account is that HPC is expected to use high-burn up fuel which could require up to 100 years of cooling before it will be cool enough to be emplaced in a GDF. (9)

So assuming HPC comes on stream around 2025, with an expected reactor life of 60 years, this means spent fuel may need to be stored in Somerset until about 2185.

7. How much waste will Hinkley Point C generate?

The UK nuclear industry and government repeatedly claim that the volume of nuclear waste produced by new reactors will be small, approximately 10% of the volume of existing wastes; implying this additional amount will not make a significant difference to finding an underground dump for the wastes the UK's nuclear industry has already created. The use of volume as a measure of the impact of radioactive waste is, however, highly misleading. (10)

Volume is not the best measure to use to assess the likely impact of wastes and spent fuel from a new reactor programme, in terms of its management and disposal. The 'high burn-up fuel' which Hinkley Point C is expected to use will be much more radioactive than the spent fuel produced by existing reactors like Hinkley Point B. So rather than using volume as a yardstick, the amount of radioactivity in the waste, which affects how much space will be required in a deep geological repository, are more appropriate ways of measuring the impact of nuclear waste from new reactors.

According to Radioactive Waste Management Ltd, the radioactivity from existing waste (i.e. not including new reactors) is expected to be 4,770,000 Terabecquerels (TBq) in the year 2200.

The radioactivity of the spent fuel alone (not including other types of waste) generated by a 16GW programme of new reactors is expected to be around 19,000,000TBq. HPC would be a 3.2GW station, so the amount of radioactivity in the spent fuel from HPC in the year 2200 would be 3,800,000TBq – ***or about 80% of the radioactivity in existing UK nuclear industry waste streams***. (11)

8. How will spent fuel be stored at Hinkley?

Although EDF Energy says it is possible that spent fuel might start to be transported off site during the lifetime of HPC, the Company says it is prudent to plan to store all of the lifetime arisings of the two reactors which are planned. The plan is to store spent fuel from HPC in spent fuel storage ponds. EDF is planning to be able to extend the life of the storage ponds for up to 100 years after the reactors close. (12)

A recent study in the US detailed how a major fire in a spent fuel pond ***"could dwarf the horrific consequences of the Fukushima accident."*** The author Frank von Hippel, a nuclear security expert at Princeton University, who teamed with Princeton's Michael Schoeppner on the modelling exercise said ***"We're talking about trillion-dollar consequences."*** (13) This would clearly involve major transboundary radioactive releases.

8. Safer, sustainable renewable energy alternatives to Hinkley Point C

Clearly there are cleaner ways to generate electricity available which do not discharge radioactive wastes into our atmosphere and seas. These should be used in preference to building HPC. The evidence is stacking up to show that, in the words of Professor Keith Barnham, author of '*The Burning Answer: A user's guide to the solar revolution*' the UK "…*doesn't need a new generation of expensive nuclear reactors or a dash for shale gas to keep the lights on. An all-renewable electricity supply can provide energy security*." (14)

The Environmental Impact Assessment for HPC should compare the potential impact of building two new EPR reactors in Somerset, England, with improving energy efficiency or supplying energy from alternative sources such as renewable energy. The EDF Energy Environment Statement does not do that.

NFLA notes that, according to the UK Energy Research Centre (UKERC), energy efficient improvements to home heating, insulation, lighting and appliances could reduce the energy consumed in UK households each year the equivalent to the output of six nuclear power stations the size of Hinkley Point C saving consumers £270 off the average household energy bill of £1,100. (15) In fact, when the UK government first endorsed Hinkley Point C, (HPC) it was projecting an increase in electricity consumption of 15% by now, whereas in practice the UK is consuming 15% less than a decade ago. In other words Government projections were out by 30%, and the need for new nuclear therefore lessens. (16)

The price of £57.50 per megawatt hour unveiled recently for two giant wind projects, off the coast of the UK is almost half the level expected to be paid for HPC - £92.50/MWh at 2012 prices (which by now will be around £100/MWh). What is more the offshore wind payments only continue for 15 years compared with nuclear payments which continue for 35 years.

