

# *Nuclear Free Local Authorities* briefing



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No.133

**Subject: Fukushima update and its impact on UK & European nuclear emergency planning**

## 1. Overview of report

This report has been developed by the NFLA Secretary to provide member authorities with an update on post Fukushima decommissioning, some four years after the extensive damage to its nuclear reactors. It also considers the medium-term impacts of the incident on the nuclear emergency planning regime in the UK and across Europe. Significant changes are being proposed to offsite nuclear emergency plans by nuclear regulatory agencies and the UK Government has also undertaken a review of national nuclear emergency planning.

This briefing provides an update from previous reports such as NFLA Policy Briefing 100, which it is useful to read prior to considering this report (1). It also follows on from a number of NFLA special seminars on nuclear emergency planning. (2) The NFLA Secretary is a nominated member of a DECC NGO Forum subgroup on nuclear emergency planning. DECC specialist officers in nuclear emergency planning, along with specialist representatives from the Office for Nuclear Regulation (ONR) and the Environment Agency (EA), also attend this group. (3)

Finally, this briefing seeks to provide an update of the changes to UK nuclear emergency planning as a result of Fukushima, and challenges government and the nuclear regulator to go significantly further in improvements to national emergency planning arrangements. Separate but linked NFLA briefings - on nuclear security and on nuclear safety - are also being developed by the NFLA Secretariat, and will be published shortly as contributions to post-election nuclear policy debate.

## 2. Executive Summary

This report profiles various issues relating to nuclear emergency planning and the Fukushima disaster. It argues that the environmental, financial and nuclear emergency planning lessons from this disaster are still being considered and should be providing more fundamental change to all aspects of nuclear policy than is actually taking place.

It profiles two reports by civil society groups:

- A Fukushima civil society groups report providing a local perspective on the problems arising from the Fukushima nuclear leaks and a guide to nuclear emergency planners to improve local planning guidance and training.
- A Nuclear Transparency Watch report outlining a number of inconsistencies in the approach of European nuclear safety authorities to nuclear emergency planning.

It also outlines the academic debate questioning the relevancy and accuracy of probabilistic risk assessment models, which were found wanting in the Fukushima disaster. Various influential nuclear scientists suggest the potential for a similar incident remains significant.

**THE LOCAL GOVERNMENT VOICE ON NUCLEAR ISSUES**

The report analyses the changes made to the UK nuclear emergency planning regime, and argues that either substantial reform or legislative change - as part of the implementation of the European Basic Safety Standard into UK law - should be fully considered by the UK Government and nuclear safety regulators.

The report outlines the frustration of civil society groups with not being provided with sufficient information from government in the area of nuclear emergency planning (as with nuclear safety and nuclear security). Using the well-worn excuse of 'national security' prevents a full and open discussion between policy-makers and valid local community groups and national nuclear policy groups like the NFLA. There are ways and means to improve openness and transparency if more effort was made to engage with NFLA and other groups.

The report welcomes minor changes to nuclear emergency plans and emergency planning zones around nuclear sites, but argues they do not go far enough. There remains a fundamental lack of positive engagement with not just local communities, but those geographical areas a little further afield, who are likely to have to deal with the wider consequences of a wider-scale nuclear emergency incident. Such Council Emergency Planning Units are unlikely to have the same levels of training and expertise as the local Councils and the local emergency services who host nuclear sites.

The report questions the robustness of the nuclear emergency planning exercise programme, and particularly the lack of 'live' exercises. It encourages the nuclear industry and nuclear emergency planners to engage more with the local community and more critical groups when undertaking such exercises.

The report also notes that the significant cuts to personnel and budgets of local authorities and the emergency services are likely to have had a negative effect on their ability to respond to a nuclear incident of the size of the Fukushima disaster. It calls for a rethink of such cuts and postulates whether nuclear emergency planning (and emergency planning in general) would benefit from a regulatory agency pushing up standards and challenging the status quo.

### **3. Fukushima decommissioning – still much to be done**

The events that badly damaged most of the nuclear reactors at the Fukushima Daiichi nuclear power plant are now almost four and a half years ago. It remains one of the worst nuclear disasters in the history of the global nuclear industry and is on a par with the 1986 Chernobyl disaster. Since the disaster in March 2011 there remains much that still has to be done to make the site safe, deal with the widespread clean-up and overcome a substantial and extensive radioactive waste burden around the site and for the wider country.

The NFLA Secretary provides members of the NFLA Steering Committee with a regular update of the Fukushima issue every 2 - 3 months. (4) These updates consistently show that there remain many large and complicated logistical issues around how to prevent the facility from causing more land and marine environmental damage. It has been estimated by the Japanese nuclear regulator that it will take at least 40 years to decommission the facility and make it safe, and that is likely to be a conservative assumption. The financial cost of the disaster has also been immense – one of the most recent estimates being \$105 billion (£70.5 billion). This figure itself is more than double what was predicted at the end of 2011; and it does not include final storage, decommissioning, decontamination and full community compensation costs. (5)

At the same time, many difficult questions remain around what to do with the huge amounts of radioactive waste and contaminated water that have been generated from the site. The scale of this problem was highlighted in the NFLA's media release on the fourth anniversary of the disaster on March 11<sup>th</sup> 2015 (6). This noted:

- By the end of January 2015, there was 258,300 cubic metres of radioactive waste produced from Fukushima - equivalent to the capacity of about 650 25metre long swimming pools.
- Sensors monitoring a drainage gutter on the Fukushima site detected a radiation spike 70 times (or 7000%) higher than normal levels in late February 2015.

- The site is still generating 400 tons of new radioactively contaminated water every day. There remains real concern that there will soon not be enough available space on the site to continue to build storage tanks for all this waste.
- There remains concern that contaminated water is continuing to leak into the Pacific Ocean.
- According to *The Ecologist* magazine, the Fukushima Reactor 3 fuel storage pond still contains upwards of 89 metric tons of plutonium-based, mixed-oxide fuel that, should the pond leak or dry up, result in another major reactor meltdown.
- Over 100,000 people evacuated from the area are still living in temporary accommodation and suffering from physical or psychological distress, discrimination and many years waiting for the land to be decontaminated to a point where they can safely return home.

