Nuclear Free Local Authorities
briefing

Date: 14th September 2012 **No.100**

Subject: **The Fukushima disaster and UK nuclear emergency planning – the need for a fundamental change?**

1. Introduction

The Nuclear Free Local Authorities (NFLA)* have published a number of previous Policy Briefings outlining various issues and concerns over UK nuclear emergency planning (see NFLA Policy Briefings 74 (1) and 75 (2), published in 2010 and 93 (3), published in 2011). Following the publication and detailed recommendations made in the interim (4) and final reports (5) of the Office for Nuclear Regulation's (ONR) analysis of the Fukushima incident, and its potential impact on the UK nuclear industry; the UK Government, the Nuclear Emergency Planning Liaison Group (NEPLG) and the ONR have been undertaking an extensive national nuclear emergency planning review (6). It is not clear when all these reviews will be finally completed. Groups like the NFLA have been invited to give their views on improvements to the UK nuclear emergency planning regime at meetings with the Department of Energy and Climate Change (DECC).

This briefing has been developed by the NFLA Secretary (who is a former Local Authority Emergency Planning Officer) to feed constructive suggestions into that review. It also puts forward the wider views of the NFLA in improving the national nuclear emergency planning regime and its interaction with international radiation monitoring programmes.

2. Scope of the briefing

The NFLA Secretary was invited by DECC to give a presentation on nuclear emergency planning at the DECC NGO Forum meeting on the 1st May 2012. This presentation was well received by both DECC officials and NGO representatives present. This briefing goes into more detail and considers the following issues:

- The main emergency planning issues arising from the post Fukushima nuclear safety reports and Greenpeace International's independent review of the Fukushima incident.
- The UK Government and ONR emergency planning reviews.
- The major issues raised from the European stress test reports.
- Public / NGO concerns over REPPIR, the size of emergency planning zones and 'extendability' of an emergency response and other related matters.
- What the impact of public spending cuts on the emergency services and local authorities may have on an effective nuclear emergency response.
- An overview of a DEFRA report on flooding risks around nuclear sites.
- Ongoing concerns over nuclear transportation and nuclear terrorism.
- Recommendations and actions for NFLA member authorities.

* A full glossary of terms is attached on page 19 of this briefing.

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3. Executive Summary

The key points made in this NFLA Policy Briefing are:

- The Fukushima disaster was one of the worst nuclear disasters in the past 60 years. Though the natural disasters that befell north eastern Japan could not have been prevented, many of the dire consequences on the Fukushima Daiichi facility could have been alleviated by better pre-planning. Human error and poor emergency preparedness and response were a key part of the failings in the post-incident scenario.
- The independent Japanese report on the disaster outlines a long list of serious failings which have contributed to significant environmental degradation, community dislocation, economic destruction and potential long-term health consequences for a large number of people in the vicinity of the stricken reactors.
- An important Greenpeace International report developed by independent experts has also outlined that key emergency planning concepts around evacuation and confinement need to be reassessed. It outlines the misuse of radiation fallout software put a large number of people at further risk. And it notes that many key emergency staff were very reluctant to stay in the contaminated area, with a considerable number resigning to avoid this. It also shows problems over the care of vulnerable people during a major nuclear incident and the widespread failure of public communication plans.
- These reports contain many learning points that should be extrapolated for consideration at the European and UK level.
- The ONR reports on the Fukushima incident and the reporting of the findings of the European 'stress tests' highlight a long list of additional issues that need to be considered for the improvement of nuclear safety plans and nuclear emergency plans across the UK civil and defence nuclear sector.
- An extensive review of nuclear emergency planning arrangements in the UK is taking place and its length suggests that significant reforms are being considered.
- The Fukushima incident highlights major complexities in the size of an evacuated area, and how to extend the area in the event of increased radiation contamination. The problem of dealing with self-evacuation complicates the matter even further.
- The concept of 'confinement' needs to be seriously reconsidered in the event of a prolonged nuclear incident like Fukushima. Large numbers of people were left indoors for as much as 10 days running out of food and fuel with only limited support from the emergency responding agencies.
- The UK's 'REPPIR' nuclear emergency planning regulations require a thorough review. The size of detailed emergency planning zones around a nuclear site, the availability of a large pool of suitably trained emergency responders to a nuclear incident, the serious problems and difficulties in 'extending' an evacuated area, the lack of 'live' exercises considering prolonged nuclear incidents, the content of public information and the provision of potassium iodide tablets are all questioned to be in need of reform following the learning points of the Fukushima incident.
- The radiation impacts and the effects on public health due to the failure of emergency preparedness and response in the Fukushima incident may lead to significant long-term problems for a large number of Japanese people. These need to be carefully considered by the public health agencies in the UK for parallel issues with the UK nuclear sector.
- The NFLA are concerned what negative effect the severe trimming of emergency service and local authority budgets may have had on the local, regional and national emergency preparedness and response system in the UK.
- The NFLA publicises a DEFRA report which outlines that most existing and proposed civil and defence nuclear sites in the UK are in 'high' flooding risk areas using climate change prediction modelling. Similarly, the NFLA remains concerned why the French nuclear regulator has demanded that EDF install flood-proof diesel generators and bunkered, remote, back-up control rooms at its French plants or else face having to shut down some of its reactors; but that the ONR has made no mention of such developments for existing and proposed EDF plants in the UK.
- The NFLA are concerned over the likely increase in the transportation of nuclear materials by road, rail and sea in the UK and internationally, and the potential emergency response issues in the event of an accident or malicious attack on them.

- The NFLA also remain concerned over the alarming potential for a malicious attack by a terrorist organisation using an improvised nuclear device. The review of nuclear emergency planning is a timely opportunity to reconsider if the UK is fully prepared for such an incident.
- The NFLA is fully aware of the sensitive balance between public reassurance and national security in the development and review of nuclear emergency planning following the Fukushima disaster, and its extrapolation to the UK context. However, there remain many ways to improve openness and transparency without compromising nuclear safety and nuclear security.

4. Fukushima – a disaster waiting to happen?

The starting point for the review of the nuclear emergency planning regime in the UK is the devastating effects of the March 2011 Fukushima disaster in north-eastern Japan. Following a 9.0 earthquake and a 12 metre tsunami breaching the site's flood defences, the collapse and subsequent radiation leakage of three of Fukushima's five nuclear reactors led to the largest peacetime evacuation in Japanese history.

Amongst a whole range of issues that affected the Fukushima facility, a number have major implications for nuclear emergency planning and nuclear safety, including (7):

- The establishment of a 20 kms (and up to 32 kms) exclusion zone around the Fukushima Daiichi nuclear power plant complex.
- Over 90,000 people evacuated to rest centres (a key local authority emergency activity).
- A further 140,000 people in an area around the evacuated zone told to stay indoors in the first critical days after the disaster and radiation leaks.
- The evacuation took place at a time of extensive infrastructure damage caused by the earthquake and tsunami. Road, rail and sea connections were all badly damaged or completely destroyed.
- The emergency cooling systems at the Fukushima Daiichi facility failed, exacerbating the level of radiation leakage into the environment.
- Beneficial weather prevented even more widespread radioactive contamination, which could have necessitated a much larger evacuation.
- The rapid evacuation of the wider area may have actually been counter-productive, and requiring residents to leave may have harmed their health.
- Whatever the short, medium and long-term effects, there has been substantial radiation leakage to land, air, sea and the food-chain. The extent and effects of this contamination on human health and the local environment will take considerable time to assess.

All of these issues do not just have implications for Japan's nuclear emergency planning regime, but have international repercussions that need to be considered by all countries with civil and military nuclear facilities. It is now getting on for 18 months after the incident. This does allow for greater reflection on why the incident happened, what could and should have been done to have prevented it from being one of the world's worst radiation leakages, and what needs to be done to improve the national and international nuclear safety and nuclear emergency planning regimes.