NFLA also note that, according to the *Daily Telegraph,* Britain could theoretically produce up to 595GW from offshore wind at competitive cost, an order of magnitude more than Britain's entire power needs, even at peak times in the dead of winter (53GW). Some excess power could be sold to Europe through interconnectors, and some could be turned into hydrogen through electrolysis and used to replace fossil gas. (17)

Solar power, once so costly it only made economic sense in spaceships, is becoming so cheap that it will push coal and even natural-gas plants out of business faster than previously forecast according to the Bloomberg New Energy Finance (BNEF) outlook. (18) According to the 100% renewable utility, Good Energy, the wholesale price of electricity in the UK is falling, mainly due to the rise in solar photovoltaics (PV) and wind power. (19) Emeritus Professor Keith Barnham says if renewable expansion had continued at the same rate it did between 2010 and 2015 we could have achieved an all-renewable UK electricity supply by 2025.Why cull such popular and successful industries, apart from the political imperative to develop new nuclear?

The UK has more than 32GW of renewable power, 10 times the power the Hinkley Point C nuclear plant may achieve in 2030. Hinkley's power is not only almost irrelevant; its inflexible nature will make it redundant. Once operating, a nuclear reactor should run with constant output, 24/7, month to month, but power that complements wind and PV has to vary in less than one hour. What the UK needs (like Ireland) is flexible, not continuous baseload power generation to back up wind and PV power. (20)

Clearly, the electricity which HPC is expected to generate could be replaced by energy efficiency measures and renewable energy systems more cheaply, more quickly and without radioactive discharges to the environment or the generation of radioactive waste. The risk that the UK, Irish and European public will be subjected to by the construction of HPC can, therefore, no longer be justified.

9. Additional observations

NFLA would like to note a number of additional observations since its October 2017 submission to the UK Government, which add relevant concerns.

ESRI report – The Potential Economic Impact of a Nuclear Accident: an Irish Case Study
This 2016 report was commissioned by ESRI for the Irish Environmental Protection Agency to consider what the economic impacts could be from a UK or French based nuclear accident sending a radiation cloud over parts of the island of Ireland. (21) The report looked at a range of scenarios from one where no radioactive contamination occurs, to others with minor, significant or high on-land contamination. NFLA encourages the UK Government to study this report and respond directly to its totality as part of this consultation process.

'Headline' issues noted from the report include:

- In the worst-case scenario, a nuclear disaster in North West Europe (originating from the UK or France in particular) could create total economic damage to the Irish economy of **€161 billion.**
- Irish agricultural production would grind to a halt, with the tourism industry and exports also incurring substantial damage.
- Even the most benign scenario considered by ESRI, where no radioactive contamination occurs, could still see a total loss estimated at €4 billion, due to the reputational damage this could have on Ireland.
- By comparison, the total value of corporation tax collected in the first nine months of 2016 (when the report was published) was €4.16 billion.
- ESRI also acknowledge that their analysis ***underestimates*** the true extent of such an incident to its cost to the economy.
- For example, in addition, health risks from high levels of radioactive contamination, could put a significant strain on the health service, requiring additional resources to be found.
- The total cost of a low-level radioactive contamination scenario, which requires the imposition of food controls to reassure the public and restrictions food imports to Ireland, would be €18 billion.
- The impact on tourism would also be significant, with long-term reputational damage resulting in an economic cost of €80 billion.
- In the absolute worst-case scenario in the ESRI study, not only would exports be decimated but the need to import much of the country's food would lead to far higher domestic costs. There could also be significant emigration.

NFLA / KIMO submission to the OSPAR Radiation Substances Committee
In early 2018, NFLA was commissioned by KIMO International, to consider the potential impacts of the entire proposed UK new nuclear programme, which includes Hinkley Point, but also new nuclear reactors at Wylfa, Sellafield Moorside, Sizewell, Bradwell, Oldbury, Heysham and Hartlepool. (22)

Table 1 summarises the levels of planning electricity such a programme could generate:

Proposed Nuclear Station	Technology Proposed	Developer	Construction start expected	Commercial operation forecast
Hinkley Point C (Somerset)	2 x 1600MW EPRs	EDF 66.5% CGN 33.5%	First concrete 2019	End of 2025 with risk of 15 month delay (11)
Wylfa Newydd (Anglesey)	2 x 1350MW ABWRs	Horizon Nuclear Power - wholly owned subsidiary of Hitachi, Ltd.	2020	First electricity mid-2020s - 2025-2028 (12)
Moorside (Cumbria)	3 x 1150MW AP1000s (but could be replaced by 2 x 1400MW APR1400)	NuGen (currently owned by Toshiba – but hoping to sell to KEPCO) (13)	No date – but a 4-5year Generic design Assessment process required for APR1400, so ~2023-4	Not by 2025 – no new date
Sizewell C (Suffolk)	2 x 1600MW EPRs	EDF 80% CGN 20% (14)	2021	2031 (15)
Oldbury B (Gloucestershire)	2 x 1350MW ABWRs	Horizon Nuclear Power - wholly owned subsidiary of Hitachi, Ltd.	Late 2020s at the earliest. (16)	Mid to late 2030s?
Bradwell B (Essex)	2 x 1000MW UK HPR1000	CGN 66.5% EDF 33.5% (17)	No defined timeline; began GDA process in Jan 2017	

The NFLA / KIMO submission also considered the potential levels of gaseous and aqueous discharges from such a programme.

Table 2: Predicted gases discharges for a single reactor of each type

Radionuclide	EPR (18)	AP1000 (19)	ABWRs (20)	Range for 1000 MWe station (21)
Tritium	500GBq	1800GBq	2700GBq	100 – 3600GBq
Carbon-14	800GBq	606GBq	910GBq	40 – 530GBq
Radioactive Noble Gases	350GBq	8047GBq	1980GBq	100 – 10,000GBq
Radio-iodines	50MBq	210MBq		<1 – 2000MBq

Given that there are four EPRs proposed, three AP1000s and four ABWRs the total gaseous discharges from the proposed new nuclear programme are noted in Table 3.

Table 3: Predicted gaseous discharges from notional UK new reactor programme

Radionuclide	4 x EPRs	3 x AP1000s	4 x ABWRs	Total
Tritium	2,000GBq	5,400GBq	10,800GBq	18,200GBq
Carbon-14	3,200GBq	1,818GBq	3,640GBq	8,658GBq
Radioactive Noble Gases	1,400GBq	24,141GBq	7,920GBq	33,461GBq
Radio-iodines	200MBq	630MBq		830MBq

Table 4: Predicted liquid discharges for a single reactor of each type;

Radionuclide	EPR (27)	AP1000 (28)	ABWRs (29)	Range for 1000 MWe station
Tritium	52,000GBq	33,400GBq	200GBq	2,000 – 30,000Gbq
Carbon-14	23GBq	3.3GBq		3-45GBq
Iodine radionuclides	7MBq	15MBq	0.035MBq	10-30MBq
Other radionuclides	0.6GBq	2.7GBq	2.3MBq*	<1-15GBq

*This is Fe-55. According to the Environment Agency the aqueous discharge activity is dominated by tritium (H-3), which is not abated and constitutes over 99.99% of the activity in the aqueous discharges. The second largest contributor of activity to the discharges is iron-55 (Fe-55), which only constitutes 0.0012% of the activity discharged.

Table 5: Predicted liquid discharges from notional UK new reactor programme

Radionuclide	4 x EPRs	3 x AP1000	4 x ABWRs	Total
Tritium	208,000GBq	100,200GBq	800GBq	309,000GBq
Carbon-14	92GBq	9.9GBq		101.9GBq
Iodine radionuclide	28MBq	45MBq	0.14MBq	73.14MBq
Other radionuclides	2.4GBq	8.1GBq	9.2MBq	10.5GBq

The report goes into detail about these issues and it concludes:

- Gaseous and liquid emissions from the UK's proposed new reactor programme could mean up to 23 theoretical deaths somewhere in the world for every year all of the reactors operate. Since they are each expected to operate for 60 years the total number of theoretical deaths could be 1380.
- The new reactors would produce extremely high levels of radioactive spent fuel. In the year 2200 spent fuel arisings would amount to almost five times the radioactivity contained in all existing legacy wastes from the UK's nuclear power industry.
- The requirement for 'Best Available Techniques' (and clean technology) for producing electricity should rule out building new electricity generating stations which produce such highly dangerous wastes. Especially as less expensive, quicker and safer alternatives are available which don't produce such wastes.

These two additional reports adds much to the concerns of the NFLA All Ireland Forum that the transboundary impacts of Hinkley Point C and the wider UK new nuclear programme could be significant and severe.

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