On the 11<sup>th</sup> April 2015, TEPCO sent in a remote control survey robot into Fukushima Reactor 1 to assess for the first time the extent of the damage and locate the highly radioactive fuel and debris. However, it stalled and stopped working after just three hours of its survey, close to the vessel's basement, where the molten fuel is believed to be located after the core meltdown. (7) In this time TEPCO argued that the robot sufficiently collected temperature, radiation levels and images from parts of the platform just below the reactor core's bottom by the time it got stuck and became unrecoverable. TEPCO also said the test showed the robot was able to tolerate radiation, and that the radiation levels were significantly lower than anticipated. (8)

In early April it was also reported that TEPCO were actively considering evaporating some or all of the 280,000 tonnes of radioactive water held in the 1,500 storage tanks at Fukushima. (9) Dr Ian Fairlie, an independent consultant on the effects of radioactivity on the environment, raises real alarm with such a prospect. Dr Fairlie notes that, whilst disposing of highly tritiated water is a serious problem, evaporating it is quite dangerous due to a number of key misconceptions.

These include:

- Evaporating this radioactive water will **not** isolate the radioactivity: all it would do is convert liquid tritiated water to tritiated water vapour which would be emitted to the air at Fukushima and result in high exposures to those downwind of the plumes.
- Evaporation would make the problem worse as aerial emissions are more hazardous than liquid discharges to sea. Briefly, this is because a person can avoid drinking tritiated water and food to a large degree, but cannot avoid breathing in tritiated water vapour or absorbing it through skin.
- Tritium is not "relatively harmless" as alleged. Tritium is a relatively dangerous nuclide. For example, its beta particle inside the body is more harmful than most X-rays and gamma rays. Tritiated water vapour has several other dangerous properties, and organically bound tritium (i.e. attached to lipids, carbohydrates and proteins) inside humans is even more dangerous.
- A complicating factor is the very high tritium levels in the tanks. From Japanese Government statistics (10), tritium concentration in March 2014 was around 500,000 Bq per litre. This is a very high level. As far as Dr Fairlie is aware, there are no internationally agreed limits for discharging tritium to water. But as an example, the limit used by Ontario Power Generation (a nuclear utility in Canada) is 4,000 Bq/L. TEPCO is facing an immense storage problem with its tanks on site now full, and no space to build more. However, neither evaporating the tank contents nor discharging them to the sea appears to be a sensible solution.

The time it will also take to fully decommission the site has also been dramatically extended. In late March 2015, the current TEPCO Chief of the Fukushima decommissioning process, Akira Ono, conceded that the stated goal of decommissioning the plant by 2051 may be impossible without a giant technological leap. He said it could potentially take as long as **200 years for full clean-up and decommissioning of the site.** (11)

Furthermore, in late May, TEPCO inspections of containers holding contaminated water from the Fukushima No. 1 nuclear power plant found that at least 10% of them have leaks in them, which could trigger a hydrogen explosion. In its May 22<sup>nd</sup> report to the Japanese nuclear regulator, TEPCO claimed no radioactive water was found to have escaped outside the concrete structures that encase the containers. However, the Japanese nuclear safety regulator noted the accumulation of hydrogen in the tanks is prone to an increased risk of a hydrogen explosion in

the event of a spark from static electricity. This was reported at the same time as a separate TEPCO study shows as many as 333 of the tanks could have defective pressure-release valves on them. (12)

It was also reported at the end of May 2015 that TEPCO have confirmed record levels of radioactive contamination in seaweed around the Fukushima facility's port. As much as 22,000 bequerels per litre of beta radiation was found in one ditch on the site, whilst seaweed had 190 – 320 bequerels per litre of radioactive substances at four locations around the port. This is the highest ever levels recorded in the port. This could be due to a leak of comparatively high radioactive contaminated water flowing into the port and the open sea. Such evidence highlights the continuing risks of low level radiation affecting the Japanese coastline and the wider Pacific Ocean. (13)

#### **4. Nuclear emergency planning lessons from Fukushima**

In the past year the NFLA Secretariat has been in close contact with groups actively supporting those directly affected by the Fukushima disaster. For both the third and fourth anniversaries of the disaster NFLA has co-operated with Green Cross International, a non-governmental organisation (NGO) that assists those involved in environmental disasters, and lobbies for more urgent measures to mitigate the effects of climate change. Green Cross has established a number of projects to support evacuees from the Fukushima disaster. (14)

In October 2014, a small delegation of UK representatives, including two NFLA nominated representatives, joined a Green Cross study tour to the Fukushima area. This included delegates going into the exclusion zone, meeting with evacuees and understanding some of the difficult issues in dealing with the ongoing effects of the disaster – environmental, technical, health, social and psychological. Presentations on this visit were given to NFLA meetings in Cardiff and Edinburgh.

Key points that came out of this visit included:

- The huge logistical problems in dealing with radioactively contaminated water on the Fukushima site.
- The significant increase in the permitted radiation dose levels to Fukushima site workers and the general public.
- The difficulty in removing spent fuel rods from storage ponds of reactors 1 – 4 on the site.
- It was noted that on average 400 litres a day of radioactive water has been released into the sea every day since the disaster occurred.
- There are over 1,000 storage tanks on the site now, containing over 14 million tonnes of contaminated water.
- Thyroid cancer rates in children have been recorded at between 150 – 300 times higher than the expected level in evacuated communities.
- It is at present too early to see if any significant physical health impact on adults takes place. However, there has been no systematic health screening of adults taking place. Official Fukushima Prefecture figures for morbidity across the population for the first year did show a marked increase in health problems – but the figures are no longer published. Anecdotally many adults have reported numerous health issues and an increase in 'sudden deaths'.
- There have been serious mental health issues affecting evacuated communities. For example, in Tomioka, a village partially evacuated, there have been over 300 "disaster related deaths", particularly suicide.
- Over 160,000 people had to be evacuated. At least 25,000 people will never be able to return to their homes as they are too irradiated.
- Of those who have been evacuated, around 13.5% are in temporary housing, 54.5% in locally rented housing and 32% have moved away from the Fukushima Prefecture area completely. (15)

This visit was followed up by special events in late February 2015, where the NFLA was one of the supporting groups to bring the former Japanese Prime Minister (at the time of the Fukushima disaster), Naoto Kan, to Wales, to reflect on his experience of the Fukushima disaster and the post Fukushima response. In his speech to a specially invited meeting in

Cardiff, that included Welsh Assembly members, NFLA members and members of environmental and anti-nuclear groups; Mr Kan commented that, despite the colossal earthquake and tsunami, the Fukushima disaster still remained very much a man-made disaster of defective pre-incident emergency planning. He also noted that an even greater nuclear disaster was only narrowly averted and that the evacuation of the Greater Tokyo area – made up of tens of millions of people – was actively considered.