The interim official independent Japanese review of the Fukushima disaster was published in December 2011. The report's main nuclear emergency planning conclusions included the following (8):

- The Fukushima operator Tepco (Tokyo Electric Power Company) and the Japanese Government's nuclear regulator singularly failed to anticipate the effect of an earthquake and tsunami of this magnitude on a nuclear facility.
- Computer simulations undertaken by the nuclear regulatory agency in 2006, 2008 and February 2011 which considered the effects of a tsunami of such a magnitude had not led to specific measures on Tepco to develop appropriate safety features, which completely failed at Fukushima Daiichi.

- Senior managers at the Fukushima facility had a general lack of knowledge of some of the emergency plans for dealing with the implications of a safety breach and loss of emergency coolant on the site. There were key delays in getting information out to the public from all agencies involved in the emergency incident.
- Staff on-site had not been trained on what to do when the back-up generators failed.
- During the critical first two weeks of the incident, there was generally a poor state of communications between Tepco and the Japanese Government and between Tepco and the agencies providing an emergency response to the incident.
- The Japanese Government was also unprepared for an incident of this magnitude.
- The nuclear regulatory agency should be moved from the Japanese Trade Ministry to the Environment Ministry (which is taking place) to improve its independence.

The Prime Minister of Japan at the time, Naoko Kan, summed the mood of this incident up when he said: "Japan was woefully unprepared to deal with the effects of the Fukushima disaster." (9)

The final report, which involved 900 hours of hearings, interviewed over 1,100 people and was published in July 2012, added a number of additional issues of relevant concern, including (10):

- Misplaced deference and a lack of willingness to question authority were seen as a 'Japanese' factor in the exacerbation of the incident.
- The magnitude-9 earthquake that preceded the tsunami could not be ruled out as the actual cause of the accident, rather than it simply being due to the tsunami breaching flood walls, contradicting Tepco's explanation of the incident.
- "Across the board, the commission found ignorance and arrogance unforgivable for anyone or any organisation that deals with nuclear power. We found a disregard for global trends and a disregard for public safety."
- The 'direct intervention' of the Japanese Prime Minister confused the chain of command and wasted valuable time.

In Japan the Fukushima disaster has led to a major and fractious debate over the future development of nuclear power. For a short time all of Japan's nuclear power stations were closed down for safety checks, and the recent reopening of two reactors has led to demonstrations of over 70,000 people. A new cross-party Japanese local authorities organisation, 'Mayors for a Nuclear Power Free Japan', complementing the existing Japanese National Council of Nuclear Free Local Authorities, is a key part of this public movement (11).

5. Greenpeace International independent report on Fukushima and emergency planning

Before considering the official response to the Fukushima incident in the UK and Europe in reference to nuclear emergency planning, it is worthwhile highlighting an independent report by Greenpeace International on the disaster.

Its report 'Lessons from Fukushima' was commissioned to seek an independent assessment of the key failings of this disaster and improvements that need to be made. A whole chapter of the report was dedicated to emergency planning and written by Professor David Boilley, chairman of the French NGO ACRO, the only independent organisation that conducted detailed radiation measurements around the Fukushima area and the marine environment in the days after the disaster.

Professor Boilley documents in the chapter how Japan, which beforehand was internationally considered to be one of the most experienced and equipped countries in handling large-scale natural disasters (due to being on a major earthquake fault-line), "found that its emergency planning for a nuclear accident was not functional, and its evacuation process became chaotic, which led to many people becoming unnecessarily exposed to radiation." (12)

Some of the main points from Greenpeace's report include:

- Evacuation planning based on circles with diameters of several kilometres is too rigid and hopelessly inadequate for nuclear power plants.

- Specially designed computer software for predicting radiation fallout patterns was at times not used correctly. As a result thousands of people stayed in areas which were highly contaminated.
- Evacuation of vulnerable people was badly organised and in places completely failed. For example, patients from one shelter and a nearby elderly persons home were sent to shelters but 45 of 440 patients died after staff fled. A number of hospitals in the Fukushima Prefecture had to suspend services because hundreds of doctors and nurses in the area resigned to avoid radiation exposure.
- One of the key principles of nuclear emergency planning – confinement – may not work so readily in practice when an incident becomes as prolonged as the Fukushima incident became. Large radiation releases took place over 10 days after the initial disaster, leaving confined communities without food and fuel. Specialised emergency workers, who were also needed to help those who were confined, refused to stay in an area of high radioactive contamination.
- In terms of the post-emergency situation, problems have arisen as pragmatic Japanese Government radiation standards have been higher than internationally recognised limits, leading to continued public alarm.
- The Government had insufficient programmes for monitoring and screening radiation levels (leading in some case to communities buying their own radiation monitors) or for dealing with contaminated food and crops. Decontamination efforts have been questioned in terms of their effectiveness, costliness and unforeseen negative side effects.
- The huge scale of the post emergency response for dealing with the radioactive waste at the Fukushima facility and the wider area has created major problems for the nuclear regulatory authorities, local authorities and the Japanese Government.
- There has been a huge human cost to the disaster beyond the thousands that actually died or were injured on March 11th, 2011. All those who have been evacuated have lost nearly everything and have been denied sufficient support and compensation to return to any form of 'normality'. The recovery from this incident has been slow and may take decades to completely resolve.

Almost 18 months after the disaster there remains significant concern over the state of at least one of the reactors, despite 'cold shutdown' of the facility being formally announced at the end of 2011. Many other difficult post-incident issues are still being dealt with, including resettlement of evacuees, locating an onsite and offsite store for radioactive water and materials from the incident, and dealing with the potential health effects of this incident.

For example, Japan's Health Ministry has reported in late August that many of the 3,000 workers on the Fukushima site will soon reach legally-allowed radiation exposure limits; whilst the Japanese Prime Minister's Cabinet Office have ordered thyroid checks for 4,500 children aged 18 and under outside of the Fukushima Prefecture. More than one third of 38,000 children evacuated from the Fukushima area (over 13,000 children) have been found to have abnormal lumps on their thyroid glands. Though medical officials have said lumps are not necessarily dangerous, they have led to significant public alarm. Thyroid radiation exposure is a potential cause of cancer, with children particularly susceptible to it. (13)

In sum, taking all the aspects of the independent Fukushima panel report for the Japanese Government, and the additional points made in the Greenpeace International report, there is a huge catalogue of issues for all countries with civil and military nuclear facilities, such as the UK, to deal with, and particularly in the area of nuclear emergency planning.

6. ONR Fukushima nuclear safety report and UK emergency planning review

The response to the Fukushima report in the UK was centred around two main policy developments – the production of an interim and final report on the implications on UK nuclear safety by the Chief UK Nuclear Inspector Mike Weightman under the auspices of the Office for Nuclear Regulation (ONR); and the ONR's involvement in overseeing a series of 'stress tests' of all civil and defence nuclear sites on behalf of the European Commission.

NFLA Policy Briefings 83 (Fukushima and ONR Safety review) and 93 (Nuclear emergency planning), which can be found on the NFLA website, outlined a long list of recommendations in the area of nuclear emergency planning that needed to be considered by the UK Government and devolved governments, nuclear regulators, the Nuclear Decommissioning Authority and the nuclear industry. The ONR report sought to reassure the public that the nuclear safety regime in the UK was fit-for-purpose, but that the Fukushima disaster nonetheless required a thorough review and enhancement of all nuclear safety and nuclear emergency planning systems across the nuclear sector.

In the area of nuclear emergency planning, the report particularly recommended (14):

- The UK Government should instigate a full review of nuclear emergency planning in the UK.
- The Nuclear Emergency Planning Liaison Group (NEPLG) should specifically consider the risks, impacts and issues relating to a prolonged nuclear emergency incident.
- The nuclear industry and the ONR should review public communication plans for a major nuclear emergency incident.
- Long-term severe accident exercise scenarios needed to be reviewed and tested across the nuclear industry.
- A review of the potential and implications for serious flooding at UK nuclear sites should be initiated within the nuclear emergency planning review.
- A review by the National Grid on the resilience of offsite electricity networks around nuclear installations should be initiated.
- The nuclear industry should review with emergency agencies the contingency plans for onsite cooling ponds at civil nuclear reactors.
- The nuclear industry should also review contingency plans for the care of on-site staff during a prolonged incident.

The UK Government's review of nuclear emergency planning commenced following the publication of the ONR interim report. It was initially expected to have been completed by the end of 2011, but is now expected to be complete by the end of 2012 or shortly into 2013 (15).

The review has been instigated as part of the ongoing development of the UK 'National Strategic Framework' (16) and it contains six key strands or 'blocks':

- Strategic Co-ordination – ensuring national and international governmental structures and procedures are in place to respond to a major nuclear incident of the magnitude of Fukushima.
- Risk assessment – ensure a thorough national risk assessment is reviewed and improvements implemented across all aspects of nuclear emergency planning.
- Emergency plans – conduct a gaps analysis of national, on site and off-site nuclear emergency plans.
- Emergency response – conduct a gaps analysis of local and national emergency response arrangements interfacing with key agencies and ensuring adequate training and exercising takes place of such arrangements.
- Recovery planning – outline transition from response to recovery and initiate a gaps analysis of local and national recovery arrangements. Decontamination and the training and exercising of recovery plans are also being considered in this area.
- Communications – review existing arrangements and the resilience of communications infrastructure.

Much of the development of this review arises out of an initial assessment by the NEPLG (which brings together emergency planning specialists in central government, local government, the emergency services and the nuclear industry) on four specific areas (17):

- Radiation monitoring capacity, capability and co-ordination.
- Central government response to a major nuclear incident.
- The 'extendibility' of an emergency response to a major nuclear incident.
- The capacity and capability of emergency services, including resilience to radiation exposure in a major nuclear incident.

The final ONR Fukushima report had commented that the NEPLG had 'found current arrangements fit for purpose' but that (unspecified) 'strengthening arrangements' had been identified. The UK Government review and ONR's internal review is presumably incorporating such 'arrangements' within the nuclear emergency planning review.

7. European post-Fukushima nuclear site 'stress test' reports

Shortly after the Fukushima disaster, the European Commission (EC) requested that each EU state should initiate an agreed series of 'stress tests' on all civil nuclear reactors. The aim of the tests programme was to provide confidence that such sites did not contain the same inherent safety flaws found at Fukushima.

The European Commission noted, in its publication of the stress test report, that they had proved valuable and 'identified tangible improvements'. The four main findings for improvement to be explored across Europe included (18):

- Issuing guidance, with the contribution of the best available EU expertise, on an assessment of natural hazards and margins taking account of the existing IAEA guidelines;
- Underlining the importance of Periodic Safety Reviews of all nuclear facilities;
- Implementing the recognised measures to protect containment integrity of nuclear reactors;
- Minimising accidents resulting from natural hazards and limiting their consequences.

In providing the information to the EC, the ONR stated that ''no serious safety weaknesses' in UK nuclear installations were identified. One of the concerns of the NFLA throughout the reporting of this process has been the amount of alarming detail which lay behind the production of such information. In the NFLA's view, this does not give the same amount of public confidence as overall summaries may suggest. For example, in its media release on the stress tests, the NFLA noted a number of serious issues that were highlighted through the 'stress test' reports, including (19):

- The EC report noted that Sizewell B has no specific design provisions for the mitigation of hydrogen generated in severe accident conditions.
- The EC report also noted that Sizewell B has no design or operational provisions in the fuel building for the management of hydrogen generated by zirconium oxidation by overheating fuel in the fuel storage pond.
- EDF concluded that it was not in a position to carry out meaningful margin assessment for seismic, flood or extreme weather conditions in the timescales of the stress test assessment for all its sites, including Sizewell and Hinkley Point. Though ONR considers the design basis requirements to be robust, it does believe more robust, systematic research is required for 'beyond design basis' events.
- The EC review team identified that most nuclear site Emergency Control Centres do not have proper ventilation systems to cope with severe accident conditions or are not sufficiently protected against radiation in case of a severe accident. None of the Advanced Gas Reactors (AGRs) and Magnox reactors posses a fully functioning Backup Control Room (ECR) - allowing control and shutdown to safe condition of the plant if the Main Control Room becomes uninhabitable.
- Why have the French stress tests on EDF sites recommended safety system improvements costing 40 – 50 billion euros, but the UK stress tests mention no such figure?
- There are also a further 75 recommendations for decommissioned nuclear sites and defence nuclear sites like Sellafield, Dounreay, Aldermaston and Springfields.

Furthermore, the NFLA notes that, whilst welcoming increased openness and transparency amongst some of the individual European nuclear regulatory agencies, Greenpeace International's Nuclear Policy Advisor Jan Haverkamp also noted a number of 'black holes' which indicate significant shortcomings, particularly in the area of emergency response. Haverkamp notes (20): Fukushima taught us to think the unthinkable and these tests have forced plant managers to do a little of that. But there are major blind spots - why are evacuation plans for towns and cities ignored; why is reactor age not properly considered; why

did the authorities promise, but fail to look at the danger of multiple-reactor failure and large airplane crashes?"

Likewise, the NFLA has also not found any mention in the ONR and Defence Nuclear Safety Regulator (DNSR) stress testing documents which addresses hazards posed by malicious acts such as an attack on a nuclear installation during wartime, a well-planned and resourced terrorist attack, or a major cyber attack.

Haverkamp also noted the Greenpeace International view that the UK ONR (along with the Czech, Swedish and Slovakian nuclear regulators) 'failed to provide substantial information' in comparison with other regulators, particularly France and Finland.

In addition, Haverkamp pointed out that the 'stress tests' report indicated a generic lack of coordination between the different emergency response teams inside and outside the nuclear facility. Nuclear regulators have no mandate in dealing with safety issues outside nuclear power plants. As in the UK, these are dealt with mainly by the emergency authorities and local authorities. This was a key issue in the off-site emergency response in Fukushima. Haverkamp notes: "Communication about what is considered an acceptable level of exposure of radiation was chaotic. It delivered a lot of psychological, physical and economical stress."

The rest of this briefing now outlines some specific concerns which the NFLA and other NGOs have raised with the UK Government and the ONR in regards to nuclear emergency planning. It partially arises out of the concerns raised in the official reports on Fukushima, and the learning points that the incident has raised. It also comes out of long-held consistent concerns that organisations like the NFLA have had with nuclear emergency planning in the UK.

8. Evacuation and confinement issues and implications for UK nuclear emergency planning

On March 12th 2011, the evacuation at Fukushima conformed to international nuclear safety guidelines in that the Japanese Government issued evacuation orders using a series of concentric circles rising out to a distance of 20 kilometres. People situated outside this area were also urged to take shelter as a precautionary measure. However, it has emerged that despite reported independent findings by radiation specialists of very high levels of radioactive contamination in Itake, some 40kms from Fukushima - found and announced on the 27th March 2011, which were confirmed a few days later by an IAEA team - an extension of the evacuation zone only took place on the 22nd April 2011 (21).

In addition, due to inaccurate use by officials of the Japanese Government's radioactive fallout prediction software, thousands of people stayed in areas that were highly contaminated. For example, 8,000 evacuees from a neighbouring town to Fukushima, Namie; were initially taken by bus to 'safer' Tsushima in accordance with the information from the software. Tsushima though was actually found to be significantly contaminated. These people were only told to move on to a safer area 5 days later (22).