As Mr Kan said: “What occurred in Fukushima in 2011 was caused by humans, not natural disaster. It is clear to me that what caused this catastrophe was our commitment to an unsafe and expensive technology that is not compatible with life on this planet. The only safe option when it comes to nuclear power is to abandon your plans for nuclear power. It simply is not worth the risk. Prior to the meltdown at Daiichi, Japan’s nuclear industry was confident it had all required safety measures in place. Within hours of the tsunami, it became quite clear that our physical and communications infrastructure was insufficient. As a result, we came close to causing a disaster that would have required the evacuation of a 155 mile radius, perhaps keeping 50 million people from their homes for up to 30 years. That would have included Tokyo. Half the country would now be lost to us.” (16)

To coincide with the fourth anniversary of the disaster a detailed booklet by a group of Japanese based NGOs assisting affected communities from the disaster was published. ‘10 Lessons from Fukushima – Reducing risks and protecting communities from nuclear disasters,’ has been expressly written from a community perspective to help emergency planning officers in national government, and particularly in local government, as a guide to try and prevent nuclear disaster happening again, and to mitigate its damage if it does occur again. The NFLA Secretariat strongly recommends all UK local authority emergency planning officers read this informative publication. (17)

Some of the key nuclear emergency planning points from this publication include:

*Evacuation planning -*

- Prior to the Fukushima disaster, Japanese nuclear off-site emergency plans were predicated on evacuation plans for residents within 10 kilometres from the plant. In the end, a 30kms evacuation was required, but the report notes areas much further than that where no evacuation orders were issued. This included Fukushima City (60kms from Fukushima Daiichi), which received, via rainclouds, a radioactive dose of 23.88 microsieverts per hour four days after the disaster; and again in Koriyama, 45kms south of Fukushima Daiichi.
- There was huge traffic congestion on all roads away from the Fukushima disaster, putting large numbers of people in direct danger of radiation exposure.
- Hardly any municipalities received direct evacuation orders from central government during the early days of the incident, and the majority of residents in the Fukushima prefecture could not obtain detailed information of what they should do.
- After the disaster struck, some people could not evacuate due to a severe shortage of petrol.
- Many people had to re-evacuate over and over again, some becoming ill due to this exhausting process.
- The conditions in evacuation and rest centres were extremely difficult for mothers with children, elderly people and people with disabilities.
- Despite having SPEEDI (System for Prediction of Environmental Emergency Dose Information) to predict the spread of radioactive particles, it was not until 12 days after the disaster that information was released, making it a redundant tool for evacuation.

*Sheltering issues -*

- For those who were told to stay indoors and shelter they had difficulty blocking out the external outflow, as Japanese houses are mainly made from wood and not airtight concrete buildings.
- In Minamisoma City, 30 kms to the north of the nuclear plant, residents told to stay indoors ran out of supplies, with the Mayor of the City having to resort to a You Tube plea on the internet seeking help and volunteers to transport supplies ‘at their own risk’. **Many**

***Local Councils in the vicinity of the disaster were woefully unprepared to deal with the after-effects of the disaster.***

- Thousands of people voluntarily self-evacuated from cities outside evacuation zones, often families without children. Such voluntary evacuations have led to receiving no compensation to cover the moving away from the area. There are also many 'mother and child evacuees' from families where the father has stayed behind to work, putting a real financial and emotional strain on them.
- Many evacuees have had their family units split up, with many elderly people moved from their children and grandchildren. Ill health in such people is high.

*Community recovery issues -*

- The number of 'disaster related deaths' of evacuees continues to rise. The report calculates 441 people in Iwate Prefecture, 889 in Miyagi Prefecture and 1,704 in Fukushima Prefecture.
- Unlike in Chernobyl, there is great pressure from the Central Government and local authorities to rush citizens back home in areas which still have considerable levels of radioactive contamination. This is putting many people who have been evacuated from such areas under great uncertainty about their future living and work arrangements.
- It is essential for communities living around nuclear sites to receive extensive information on how emergency orders will be issued and the systems for receiving such alerts. They must know where to go when evacuating to receive facemasks, raincoats, long boots and prescription medication.

*Public health emergency planning issues -*

- Households and schools in affected areas should also be given a prior stock of iodine pills. Local schools and community organisations should also be given stocks of radiation Geiger counters.
- Local residents around nuclear sites should build a network of independent experts whom they can go to during an emergency to verify public information messages, or to provide a second opinion.
- It is critical to immediately obtain and make public weather and contamination prediction maps based on weather modelling to enable institutions and the public to make evidence-based decisions.
- The Fukushima accident showed the need for a fundamental re-think of the entire emergency radiation exposure medical treatment framework.
- During an emergency, it is extremely important for individuals to keep records of their movements and local weather and feeding information.
- Despite having adequate stocks of iodine, many residents did not receive it due to confusion in communication between central government and local municipalities.
- The reopening of some schools in April 2011 with a much higher annual radiation exposure limit (increased from 1 mSv to 20 mSv) created a huge public outcry.
- Many citizens in areas where no evacuation directive was issued did not have any information of safe behaviour, and had to seek information from non government sources to assist them.

*Post-event offsite issues -*

- Many citizens were filled with a sense of mistrust towards central and local government following the incident. Many community groups independently bought Becquerel radiation hand-held monitor counters and even whole-body counters to determine the radiation risk to them. It was only a year after the incident that local Councils bought such equipment.
- Over 4 years since the disaster, community groups from around Japan are inviting children and their families for holidays for evacuated communities, amidst fears they are not able to exercise adequately and to give them time in a 'clean' part of the country. Such 'recuperative holidays' have been a feature of the Chernobyl disaster, but there are to date no plans by central or local government in Japan to provide such schemes.
- There has been a lack of a comprehensive health study, despite the fact that radiation contamination crossed prefectural boundaries. Those studies that are taking place are too localised and limited in scope. The report argues that this is aimed at reducing the amount of people who will eventually receive compensation from the disaster.

- Concerns over the safety of food, fish and agricultural livestock still remain four years after the disaster. There is a real need for full and transparent information on exposure and local community groups should participate in measuring radiation in the area. Without this it is difficult to restore trust in the food distribution system.
- Tsunami debris contaminated with radiation is being transported around Japan to be incinerated. This is often against the wishes of communities in tsunami-hit areas, and residents near incinerators are also concerned about a release of radiation from them.

*Post-event onsite issues -*

- There is a huge radioactive waste legacy in the region which will take several decades to resolve. Local NGOs believe complete decontamination is impossible.
- There is real concern over decontamination being sub-contracted to companies without the required level of expertise, leading to the potential dispersal of radioactive materials to a wider area. Central government has also put too much pressure on local councils to deal with this very difficult issue.
- Most workers on the Fukushima site are receiving inadequate treatment for their toil, meagre wages and insufficient healthcare. Many workers have received radiation doses greater than the annual safe maximum dose – the report calculates at least 174 workers in this category, with the highest contamination a TEPCO employee exposure to over 678 millisieverts. Such workers should be guaranteed medical expenses in the long-term and be issued with a personal health record. At present many are not.

*Post-event financial and community cohesion issues -*

- There has been increased division and discord between the local communities affected by the disaster due to the psychological stress of being so close to radiation sources. Increased levels of prejudice to such communities are growing. There is also great tension between evacuees and host communities who have had to rapidly expand in a short period of time.
- The Nuclear Disaster Victims Act that was established by the Japanese Government in June 2012 has been significantly watered down by the successor (pro-nuclear) government. Similar to the 'Chernobyl laws', people in Japan expected that the government would establish a series of resettlement zones and a fair system to resettle. There has also been a lack of public participation for evacuated communities. It has become increasingly complicated to claim compensation from the disaster.
- Many community ties that had existed for generations have collapsed.
- In the end, those who will ultimately bear the financial cost of the disaster will not be the nuclear industry that created it, but the taxpayer.

This detailed list of issues is relevant to all countries which possess nuclear facilities, and particularly for UK local authorities with nuclear sites, or close to nuclear sites, who would be responsible for many of the pre- and post-incident response issues to a nuclear incident. It is clear to NFLA that the Fukushima incident highlighted extensive pre-planning and accident response emergency planning gaps which are of relevance to a UK context. The recovery operation has often shown a lack of sympathy and empathy to the affected evacuated population. A significant change to a much more pro-nuclear government in Japan has seen many of the welcome initial responses to the incident being significantly diluted. This is to the detriment of local communities in Fukushima Prefecture.

## **5. Nuclear emergency preparedness & response in Europe**

In Europe, there was a swift response to the Fukushima accident from Governments and nuclear authorities. The European Commission initiated a series of detailed 'stress tests' of all nuclear facilities in the EU (Switzerland and Ukraine also took part in this programme) through the European Nuclear Safety Regulators Group (ENSREG). In the UK the Government asked the UK Chief Nuclear Inspector Mike Weightman to undertake a detailed consideration of the safety procedures for all nuclear facilities.

However, in both cases there was less specific consideration made of off-site emergency preparedness and response (EP&R). NFLA therefore welcomes a recently published report by Nuclear Transparency Watch (NTW) that conducted an investigation into such matters.

Like the Japanese NGO report, the NTW investigation seeks to carry out this evaluation from a civil society point of view. This is in order to provide informed comment to the public and offer a strategy that could be implemented by government and the nuclear authorities for the benefit of the general public. (18)

The NTW report found perceived deficiencies in EP&R provisions across European nuclear facilities and an urgent need for extensive improvement. NTW argue that nuclear emergency planning arrangements in Europe are mostly based around the 'International Nuclear Event Scale (INES) 5' type of nuclear accidents, but may not have the capacity to cope with an 'INES 7' accident, as occurred at Chernobyl and at Fukushima.

The report focuses on five areas of concern:

- *Emergency drills* – the NTW report observed that many regional and local authorities are not adequately prepared for a nuclear incident. They note: "Sufficient dedicated staff, accurate evacuation plans and full scope exercises involving the local population are missing. Lessons learned from exercises and drills are not taken into account in new versions of plans, not are they communicated to the stakeholders."
- *Changes updating* – the report identifies poor updating of EP&R plans regarding important recent spatial changes (new residential developments, shopping centres, health centres, educational and social establishments, roads) and recent changes in technology (internet, mobile phone communication, social media, availability of reasonably-priced basic radiation monitoring equipment). The report notes that in Fukushima social media played an important role in how the public gathered on-going information. NTW also note that the multi-lingual, multi-national and multi-cultural character of European society is also not being fully addressed in existing nuclear emergency plans.
- *Communication* – the report notes that, even during emergency exercises and drills, the communication and notification lines for the responsible institutions are not entirely working. The report notes that contact data for involved personnel is sometimes wrong and out-dated. Communication within critical services is often patchy and communicating to other services is at times inadequate or could leave to important delays. An example given is a German Federal Ministry of the Environment nuclear communication exercise in September 2014. This exercise showed a lack of adequate communication between the Federal Government and the State Governments that could have led to more than one million people being affected by a radiation release before a public warning is given out. It also noted that security instructions – to close windows, doors etc – were given five hours too late.
- *Distribution of iodine tablets and evacuation zones* – the report found real inconsistency in the policies of governments around the EU in the distribution of iodine tablets, the use of evacuation perimeters and zoning. For example, Austria and Luxembourg allow for iodine tablets to be collected in any pharmacy and be stored at home for members of the public across the country. In the Czech Republic, iodine tablets are pre-distributed and stored in houses only in an emergency zone up to 13kms around the Temelin nuclear plant and 20kms around the Dukovany plant. In Belgium and France iodine tablets are distributed within zones of 20kms and 10kms respectively, with centralised stocks for residents living outside these zones (this is the case in the UK but the zones are even smaller). In Germany, iodine tablets have to be collected by the public itself after the accident.
- *Food standards* – the report argues that there is a need for clarification of food standards and their harmonisation in the post-accident context. The report provides an example of different food standards for levels of Caesium-137 contamination of foodstuffs between the World Health Organisation and the EU. NTW argue there was a chaotic understanding of food standards after the Fukushima incident that has led to a mistrust of the legal framework and the responsible institutions.

NTW conclude their report by calling for a systematic involvement of the public and civil society groups in the nuclear emergency planning regime. They believe the 'top-down' approach needs to be changed to actively involve local populations around nuclear sites



and interested civil society organisations. This would reduce the 'silo thinking' of public bodies and resolve the issue of properly defining the responsibility of civil protection authorities on the one hand, and the safety and radiation protection authorities on the other.

NTW note: "Active citizen engagement would also increase the scope, reduce the use of false or out-dated assumptions and data, steepen the learning curve necessary after the Fukushima experience and overcome cross-border obstacles. Current limitations due to a certain 'tunnel view' based on a reluctance to include the unexpected, need to be overcome if the complexity of nuclear emergency situations in real world settings is to be addressed." (19)

NFLA see this detailed assessment of nuclear emergency planning arrangements around Europe as of real benefit and use for the situation in the UK, where to a large extent a similar 'top down' approach exists across government and the nuclear authorities. The reticence which seems to lie at the heart of providing adequate public information and support in relation to nuclear emergency planning needs to be fully reviewed and, where necessary and practical, overhauled.

## **6. Issues of concern with probabilistic risk assessment**

NFLA further notes a third series of reports which should be of interest to nuclear emergency planners when considering nuclear accidents and the concept of 'probabilistic risk assessment'.