Evacuating large numbers of people for any type of incident is an immensely difficult task for emergency responders, particularly in densely populated countries like Japan and the UK. Seeking to evacuate large numbers of people in an incident involving radiation leakage complicates matters even further.

The evacuation of sick and vulnerable people is particularly difficult for emergency responders, whatever type of evacuation is required. In Fukushima the most extreme example of a botched evacuation took place at Futuba Hospital. In this case patients who were bedridden and unable to walk on their own were abandoned for three days without care and food. Those who were able to walk were despatched to emergency shelters without any medical care structure. This happened despite Japanese Government guidelines for safely evacuating elderly and handicapped people in the event of a natural disaster. As such, in March 2012 it had been calculated that 573 deaths have been certified as 'nuclear disaster-related' by 13 local authorities affected by the Fukushima incident. The death certificate is issued this way not due

to a direct fatality from the incident, but rather from fatigue or the aggravation of a chronic disease due to the disaster (23).

In the Fukushima areas as well 4,300 cows, 31,500 pigs and over 630,000 chickens were abandoned in the evacuation zone. Most died or were released into the wild (24). Similarly, some evacuees who brought their pets to emergency shelters were told to abandon them or be transported on to other shelters.

Along with these issues in terms of evacuation – which are generic problems for emergency planners in the UK in developing various types of evacuation plans – there were also significant problems in confining large numbers of people outside the evacuation area for a long period of time. In nuclear incidents, the first generic action of emergency responders is to inform the population to stay indoors and close all windows and ventilation systems. Large releases of radiation took place around Fukushima in the first ten days after the disaster and remained uncertain for some time afterwards. Confining people into their homes for such a long period of time is impractical and potentially dangerous, particularly for people with special needs.

In the Fukushima incident, the testimony of the Mayor of Minamisoma is important to note in explaining the difficulties local authorities and the emergency services would have in coping with such an incident in the UK. He had over 20,000 people in his area that were confined to their houses. All shops were closed and he complained about the lack of essential supplies provided to those who were confined. There was also a real lack of public information about the incident and what dangers still remained. (24)

A study of Fukushima Prefecture Hospitals in July 2011 emphasises another unforeseen issue which may occur after a nuclear accident. The study found that 12% of all doctors (125 in all) in the 24 hospitals resigned following the incident. A further 407 nurses in 42 hospitals also resigned, around 5% of the workforce. As a result some hospitals had to suspend night time emergency care and other treatment services. In Minamisoma alone, the figures of resignations are even more alarming – 46% of doctors and 16% of nurses resigned in the local hospitals. The study concluded that the resignations were due to a desire to leave the area amidst concern about radiation exposure. Similar figures have also come to light about other emergency workers including drivers, social workers and firefighters. (25)

Decontamination of evacuees was a further problem in the Fukushima prefecture. Emergency responders were unprepared to screen such a large number of people. It was also found that many evacuees felt uncomfortable being screened by TEPCO employees, who they blamed for the disaster. 3 days after the disaster the Fukushima prefectural government raised the standard for designating people requiring full-body decontamination from 13,000 counts per minute (cpm) to 100,000 cpm (cpm is a measure of the amount of radiation found inside the body). This decision was taken due to fears that there was not enough capacity to deal with the lower figure, amidst staff and water shortages. Other local authorities kept to the lower level. Following this decision around 1,000 people were found to be contaminated at levels of between 13,000 and 100,000 cpm, and 102 people were found to have levels above 100,000 cpm. (26)

Finally, regardless of the public message given out by the public authorities many people self-evacuated. Estimates of around 36,000 people had voluntarily evacuated by October 2011. Many relocated over the discrepancies between the raised local and internationally recognised safe radiation limits. (27)

All of these issues are generic concerns in evacuating civilian populations following a nuclear accident and serious radiation leak. They all have clear implications for UK authorities and should be considered in detail in the reviewing of plans and resources around UK nuclear facilities.

9. REPPIR, emergency planning zones, extendability and distribution of potassium iodine tablets

The NFLA agrees with the UK Government and the ONR that Fukushima clearly shows the need for a complete review of existing nuclear emergency planning arrangements, particularly in its view the ONR's REPPIR regulations. A key part of REPPIR that the NFLA is concerned about is the size of the designated emergency planning zones (DEPZs) around UK nuclear sites and how an evacuated area is 'extended' during an incident involving a potentially harmful release of radiation materials. The public communication of such plans needs also to be addressed, along with concerns raised by local community groups over the potential distribution of potassium iodine tablets to the public in the event of a nuclear emergency.

The Radiation (Emergency Planning and Public Information) Regulations 2001, or REPPIR for short, are the statutory guidelines for dealing with radiation emergency incidents around nuclear installations. They are implemented by the ONR. They are the generic local nuclear emergency planning regulations arising out of European Nuclear Safety Directives under the Euratom Treaty (28).

REPPIR establishes a framework of emergency preparedness measures to ensure that members of the public are properly informed and prepared, in advance, about what to do in the event of a radiation emergency occurring, and provided with specific information if a radiation emergency actually occurs. Under the terms of REPPIR, a "radiation emergency" is an event that is likely to result in a member of the public receiving an effective dose of more than 5 microsieverts during the year immediately following the emergency. REPPIR does not replace existing nuclear site licence conditions but operators of licensed sites who comply with such conditions will also need to satisfy equivalent provisions in REPPIR.

A regular emergency exercise programme is also expected under REPPIR. The ONR maintain the legislation and official guidance for REPPIR. Local authorities have a specific duty to produce an offsite emergency plan around any site that comes under the REPPIR regulations. Emergency planning exercises to test these plans have to be scheduled to take place on a three yearly timetable, including virtual run-throughs and 'live' exercises.

With the sheer size and scale of the Fukushima disaster, the NFLA and other NGOs are concerned that REPPIR, in its current guise, is robust enough to deal with a similar incident occurring at a UK nuclear installation. The NFLA would argue that the national nuclear emergency planning reviews should be concentrating on a thorough review of the REPPIR regulations in a number of areas. The particular areas of concern are outlined in the rest of this section. It should be noted that some of the points made are of a generic nature, as large amounts of information in this area may not necessarily be available to the public.

Staffing of emergency responders in an emergency

Fukushima emphasised the need for a very large pool of emergency responders to a major nuclear incident.

Regulation 14 of the REPPIR guidelines specifies the conditions under which all potential emergency responders may be asked to receive a radiation dose. It outlines that only appropriately trained and suitably equipped staff, who has already agreed to undergo exposure, may be placed at risk of receiving such radiation exposure.

In its analysis of the off-site plans for Aldermaston and Burghfield, the independent consulting engineer consultancy Large & Associates comment (29):

"A particularly weak feature of the West Berkshire Council Plan is the allocation and availability of human resources. Generally, the Plan assumes that large reserves of human resources will be available as-and-when-needed but this approach is intrinsically flawed because very few, if any, of the Council's own employers, the police and medical personnel (ambulance drivers, paramedics etc), and sub-contracted personnel (transportation drivers, school and hospital staff, etc) will be permitted to undertake response actions in a radiological environment. Of the remaining emergency services, the County Fire Brigades personnel could exhaust their

nationally and locally agreed single-incident radiation dose limits at which point they would be required to withdraw from the radiological environment."

Large & Associates go on to suggest that the post-incident response would then be dependent on the on-site staff which, on the usual shift system would be around 30 experienced and qualified responders over two sites. This number could obviously be reduced further if there are problems on the site following a nuclear emergency, or if the staff are incapacitated by the incident. In the NFLA's view, the key point here to note is that AWE's registered responders would be fully occupied in dealing with the on site response, and not available to support the civil responders.

Given this generic example for a dual nuclear site, the NFLA are concerned if there are adequate numbers of sufficient personnel within responding agencies registered under section 14 to deal meaningfully with any radiation emergency.

Emergency Planning Zones and the need for 'extendibility'

The Fukushima incident, like the Chernobyl variant of 1986, required a large-scale evacuation beyond a series of planned emergency zones. In the UK, nuclear installations have amongst the smallest detailed emergency planning zones (DEPZs) in the world. They range from just 1km for Hartlepool, 1.5kms for Burghfield, 2.4kms for Sizewell, 3kms for Aldermaston and 4.2kms for Hinkley Point (30).

Currently the ONR note that "(t)he DEPZ is defined on the basis of the most significant release of radiation from an accident, which can be reasonably foreseen. In the event of an accident being larger than the reasonably foreseeable event, arrangements are in place for extending the DEPZ consistent with the concept of 'extendability'." (31)

To the NFLA, it is not particularly clear or transparent what is the justification for keeping the DEPZ around UK nuclear sites so much lower than in comparative countries, such as the USA and France. Pressure groups like the 'Shutdown Sizewell' group or the 'Stop Hinkley' group have regularly challenged the relevant Site Stakeholder Groups over why the zones are so small. As a direct result, only a small number of households receive information on what to do in a nuclear emergency. The NFLA also remains concerned over the lack of publicly information around UK sites when the evacuated area has to be 'extended' significantly due to the level of radiation contamination.

International guidance on emergency planning zones highlights an anomaly that currently is absent from the UK REPPIR legislation. In their 2006 guidance note, 'Arrangements for Preparedness for a Nuclear or Radiological Emergency', the International Atomic Energy Authority (IAEA) recommend the development of two type of zones. A 3 – 5 km Precautionary Action Zone (PAZ), which the ONR may argue is equivalent to the DEPZ, and an up to 30 km Urgent protective action Planning Zone (UPZ). The UPZ boundary would be defined by the radial distance within which to conduct radiation monitoring and implement appropriate urgent protective actions within a few hours of a major nuclear incident. (32)

In Japan, the newspaper Asahi Shimbun uncovered documents in March 2012 which suggested the Japanese nuclear regulator NISA had hindered 2006 plans to adopt the IAEA regulations because they were concerned that they would confuse the public and spread fears about nuclear power. The documents suggest that the Japanese Government's Cabinet Office's Nuclear Safety Commission (NSC) wanted to install these new standards so as to replace the 8 – 10 km DEPZs that were currently in operation around Japanese nuclear sites (and which are still larger than for UK sites). After much discussion and pressure from NISA it was agreed that: "We would be able to cope with situations under the current guidelines" and "We do not have to include additional measures." (33)

If the PAZ and UPZ had of been introduced in Japan, then residents within 30 km of the Fukushima plant would have been told to evacuate or stay indoors on the day the accident started. They would also have taken preventive measures, such as consuming iodine tablets to

protect thyroid glands from radioactive substances. In July 2011, the NSC started to review its nuclear disaster management guidelines with an eye on adopting the IAEA international standards. (34)

The NFLA Secretariat is aware that the ONR is considering adopting the IAEA international standards. It is seeking clarification as to why ONR, like the Japanese regulator NISA, did not fully implement the guidelines in 2006.

A further linked issue the Fukushima incident raises is what the distance the evacuation should actually have been extended to and the level of self-evacuation that would take place. Five days after the Fukushima disaster, the United States Nuclear Regulatory Commission (NRC) suggested that all US citizens in the area near Fukushima should evacuate at least 50 miles. The NRC is currently conducting its own post Fukushima review of emergency planning zones around US nuclear sites. In responding to it, the US Nuclear Information and Resource Service (NIRS) and 37 other petitioners, have submitted their view to expand emergency evacuation zones and improve emergency response planning around all US nuclear sites. They advocate a three-tiered emergency planning zone (EPZ) expanding the current 10 mile EPZ (which is again considerably larger than in the UK), to an area of an inner 25-mile radius of the reactor site, a further emergency evacuation zone of a 50-mile radius of the reactor site, and to expand the radius of the radioactive particle ingestion pathway to a 100-mile radius of the reactor site. (35)

It is not just the Fukushima incident where the extent of evacuation and the size of the emergency planning zone has been an issue. For the 1979 Three Mile Island leak in the United States, the safety authorities recommended that a total of 3,400 pregnant women and children in a five mile radius (or zone) around the site should evacuate. In the event 200,000 people evacuated, some 40% of the population in a radius of 15 miles around the site. (36) It would seem obvious from such figures that arrangements to control the population within the zone during such a major incident may actually be unenforceable, particularly in such a mobile society like the UK. The national review needs to consider this conundrum.

In its ‘lay guide’ to REPPIR, Large & Associates compared what happened in Fukushima with a similar (at present) fictional radiation leakage from Aldermaston. The report says if similar weather conditions took place in such an incident, superimposition of the Fukushima Prefecture radiological conditions centred on the Aldermaston site would result in a ‘radiation emergency’ being declared over a radial segment out to at least 60km for the point of radiation release. With the prevailing south-westerly winds, radiation fall-out would reach Reading, Slough and a large area of the western suburbs of London. (37)

In August 2012 the ONR has asked the Suffolk Resilience Forum to hold off on its publication of a post-Fukushima review of the off-site emergency plan for Sizewell whilst its nuclear emergency plan review is completed. The NFLA welcomes this decision if it involves a full review and potential expansion or ‘extendability’ of the DEPZ around nuclear sites, and will argue that case robustly with ONR and DECC in upcoming meetings. In the NFLA’s view, experience from Fukushima indicates the DEPZs need to be substantially larger – a minimum of 20 km appears necessary, and the NIRS submission of a three-tiered approach should be actively considered by the ONR, DECC and the NEPLG (38).

In the NFLA’s view, it may well be the case that keeping the DEPZ to such a smaller radius has suited the nuclear industry well as fewer people are made aware of the risks and consequences of a radiation incident (a key part of REPPIR). This is even more of an issue at a time when building new nuclear reactors and new defence nuclear facilities is very much at the heart of the current nuclear policy debate. The Fukushima disaster shows comprehensively the need for more flexible and larger zones than UK plans are currently predicated on.

Furthermore, it still remains unclear exactly how ‘extendibility’ arrangements would work in a real incident. The ONR and DECC need to explain, even if a 5km and a wider 30km zone is devised under REPPIR, how it would actually work in practice and how the public situated within this area will be informed about it as to what they should do in the event of an incident.

The NFLA also do not believe that there have been any detailed 'live' emergency planning exercises at licensed nuclear sites to have rehearsed such an 'extendibility' scenario and urge these to be developed as soon as is practical.

'Live' exercise programme for nuclear sites

A number of NGOs concerned around the development of civil and defence nuclear sites have contacted the NFLA Secretariat to raise their concern that both site operators and ONR have, in the past, not adequately complied with the three year REPPIR review and exercise timetable.