A new study by American academics Spencer Wheatley, Benjamin Sovacool and Didier Sornette published in the journal 'Physics and Society' analyses 174 nuclear accidents around the world between 1946 and 2014 that resulted in the loss of human life and / or cost more than US \$50,000 of property damage. This included nuclear energy accidents involving production and generation, transmission and the distribution phase. (20)

They calculate the rate of nuclear accidents meeting their criteria decreased from the late 1970s, decreased further after the Chernobyl disaster, and has been fairly stable since then at around 0.002 to 0.003 events per plant per year (in other words around one accident per year worldwide meeting their criteria).

They note though that the worst nuclear accidents do not show any clear patterns. Using the term "dragon king" the authors define this as "the situation where extreme events appear that do not belong to the same distribution as their smaller siblings". Based on their statistical calculations, the authors estimate a 50% chance of a Fukushima event (or larger) in the next 50 years, a Chernobyl event (or larger) in the next 27 years, and a Three Mile Island event (or larger) in the next 10 years. However, they do note that "there is tremendous estimation uncertainty associated with these estimations." A more detailed version of this research, which will include a list of the 174 accidents, is being published later this year.

Within this report, the authors question the accuracy of probabilistic risk assessment (PRA). This is a technique used by the nuclear industry and nuclear safety authorities which requires the definition of failure scenarios to which probabilities and damage values are assigned. The authors argue that statistical or empirical analyses of nuclear accidents have "almost universally" found that PRA "dramatically underestimates the risk of accidents". They also point to research demonstrating that PRAs are "fraught with unrealistic assumptions, severely underestimating the probability of accidents". The Fukushima incident is a clear example of this, with an under-assessment of the height of a tsunami wave after a huge earthquake. This led to the sea walls not being built high enough to stop the wave hitting and destroying the cooling system and emergency backup power systems.

In this area of research, and in its 2011 evidence to the UK 'Weightman inquiry' on the potential impacts of a Fukushima type of accident ever occurring in the UK, the NFLA also extensively noted the work of the Princeton University physicist M. V. Ramana. Dr Ramana has challenged what he calls "misleading" PRAs, such as Areva's estimate for its EPR design (being planned for Hinkley Point) of one core-damage incident in 1.6 million years, as

well as Westinghouse's claim for its AP1000 reactors (being planned for Sellafield Moorside) the core melt frequency is roughly one incident per reactor in two million years. (21)

Ramana notes: "There are both empirical and theoretical reasons to doubt these numbers. A 2003 study on the future of nuclear power carried out by the Massachusetts Institute of Technology (MIT) points out that "uncertainties in PRA methods and data bases make it prudent to keep actual historical risk experience in mind when making judgments about safety." What does history tell us? Globally, there have been close to 15,000 reactor years of experience, with well-known severe accidents at five commercial reactors – three of them in Fukushima."

Ramana notes recent testimony to the US Senate provided by Thomas Cochran of the National Resources Defence Council. Cochran argues that, depending on how core damage is defined, there are other accidents that should be included which brings an actuarial frequency of actions that may be as high as 1 in 1,400 reactor years. At such a rate, an accident involving core damage could occur every 1.4 years if nuclear power expands from today's 440 commercial reactors to the 1,000 reactor scenario laid out in the MIT study.

The MIT study argues that the 'chain-of-event' conception of accidents typically used for PRAs cannot account for the indirect, non-linear and feedback relationships that characterise many accidents in complex engineering systems. The MIT study argues that "these risk assessments do a poor job of modelling human actions and their impact on known, let alone unknown, failure modes".

Ramana's conclusions from this study are that: "The lesson from the Fukushima, Chernobyl, and Three Mile Island accidents are simply that nuclear power comes with the inevitability of catastrophic accidents. While these may not be frequent in the absolute sense, there are good reasons to believe that they will be far more frequent than quantitative tools such as probabilistic risk assessments predict. Any discussion about the future of nuclear power ought to start with that realisation."

Ramana also notes that, in the case of Fukushima, two weaknesses of PRAs were evident – the difficulty in modelling common-cause failures and the difficulty in modelling uniquely human factors such as complacency, corruption and inadequate regulation.

To conclude this section, the comments of the Chinese academic He Zuoxiu (of the Chinese Academy of Sciences) is also relevant: "The world's 443 nuclear power plants have been running for a total of 14,767 reactor years, during which time there have been 23 accidents involving a core melting. That's one major accident every 642 reactor years. But according to the design requirements, an accident of that scale should only happen once every 20,000 reactor years. The actual incidence is 32 times higher than the theory allows". (22)

Dr Zuoxiu counters the argument that 17 of the 23 accidents were caused by human error by arguing that such error is impossible to eliminate and, as such, cannot be ignored by policy makers and nuclear regulatory authorities. Even if discounting 'human error' incidents, technical failings have caused core melting once every 2,461 reactor years, which is more than 8 times the theoretical calculation."

Taking these studies in their totality, NFLA concludes that the Government, nuclear industry, nuclear safety, nuclear regulatory authorities and nuclear emergency planners need to reconsider the accuracy and use of PRAs. This should be a focal part of a UK nuclear emergency planning review and it does not seem that this is being taken up by the Government or nuclear safety authorities.

## **7. UK nuclear emergency planning review and DECC NGO Forum sub-group**

Since the Fukushima incident and the UK 'Weightman Nuclear Safety Review' reports took place, the Department of Energy and Climate Change (DECC) has been leading a review of nuclear emergency planning in the UK to ensure it is fit for purpose. The NFLA Secretary is amongst three nominated representatives from non-governmental organisations (NGOs) who

have a twice-yearly sub-group on nuclear emergency planning issues, under the auspices of the DECC NGO Forum framework.

Reports of outline progress have taken place at these meetings, but have provided little actual detail, making it frustrating for the NGO representatives to be able to adequately question and challenge the efficacy of this review. At the most recent meeting it was reported by DECC that UK Government Ministers have now decided that new guidance for local authorities on nuclear emergency planning for a large scale incident will not be legislative, but will instead encourage the adoption of best practice. The publication of new guidance is expected later this year. DECC will be encouraging local authorities to take up the guidance materials over the next 6 – 18 months, possibly providing part-funding to local authorities to assist with implementation.

At this meeting, NGOs expressed disappointment that the guidance would not have legislative force. DECC advised that a workshop would take place to introduce the new guidance to emergency planning officers, and that an audit of take-up of the guidance would be conducted in due course. NFLA question if this will provide a full and comprehensive response.

It was also reported by DECC that existing national guidance is being reviewed in order to make it more concise and user-friendly, to clarify roles and responsibilities, and to ensure consistency with the Civil Contingencies Act. Furthermore, DECC is also preparing a business case for renewal of the UK RIMNET radiation monitoring network.