For example, the Nuclear Information Service (NIS), that monitors developments at the Aldermaston and Burghfield nuclear weapon sites, has commented that the publication of the previous round of off-site emergency plans by the local Council was two years behind schedule (due in 2007, they were not published until 2009). (39)

In their analysis of the West Berkshire Council's exercising of the multi-agency offsite emergency plans for Aldermaston and Burghfield, NIS has commented that the plans have not been tested through 'real-life' rehearsals which would highlight practical areas for improvement, and they do not cover the timescales and evolving scenarios that a real-life emergency would present. Furthermore, 'live' evacuations and road closure arrangements, rather than just notional table-top scenarios, have not been rehearsed in practice. In their analysis of 'Exercise Aldex 10' which took place in November 2010, NIS commented: "Although live on-site exercises take place regularly, it is not clear when the last live test of off-site contingency arrangements took place – if indeed such an exercise has ever been organised. At the very least it has been six years since such an exercise took place and the next opportunity to hold an off-site level 2 exercise at the AWE will not now be until 2013." (40)

The development of 'live' exercises is clearly a difficult issue to develop when allowing for a nuclear licensed site to continue its normal operation. They are also expensive to develop and produce. However, without such exercises, how can the public be reassured that all the appropriate staff that could be involved in such an incident knows exactly what that would do, and how they would interact with each other? Nuclear sites are also highly sensitive sites for many reasons – security, operation and environmental being some of them – which makes live exercises even more difficult to arrange. In the NFLA's view, there has to be a qualitative improvement in a potential emergency response following a live exercise than a theoretical 'tabletop' exercise or run-through.

Public information on protective countermeasures

As noted in section 5 and 8 above, experience from the Fukushima incident suggests that public information should be made available within at least a 20km zone. At present in the UK, under the REPPIR regulations only those residents in the DEPZ receive public information from the local authority over what to do in a radiological emergency, though the multi-agency emergency plans are made publicly available (if one knows where to look for them).

A point that has been made by NGOs to the NFLA is that the information provided to residents in the DEPZ is inadequate and does not give the sort of background advice or practical instructions that ordinary people need. Taking the example of the AWE / West Berkshire Council leaflet for Aldermaston and Burghfield (41), there are a number of examples which suggest more a sense of reassurance rather than actual information on what to do. 'Go in, stay in, tune in' is the main and only significant message being given to the public in the leaflet. The section in the leaflet on radiation also makes much reference to normal everyday 'natural' radiation that the public is routinely exposed to. Maps and drawings of the DEPZ are provided, but there is no explanation in the leaflet of what they are, or what purpose they provide, or what then to do. It would require much more detailed reading of the multi-agency emergency plan to give a lay member of the public any significant information of what may happen in a radiation emergency at either site.

It is also the case that the source of the information provided to the public originates solely from site operators. The NFLA would argue there would be a much greater sense of public

reassurance if the information provided is drawn from a wider base of experts and inputs. Since the Fukushima incident, public confidence in the Japanese nuclear industry is at an all-time low and in the decontamination phase many people were uncomfortable that Tepco staff was undertaking it, rather preferring independent volunteers to carry it out.

The NFLA would also argue that sufficiently detailed information and instructions is not being passed on to those who would need it in the local area. Though not an exhaustive list, this should include the local schools in the area as well as business premises and supermarkets within the DEPZ, and those who use such premises. The DEPZ is not an isolated area – many residents will be going in or near it on a daily basis. The NFLA questionnaire of local authority emergency planning officers showed a large majority of them believed it was important that as much practical and sensible public information should be given out about the risks from nuclear sites, subject to obvious issues around security and sensitivity. (42)

Provision of potassium iodine tablets

In the event of a radiological incident, taking potassium iodine tablets will assist the body in combating the effects of harmful radiation by protecting the thyroid gland. It has been suggested that the lack of providing such tablets following the Chernobyl disaster may well be a factor in why so many young children in Belarus developed thyroid cancers.

Fukushima and outlying municipalities had ample supplies of such tablets and, according to local nuclear emergency plans; these are given out following a government order. However, Japanese Government records published in September 2011 show that, despite nuclear safety and public health officials recommending dispensing pills immediately after the incident, it was five days later that the Japanese Government gave the order to do so. By then over 100,000 people had been evacuated. In interviews with the Wall Street Journal a number of national and local government officials and advisers blamed the delay on a communications breakdown among different government departments with responsibilities of differing aspects of the disaster (43).

Professor Samuel Epstein, MD, of the School of Environment and Occupational Medicine at the University of Illinois, has uncovered Japanese health statistics that suggest: "...during the 12 months following Fukushima, the number of deaths for all of Japan jumped 57,900 above the prior year. About 19,200 were additional deaths from accidents, almost all from the immediate impact of the earthquake and tsunami, but that left 38,700 excess deaths from other causes - with no immediate explanation. While all of these cannot automatically be attributed to radiation exposure, they should be taken seriously and become the subject of extensive health studies." (44)

In the UK, stockpiles of such tablets are likely to be available around the DEPZ, but it is not clear whether larger amounts of tablets are readily available and stored for much larger incidents. The NFLA are concerned whether such large amounts of tablets are available at short notice and if arrangements for distributing them have been fully tested on a consistent basis across all nuclear sites. It is also not clear over what area they would be distributed in the event of an emergency. As such information may be classed as sensitive, it is difficult to independently verify whether local and national stockpiles of such tablets are adequate.

Comparisons with other countries are also telling. In August 2012 the Pennsylvania Department of Health announced that free potassium iodide tablets to any residents living in a 10 mile radius of one of the five nuclear power stations would be offered. Four tablets were being offered to adults and smaller doses to children. The Department's press release emphasised that they should only be used when directed to by state health officials or the State Governor. This is an annual offer made by the Health Department and is the kind of openness and reassurance that the NFLA would like to see developed in the UK (45).

The NFLA accepts that developing such measures may be seen as alarming some residents but, if the public information message is sensitively developed like the Pennsylvania campaign, it actually provides a strong public health reassurance tool to residents around nuclear sites.

The NFLA would argue a radius of at least 10 miles around UK nuclear sites could also be used as a starting point for such a campaign.

Radiation impacts

As noted in a number of previous NFLA Policy Briefings, the scientific uncertainties around the radiation dose/risk methodology on which emergency planning is based – the ICRP model – have been contested by a significant number of independent radiation specialists. The European Committee on Radiation Risks for example have identified a number of fundamental concerns on inhalation and ingestion of radiation as important pathways which they argue render the ICRP dose/risk method redundant (46). Though a much larger and complicated debate than this Policy Briefing can adequately consider, a review of nuclear emergency planning should be taking account of this scientific debate. The NFLA therefore very much welcome the involvement of the former UK Energy Minister Charles Hendry in encouraging a meeting with the Department of Health's independent Committee on Medical Aspects of Radiation in the Environment (COMARE) with some of its independent critics. This meeting is due to take place shortly.

Thirty international physicians and public health experts who are member of the International Physicians for the Prevention of Nuclear War (IPPNW) have recently visited Fukushima and held their 20th World Congress in Hiroshima and a detailed symposium in Tokyo at the end of August 2012. They have made some key recommendations on dealing with the impacts of radiation on communities including (47):

- "People living in contaminated regions should have access to full information on their likely radiation exposures and supported in all possible ways to minimize these. For those with anticipated annual exposure greater than 5 mSv, or more than 1mSv for children and women of child-bearing age, equitable and consistent access to health care, housing, employment and educational support and compensation should be provided if they choose to re-locate. The recent Nuclear Accident Child Victims Law is an important step in the right direction and should be effectively implemented as soon as feasible. All such measures should be based on actual radiation exposure levels and not distance. Every effort should be made to reduce exposures below 1 mSv per year as quickly as possible.
- Early establishment of a comprehensive register of all likely to have been exposed to more than 1mSv of radiation from all sources as a result of the Fukushima disaster. This will include people in prefectures neighbouring Fukushima. This register should be linked with best estimates of radiation exposures since the disaster, and used as a basis for linkage with national data on mortality, cancer, congenital malformations and pregnancy outcome.
- IPPNW expressed concern for the health of the more than 20,000 workers who have worked at the Fukushima Daiichi plant since the earthquake, and the many more that will need to work there over the many decades it will take to decommission the damaged reactors and spent fuel ponds. They were disturbed by frequent reports of inadequate protection of workers and falsely low radiation exposure measurements. A lifetime radiation exposure register should quickly be established for all workers in the nuclear industry.
- There has been regrettable misinformation disseminated, including by senior professionals and in school educational materials, downplaying the risks of radiation. The corrupting influence of the 'nuclear village' is widespread. Provision of accurate, independent, timely public information on radiation health is essential."