Other aspects of improvements to UK nuclear emergency planning include a full update of the 'Consolidated Guidance' developed by the Nuclear Emergency Planning Liaison Group – an advisory group to the UK Government. NGOs in the sub-group have been involved in giving comments on a draft chapter considering communication of emergency messages, but have not seen any other changes to the document. The Consolidated Guidance is aimed to be a practitioner's guide to local nuclear emergency planners in order to prepare them for incidents involving nuclear materials. (23)

The NFLA welcomes being provided with these limited updates from Government on national nuclear emergency planning arrangements, but remains frustrated that the use of the term 'national security' creates an almost blanket ban on more in-depth discussion of the review. NFLA has remained concerned for a number of years that the lack of an agency monitoring emergency planning – such as OFSTED in education and social services and the Food Standards Agency for food safety – means there is no clear indication that all Councils are fully conversant and implementing appropriate changes in post-Fukushima nuclear emergency planning. This remains one of the key weaknesses of the Civil Contingencies Act – it is not obvious how it is enforced and there appear no real penalties on Category 1 or Category 2 responders if they are not fully implementing the Act - until after an incident has actually taken place.

In addition, in the past five years the amount of emergency planning staff in most local authorities and in the emergency services has been significantly scaled back due to large cuts in central funding to local responders. NFLA question whether there would be enough qualified staff and expertise to implement a Fukushima-scale incident in the UK, or put in place all the activity required under REPPPIR – the Radiation Emergency Planning and Public Information Regulations.

## **8. REPPPIR regulations – fit for purpose?**

The REPPPIR regulations are the statutory guidelines for dealing with radiation emergency incidents around UK nuclear installations. They are implemented by the Office for Nuclear Regulation (ONR). They are the generic local nuclear emergency planning regulations arising out of European Nuclear Safety Directives under the Euratom Treaty (24).

REPPPIR 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 millisieverts 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. 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.

At a previous DECC NGO nuclear emergency planning sub-group meeting, NGOs have outlined a significant number of concerns on whether REPPIR is 'fit for purpose' following the learning points from the Fukushima incident.

These include:

- Site operators and ONR are not adequately complying with the three-year REPPIR review timetable.
- At present there are inadequate numbers of personnel within responding agencies registered under section 14 of the REPPIR regulations to deal meaningfully with any radiation emergency.
- Experience from the Fukushima incident indicates that emergency planning zones around nuclear sites need to be substantially larger – a minimum of 20 km appears necessary.
- Fukushima has shown that circular zones, while easier to administer, do not match the reality of how wind and weather spreads radiation, in many cases well beyond 20km. "Hot spots" of radiation have been found more than 100km away.
- The Fukushima incident also suggests that emergency public information should be made available within a larger 20km zone.
- The rationale on which zones are sized is opaque and appears arbitrary.
- Arrangements to control development and population numbers within the zone are difficult to enforce and poorly understood among the populace
- Current public information provided around nuclear sites is inadequate and does not give the sort of background advice or practical instructions that ordinary people need.
- The source of the information originates solely from site operators and should be drawn from a wider base of experts and inputs.
- Sufficiently detailed information and instructions are not passed on to those who need it, e.g. schools, holiday makers, second-homers, business premises, or supermarkets within the current emergency zone and those who use such premises.
- Emergency plans are not tested enough through real-life rehearsals which would highlight practical areas for improvement, and do not cover the timescales and evolving scenarios that a real-life emergency would present.
- 'Live' evacuations and road closure arrangements, rather than just notional table-top scenarios, have not been rehearsed in practice.
- The evident conclusion is that off-site emergency plans for nuclear sites are probably unworkable as they currently stand.
- It is unclear exactly how 'extendibility' arrangements would work in practice and what such an arrangement would mean for information provision in respect of preparedness for evacuation, basic radiation facts, and other related important information the public should be told.
- Do exercises at licensed sites rehearse an extendibility scenario?
- Potassium iodine tablets are generally not available at short notice, arrangements for distributing them are inconsistent and unproven, and it is not clear over what area they would be distributed in the event of an emergency.
- The uncertainties around the dose/risk methodology on which emergency planning is based are contested and do not address fundamental concerns expressed by the European Committee on Radiation Risk, which consider inhalation and ingestion as important pathways, rendering the ICRP dose/risk method redundant.

- The basis upon which the operator calculates the maximum credible accident upon which, in turn, the ONR sets its requirements for the DEPZ area is not known.
- The basis upon which the ONR makes its decision about the size of the DEPZ based on operator information is not known.
- Greater transparency will be needed in future arrangements if NGOs are to be convinced that they are adequately robust. (25)

Despite attempts to have meaningful and substantial discussion about these issues at both the DECC NGO Forum sub-group, and at the ONR NGO Forum on the substance of the above points, there has only been limited discussion around the margins of the debate.

DECC have confirmed that the new European Basic Safety Standard Directive, which seeks to consolidate Directives under the Euratom Treaty, may require DECC to initiate a review of REPPIR. (26) As noted above, DECC officials have indicated that Government Ministers are not minded to introduce new legislation unless it can be clearly demonstrated that there is a need for it. This may mean that legislative changes to REPPIR may not happen. There appears to be at present only one area of REPPIR where ONR are instituting any significant change – the size and composition of offsite emergency planning areas around nuclear sites.

NFLA compare the lack of legislative change in REPPIR to similar regulations which govern health, safety and emergency planning for large-scale chemical facilities. The Control of Major Accident Regulations (COMAH) 1999 has now been comprehensively updated after an update of international protocols. The 2015 COMAH regulations bring key changes from the 1999 Act such as:

- New emergency planning arrangements for lower tier sites;
- Emergency plan testing - a duty on designated authorities to co-operate;
- Improved public information;
- Local authorities to give information to people concerned after an accident;
- New duties for warning and informing placed on lower tier sites. (27)

NFLA would argue that similar improvements could, and should, be made to REPPIR. It calls on the Government and the Office for Nuclear Regulation to use the opportunity of reviewing the Basic Safety Standards application in order to review and fully update the REPPIR regulations, considering full legislative change if necessary. Any change that is made within such a review should be clearly publicised.

## **9. Detailed Emergency Planning Zones (DEPZ) become Emergency Planning Areas**

A key part of offsite emergency plans for nuclear sites is the size of what are called the detailed emergency planning zones (DEPZ). The approach is determined by ONR using information provided by the site operator and setting a number of core principles to determine the extent of evacuation and shelter planning that would be required in the event of a serious emergency incident. As part of the actions required from the 2011 ONR Weightman report on Fukushima and its impact on UK nuclear safety, the nuclear regulator has initiated a full and detailed review of DEPZ's around all UK nuclear sites, which it is renaming offsite emergency planning areas. This review also takes into account the changing nature of some sites as nuclear decommissioning begins to be stepped up.