The NFLA endorse these recommendations and encourage them to be considered for UK response plans to radiation emergencies.

Openness and transparency

Above all, the NFLA is concerned that considerable parts of the present nuclear emergency planning arrangements are not transparent enough and often appear to come to what seem to be arbitrary decisions, such as with the size of the DEPZ.

For example, the rationale for specifying a maximum credible accident at each licensed nuclear site remains unclear – often argued for not publicising because of concerns over national security - and lacks transparency. It could be reasonably argued that the public interest in

disclosing the maximum credible accident is greater than the claimed security benefit of not disclosing it. A greater amount of transparency would not just help groups like the NFLA to be convinced that nuclear site emergency plans are robust enough; they would reassure the wider public that such sensitive and potentially high-risk sites have adequate safeguards for the protection of the local community.

The NFLA acknowledges the critical need for national security and preventing sensitive information getting in the wrong hands is an important factor, considers that security issues are overplayed and are too often used as an excuse for failing to engage with legitimate challenge. The NFLA remains disappointed over the lack of any real public engagement post-Fukushima to determine the level and amount of public information that could be given out. In the NFLA's view, it would seem much more preferable to have an engaged and reassured public than an ignorant public where mass panic is the likely consequence in the event of major nuclear emergency.

10. Public spending cuts, emergency planning and recovery planning

Before concluding this briefing on the effects of Fukushima on a national nuclear emergency planning review, there are some other issues that the NFLA would seek to highlight.

The Fukushima incident has taken place at a time of one of the most difficult periods for public finance in the UK. Local authorities, health agencies and the emergency services have all been subject to cuts of as much as 25% of their budget, with each agency having to individually trim millions. The nuclear industry has also not been immune to the recession, which is also exacerbated by the ongoing retirement of skilled staff. Staff cuts have been an inevitable part of this budget-trimming process. Though much stress has been made by all agencies that front-line services will be maintained as much as is possible, there has been cuts to the numbers of police, nurses, ambulance drivers, local authority social service staff and so forth across the UK.

The NFLA believe it is absolutely essential that a key part of the national review of nuclear emergency planning preparedness in the UK should also be an analysis of the potential effects of such cuts on emergency response. The review should look not just at the emergency response phase but the sheer amount of resources that are also required in the recovery phase of an emergency.

For example, the ONR's report on the Fukushima incident raised concerns over a lack of detailed consideration being given to the problems of a long-term and prolonged recovery phase of a major nuclear incident (48). As the Local Authority is usually the lead agency for recovery planning, and as a local authority organisation, the NFLA believe it is essential that such matters are considered in much more detail, and the national review is a timely opportunity to do so. In its previous reports on the Fukushima incident, the NFLA have outlined the huge financial cost to Japan of this nuclear incident, which conservatively could be as much as $200 billion (49). In the midst of one of the worst recessions in UK economic history it would seem only prudent that emergency plans are made as robust and flexible and as well resourced as is possible and that recovery planning is given more prominence than it is currently. If not, the financial cost from a major incident could be much higher than the cost of cutting a critical service.

11. DEFRA report on flooding risks around UK nuclear sites

In March 2012, the Guardian raised concerns over an unpublished report by the UK Department of the Environment, Food and Rural Affairs (DEFRA) over the risks of major flooding around licensed nuclear sites if the negative effects of climate change increase over the next century. It should also be noted that, in the ONR's Fukushima interim report, it had been noted that there is a "potential for flooding to occur in the near vicinity of nuclear sites" but that the "actual flooding risk is unknown" (50)

The DEFRA Climate Change Risk Assessment survey found that (51):

- 6 nuclear sites have a 'high' risk of significant flooding in the next 100 years;

- 4 nuclear sites have a ‘high’ risk of serious issues caused by coastal erosion without advanced mitigation measures put in place;
- 5 of the 8 proposed new nuclear build sites could become ‘high’ flood risk areas in the next 100 years;
- 5 of the 12 sites managing radioactive waste would also be in ‘high’ flood risk areas in the next 100 years.

The DEFRA study concluded that the existing nuclear sites are currently well protected, but as sea levels rise and extreme weather events become more frequent, and coastal erosion increases, the protection required to nuclear sites will reduce without further substantial and expensive mitigation measures.

Given such details, the NFLA is concerned about what is being done to combat flooding threats around nuclear sites and how much future flood defences will cost. Will such measures require increased public expenditure and how may it impact on local communities and amenities? Who will pay for such measures – the nuclear industry or the taxpayer? The current emergency planning review should in addition also consider flooding threat at defence nuclear sites as well – serious flooding has occurred in recent years at the AWE Burghfield nuclear site with the clean-up costs extending to millions of pounds.

Furthermore, the NFLA notes that the ONR's opposite number in France, the Autorité de Sûreté Nucléaire (ASN) recently decided to require EDF, post Fukushima, to install flood-proof diesel generators and bunkered, remote, back-up control rooms at its plants or else face having to shut down some of its reactors. (52) These sensible requirements are absent from ONR Reports. In the NFLA’s view, EDF should be required to do the same for its existing and proposed reactors in Britain. In this is concurs with the views made in editorials of ‘Nature’ magazine. (53)

12. Ongoing issues around nuclear materials transportation and nuclear terrorism

The Fukushima incident also highlights concerns around the transportation of nuclear materials and issues around the transport network.

Due to the sheer damage of the earthquake and tsunami, large parts of the transportation network were damaged around Fukushima. Japanese authorities got much of the network back in operation perhaps quicker than any other country in the world, but it is still a clear issue that the response to a major nuclear incident would be hindered by a dislocated transport network.

For some of the nuclear sites in the UK there are particular issues of concern. The Wylfa site in Anglesey is on an island with only one main evacuation route on or off the island, which would make evacuation and emergency access complicated if it was to be damaged. Similarly in Bradwell the neighbouring communities located on Mersea Island also only have one major access / evacuation route. Both are on the list of proposed new nuclear sites, where the site could possibly double or even triple from its present size. In total, with the exception of Hartlepool, most of the nuclear sites in the UK are in remote rural areas which would pose major issues if the local transport network is severely damaged in a manner like Fukushima. Though what happened in Japan – an earthquake and tsunami – is low risk in the UK, there are other potential scenarios which could see serious damage to the transport network, such as the major flooding that took place in Cumbria in 2010.

On a related subject, there is likely to be an increase in the transportation of nuclear waste around the UK as the Nuclear Decommissioning Authority develops a strategy of concentrating waste in fewer storage sites. A recent example is the imminent commencement of ‘breeder fuel’ rail transports (which will contain weapons-usable plutonium) from the Dounreay facility in Caithness to Sellafield. The Scottish rail network is limited and there are only a certain amounts of routes such transports can take. The NFLA strongly opposes such rail movement across remote rural parts of Scotland. It has also queried whether, given the type of material in the transports, whether there will be armed guards on the trains. This creates both a major security

risk and a potential target for a malicious attack. As many as 60 transports could take place across Scotland to take all of this material to Sellafield (54).

Waste transports by sea may well increase following the first shipment of decommissioned heat exchangers from the Berkeley nuclear reactor to Sweden for recycling of decontaminated steel and return to Gloucestershire earlier this year. As with the Dounreay rail transports, the NFLA remain concerned over the emergency response issues in the event of an accident or malicious attack on the ships (55). As noted in previous NFLA Policy Briefings, it remains concerned over the risks of an accident with a nuclear weapons convoy from Aldermaston and Burghfield in Berkshire up to Coulport and Faslane in the west of Scotland (56).