The review has been initiated by ONR using a revised set of principles for determining more effectively REPPIR off-site emergency planning areas. The intention from the review is to provide additional improvements in public protection. These amended principles encourage a two-step approach by the ONR:

- The undertaking of an assessment, by ONR, of the licensees' technical report relating to the area in which members of the public or emergency workers are likely to be affected by a radiation emergency, as defined in REPPIR.
- Consideration of practical and strategic factors related to the implementation of the offsite emergency plan and confidence in public protection. This will involve dialogue with the relevant local authority on matters such as local demographics and geography.

ONR note that these considerations have been applied to ensure that the final determination of the offsite emergency planning area provides for an area that is logical in allowing for an effective emergency response. (28)

The first detailed changes of offsite emergency planning areas have been put forward for the Sizewell site, after a public consultation process initiated by the local authority and a comprehensive site review by the ONR. Following this process, ONR has decided to dispense with its circular 2.4 kilometre zone and replace it with one based largely on postcodes. This will mean that parts of the wider 'consequence area' will stretch up to around 3km from the nuclear power station and will include the small town of Leiston and the majority of the nearby village Aldringham.

The outcome of these changes means that there is a smaller inner area where counter measures would be needed – there are around 20 residents and businesses within one km of Sizewell – and a slightly larger consequence area where generic information would be provided to the public. These zones or areas though remain considerably smaller than those found in other countries with nuclear facilities. ONR consistently argue that the designation of the zone is determined by the level of consequence and nature of the risk of materials on the nuclear site. (29)

In this Sizewell example, the local anti-nuclear group 'Shut Down Sizewell' has been sharply critical of some of the proposed changes, arguing that a much larger offsite emergency planning area is required. It is particularly unhappy with the proposed public information leaflet being planned for issue to residents and businesses in the area. At its February 2015 meeting, the group decided that they would not take any part in the preparation, production or distribution of the public information emergency planning leaflet that has to be produced by the local authority to publicise the amended plans. The reasons for non-participation include:

- The leaflet needs to have honest and workable information within it, or it will lack any integrity.
- Any recommended emergency procedure must first be tested to ensure it is workable – the Campaign understand there is no current intention to do so.
- There is no practical public warning system in place to advise the local population that an emergency has occurred.
- There is also no system to develop a dedicated and properly staffed emergency helpline.
- Even with a warning system, it would be impossible to evacuate the area as all minor roads to the A12 are likely to be gridlocked as a sense of panic emerges. (30)

Significant changes to the offsite emergency planning area are also being put forward at Sellafield. The Sellafield facility has the largest offsite EP area of any UK nuclear site - due to the large amount of high-risk activities and materials on the site. For the Sellafield site, ONR has revised the circular 2 km inner radius area to an approximately circular area varying between 6 and 7 km from the centre of the site. ONR argue that this does not mean that risks at Sellafield have specifically increased, but rather takes into consideration its revised principles for determinations. It also accounts for the assessment provided to ONR by Sellafield Ltd of on-site hazards, with an increased understanding of certain elements contained within the previous assessment. ONR has also noted that Cumbria County Council and Sellafield Ltd have for many years undertaken some aspects of emergency planning to the 6km distance. (31)

At a public meeting on the proposed changes at Sellafield the main local concerns raised have been around the main A595 road close to the Sellafield site. A representative from the local Sellafield employees Unite branch, as well as a number of local councillors, commented that the road was not 'fit for purpose' and would create major delays to the emergency services if a large-scale evacuation was required. The meeting called for a message to go to the Government for an upgrade of this road. As part of this process Cumbria County Council, like Suffolk County Council for Sizewell, has six months to produce an updated off-site emergency plan under the REPPIR regulations. (32)

Over the next 12 – 18 months all UK nuclear sites will go through similar processes, and the Local Authority Emergency Planning Units for the Councils concerned will amend the plans accordingly. NFLA share some of the concerns around public information leaflets pointed out by the ‘Shut Down Sizewell’ group. It is also frustrated that there is no real and tangible discussion between the nuclear regulator, local authority and the local population as to how the offsite emergency planning area is designated or determined. In the simplest terms, why do UK nuclear sites have smaller offsite EP areas than other countries? Unless a more open and transparent review of REPPIR is developed it remains difficult to question or challenge the ONR’s designation as the factors that bring it to its conclusions are classed as too sensitive to query.

The comments made at the Sellafield public meeting, largely by those supportive of the facility, highlight part of the wider concern that has parallels to the Fukushima disaster. Given that even minor incidents at the Sellafield site have led to intense traffic congestion and difficulties for emergency service access and egress, it is unlikely to improve in the event of a more serious emergency. Almost all of the UK’s nuclear sites are in remote areas with a limited transport network. NFLA seriously question that, though the plan is limited to a small area, in the actual event many thousands more will self-evacuate, making emergency access extremely difficult, if not impossible, to organise. NFLA welcome the diligence which ONR have brought to changes in offsite emergency planning areas, but feel that the REPPIR regulations in their totality should have a full review. NFLA do not think these small changes are enough to take into account the extensive learning points from Fukushima.

#### **10. Nuclear emergency planning exercises**

A detailed and extensive schedule for emergency planning exercises for civil and military sites has been announced by the ONR. Taking place between February 2015 and February 2017, 65 exercises are planned. Around half of them will test onsite arrangements, with the other half looking at offsite arrangements. One large exercise, at the Hinkley Point B site on the 9<sup>th</sup> June 2015, will also test local offsite arrangements supported by the national crisis management framework. (33)

Though undoubtedly important to undertake a wide range of exercises, most of these will be theoretical ‘table-top’ exercises with little ‘live’ run-throughs in real time. They will be useful for analysing emergency contacts, equipment and procedures, but will they really be able to realistically simulate some of the huge problems that occurred around Fukushima for example?

In a presentation to a NFLA Scotland seminar focusing on nuclear emergency planning in the defence sector, Peter Burt of the Nuclear Information Service noted a number of concerns NIS had with nuclear emergency exercises. These include:

- There are no specific pre-planned arrangements in ‘extendability’ zones and it is unlikely this has been adequately considered and dealt with through exercises.
- No field emergency planning exercises have been undertaken to test extendability plans.
- The experience from Fukushima suggests that an emergency affecting the extendability zone would be the norm.
- Accident scenarios used for emergency planning scenarios are not disclosed, making it impossible to check their veracity.
- More critical local NGOs are not invited to observe emergency planning exercises. (34)

At DECC NGO Forum Nuclear Emergency Planning sub-group meetings it has been acknowledged that extendability issues are a challenge, and the new framework of exercises is prioritising these issues. From a NFLA perspective, it is impossible to determine whether such exercises are fully taking this into account as information on them is precluded and not made public.