The threat of nuclear terrorism remains one of the highest threats identified in the UK's National Security Review (57) and large amount of resources have already been spent in all of the UK's largest cities in preparing for such an attack using a device with radioactive materials. At the March 2012 'Nuclear Security' summit in South Korea the IAEA and Interpol confirmed that there are 200 – 250 cases of theft and loss of nuclear materials that could be used in an improvised device annually (58). Disappointingly, this Summit failed to agree ways to secure and reduce the amount of radioactive material that could be used for a malicious device. At the Conference, the UK Deputy Prime Minister Nick Clegg said that the materials for a 'dirty bomb' were so readily available no British police force can hope to contain such a threat. As a result, expanded training for such an eventuality is continuing to take place across the UK.

13. Conclusions and recommendations

In the NFLA's view, the Fukushima incident was both a 'game changer' and a 'wake-up call' for nuclear safety and nuclear emergency planning at the international level and its impact has a direct bearing on the need for a thorough review of the UK nuclear emergency planning system. The simple fact that some 18 months after Fukushima the review of nuclear emergency planning is still taking place in the UK, and is likely to continue for some time to come, should be seen as an indication that significant improvements are being considered and need to be made.

This NFLA Policy Briefing has sought to outline in some detail a large number of the key issues that arose out of Fukushima and extrapolate them for the UK context. It may be true that the UK does not suffer from seismic events or tsunamis like Japan, but there are many feasible scenarios and other forms of natural disaster or human error that could create a significant nuclear emergency in the UK. Though the probability of such an incident remains low, the consequences of just one incident remains high. Fukushima was never expected to happen, in the same way as Chernobyl was never expected to happen, but they did. That the incident occurred in one of the most technologically advanced nations in the world which, prior to the accident, was planning a huge increase in nuclear reactors, is instructive. That Japan is moving in a cross-party way to the possible phasing out of all its nuclear reactors by 2030 is, in the NFLA's view, one of the few positives from this horrendous disaster (59). The 'culture of complacency' that Fukushima highlights in Japan needs to be seriously considered by all Governments with nuclear sites and the global nuclear industry.

For the UK, there are clear improvements and enhancements that can be made to improve the nuclear emergency planning system and Fukushima could, and should, be a positive learning experience. This report has outlined some of the key issues that arise from Fukushima and suggested many ways improvements can be made.

The NFLA will take the following actions, and make recommendations, in the following areas:

- This report will be sent to staff leading on the UK nuclear emergency planning review in DECC, the Nuclear Industry Association, the ONR, the NDA and the Nuclear Emergency Planning Liaison Group to contribute actively and positively to the review.
- As far as is possible, this report will also be sent to Regional and Local Resilience Forums around the UK who are responsible for the governance of emergency planning and the development of local risk registers.

- The report will be sent to all NFLA representatives to encourage them to forward and discuss the report with their own Council Emergency Planning Officers and the wider emergency planning community.
- The NFLA Secretary will attend meetings with DECC staff and other NGO representatives to discuss the UK nuclear emergency planning review and put forward the main points of this report.
- The report will be sent to national and local NGOs to encourage lobbying of Government and local nuclear Site Stakeholder Groups.
- The Executive Summary of this report will be published in a media release following the pre-meeting with DECC officials.
- The NFLA encourages a close reading of this report as its aim is to seek improvements to the UK nuclear safety and nuclear emergency planning regime to improve and enhance public protection and emergency preparedness.

14. Glossary of acronyms in this briefing

ACRO	A French NGO which provided Greenpeace International with independent radiation monitoring around the vicinity of the Fukushima area and contributed to the emergency planning chapter of Greenpeace International's report on the Fukushima incident.
AWE	Atomic Weapons Establishment – the agency responsible for the maintenance of the UK's nuclear weapons programme.
COMARE	The Committee on Medical Aspects of Radiation in the Environment – an independent agency that advises the UK Department of Health on radiation and health matters.
DECC	UK Government Department of Energy and Climate Change – is the lead government department for nuclear emergency planning matters. It liaises closely with the Cabinet Office Civil Contingencies Secretariat.
DEPZ	Detailed Emergency Planning Zone – a determined area around a UK licensed nuclear site where evacuation pre-planning and public information arrangements are developed by the local authority, the site operators and emergency responders under the REPPIR regulations.
DSNR	Defence Nuclear Safety Regulator – the nuclear regulator that monitors safety of all sites operated by the Ministry of Defence in the UK.
IAEA	International Atomic Energy Authority – the United Nations agency responsible for international nuclear safety standards and the 'peaceful promotion' of nuclear power.
ICRP	International Commission on Radiological Protection – an independent, international agency which provides guidelines on radiological protection standards.
Live exercise	A type of emergency planning exercise that will test a plan by running an emergency scenario in a live setting with all the staff that would be involved in a real emergency. It provides one of the most effective ways to test if the emergency plan is fit for purpose.
NDA	Nuclear Decommissioning Authority – the government agency that is responsible for the safe management of the UK radioactive waste stockpile and for the oversight and eventual decommissioning of civil nuclear reactors in the UK.
NFLA	Nuclear Free Local Authorities – a local authority body established in 1980 which seeks to improve safety and accountability in the UK nuclear industry and the eventual phase-out of nuclear power and nuclear weapons in the UK.
NEPLG	Nuclear Emergency Planning Liaison Group - An independent advisory body, chaired by DECC, which brings nuclear site operators, the emergency services and local authority emergency planning officers together to develop best practice for national nuclear emergency planning arrangements in the UK.
NISA	Nuclear and Industrial Safety Agency – the Japanese nuclear safety regulator. Formerly within the Trade Ministry, it has now been moved to the Environment Ministry to increase its independence from the nuclear industry.
NGOs	Non-governmental organisations – local or national groups who have been established by concerned members the local community or around a specific area of national concern that lobby on a particular issue and inform the public of their concerns. National NGOs include the like of Greenpeace and the Nuclear Information Service, and local NGOs include the likes of Stop Hinkley and the Shutdown Sizewell Campaign.
NSC	Nuclear Safety Commission – the Japanese Government's advisory body on nuclear matters.
ONR	Office for Nuclear Regulation – the nuclear regulator, currently part of the Health and Safety Executive and formerly the Nuclear Installations Inspectorate, which monitors nuclear safety at all civil nuclear sites in the UK. The ONR will become an independent statutory agency in the next 12 months.

PAZ — Precautionary Action Zone – a recommended inner zone of 5kms around a nuclear site to allow for pre-planning and the safe evacuation of the public living in this area, as designated in 2006 guidelines by the IAEA.

REPPIR — The Radiation (Emergency Planning and Public Information Regulations) – the official regulations overseen by the ONR which govern safety and emergency planning guidelines for the offsite response to a nuclear emergency at a UK nuclear site.

Tabletop — A type of emergency exercise in which the emergency plan is tested through a virtual run-through of a scenario, allowing for each agency to discuss how it would deal with the incident and how it would interact with other agencies.

TEPCO — Tokyo Electric Power Company – the electricity company that operated the Fukushima Daiichi nuclear generating facility.

UPZ — Urgent Protective Action Zone – a recommended outer zone of 30kms of a nuclear site where preparations are made to promptly shelter the public, to perform environmental monitoring and to implement urgent protective action on the basis of the results of monitoring within a few hours of a radiological a release. Plans and capabilities are also developed to implement sheltering or evacuation and distribute potassium iodide tablets (if appropriate).

15. References

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(3) NFLA Policy Briefing 93, 'Nuclear emergency planning issues', 12th December 2011 – http://www.nuclearpolicy.info/docs/briefings/NFLA_Briefing_93_Nuclear_EP.pdf

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