At the NFLA Scotland seminar noted above, the journalist Rob Edwards provided a presentation on one of the few occasions information on the nuclear emergency planning ‘Exercise Senator’ reached the public arena, via a Freedom of Information Act request. The exercise report by the Ministry of Defence (MOD) outlined a test of procedures around a

scenario involving a major motorway accident involving a nuclear weapons convoy. In the MOD report, it was noted that “major difficulties” were encountered by the emergency services because they had no assistance from Ministry of Defence weapon experts for five hours.

The report of this exercise, which involved 21 agencies, noted confusion with and between agencies. For example: “Heated disputes with ambulance staff over how to handle casualties contaminated with radioactivity at the crash site caused “considerable delay”, resulting in one victim being declared dead...Other problems included outdated, paper-based communications systems, poor mobile phone signals, conflicting scientific advice on health hazards and confusion over radiation monitoring”. (35)

Shortcomings from another Ministry of Defence exercise were also reported in the Daily Telegraph. Exercise Short Sermon was held at the Royal Naval Dockyard in Plymouth. Parts of the exercise went well, such as the actions made by the Ministry of Defence and Cabinet Office. However: “The report reveals how incorrect advice from the Government’s Science and Technical Advice Cell to Cornwall Council, and a breakdown of communications with the local team, led to an order being given for the wrong village to be evacuated.” (36)

The exercise report also noted serious training gaps, communication breakdowns, confusion from the health agencies on casualty information, a lack of detailed maps and radiation plume information that on-site staff were confused with.

Such information is what emergency exercises are supposed to consider – communication and training gaps and inter-agency co-operation. These two exercises came to light after the final exercise reports were released and picked up by interested NGOs, and then passed on to the media, who inevitably seek to emphasise the shortcomings. They also look at defence nuclear sites whilst information on civil nuclear site exercises is much more difficult to attain. The recent allegations by Able Seaman William McNeilly over the safety and security of Trident nuclear submarines provide even more alarming detail and serious allegations of failings around defence nuclear safety and nuclear emergency planning, and these will be considered in a separate NFLA briefing. (37)

As noted above, the reductions in staffing across most local authorities and emergency services also make attending emergency exercises a challenge in itself and ‘live’ exercises are inevitably expensive to organise. It is though difficult to assess if Fukushima type scenarios are being looked at extensively in UK based nuclear emergency planning sites as so little information is available to the public.

## **11. Openness and transparency**

The major issue for civil society groups and NGOs to assess the effectiveness and robustness of nuclear emergency planning in the UK remains a general lack of openness and transparency on the issue. NFLA accept there is real sensitivity in this area, and it would not be good to allow malicious terrorist organisations for example to know of shortcomings at a nuclear site or with a nuclear weapons convoy. However, the public cannot simply be reassured with a ‘we know best’ and ‘we will muddle through’ type of attitude. In the NFLA’s view, there would be a real benefit for the Government to commission some kind of external, independent analysis of UK nuclear emergency planning effectiveness.

As Peter Burt noted at the NFLA Scotland seminar (reference noted above):

- Accident scenarios used for emergency planning are not disclosed to the public.
- The basis on which emergency zones are calculated is not disclosed to the public.
- As a general rule, MoD and DECC are failing to engage with the public in this area.
- Present arrangements are opaque and appear to be arbitrary to civil society groups.

The NFLA Secretary takes part in the DECC NGO Forum sub-group principally to try and break through this barrier, to engender trust and to encourage engagement with the Government, nuclear regulators and the nuclear industry to improve UK nuclear emergency planning arrangements, not simply to criticise them. There has been some increase in trust,



but there remains an ongoing reluctance to more deeply engage. It makes it difficult to independently verify if the UK is completely ready for a major or catastrophic nuclear incident. It does not appear to be right that, as in Japan, the public is simply reassured that 'we know best'. NGO representatives have offered to be security cleared in order for trust to be increased in this area, but have been told this is prohibitively expensive. NFLA believe a way can be found around this. It challenges the Government to more readily engage with groups that seek the protection of the public from a nuclear accident, like NFLA.

## 12. Conclusions and recommendations

This report has outlined that the Fukushima disaster, over four years on, is still a major safety threat to the local population, many of whom are still suffering significant travails and stress. The independent civil society and academic reports noted in this briefing emphasise that the public are genuinely and reasonably concerned of real shortcomings in effective nuclear emergency response. Japan is a highly ordered society where there is a culture of respect to authority. The Fukushima disaster showed that, even in this most technologically advanced of societies, the emergency response was confused, contradictory and overcome by the extent of the destruction. It will take many years to understand the health and environmental effects of this disaster, but the human impact has been highly negative to over 160,000 people forced to evacuate their homes, many of whom may never be able to return to them.

The disaster also emphasised that, in the early phases of the incident, local communities and local authorities were left largely to deal with the effects of the incident on their own. Wider resources only came in, and were of use, significantly later. The potential for a similar experience to occur to UK communities and UK local authorities if such an incident ever occurred at a UK nuclear site is obvious.

The NFLA encourages local authority emergency planning officers, nuclear regulators and Government officials to read this briefing and consult some of the reports noted within it.

NFLA also recommends that:

- The 'nuclear community' needs to recognise the shortcomings in emergency planning arrangements for a catastrophic INES 7 type of incident.
- There should be a complete review of the REPPiR emergency planning regulations. Given the changes made recently with similar COMAH regulations, now is the time for a full update and possible legislative change of REPPiR.
- The UK Government and Devolved Governments must engage more actively with communities affected by nuclear programmes, all potentially affected local authorities (across a much wider area than at present), and local NGOs.
- The UK Government, with the nuclear regulatory agencies, needs to review emergency planning policies and set a defined standard of service for emergency arrangements which will protect people and society from the hazards of the nuclear industry.
- Local authorities, NGOs and the affected public need to request clarification and certainty from central government agencies - 'muddling through' is simply not good enough.
- There also needs to be pressure for improvement and openness at the political level to encourage a more open and transparent culture, where possible and practical, within nuclear emergency planning.
- Given the wider concern noted by defence nuclear exercises, the regulation of Ministry of Defence nuclear programmes should be brought under an independent civilian regulator like the Office for Nuclear Regulation.
- A review of the effect of major financial cuts on emergency planning units in local government and services provided by the emergency services in terms of determining whether there is adequate resources to deal with an INES 7 incident should be undertaken by the new Government and / or the Emergency Planning Society.
- There should be a full discussion between nuclear regulatory agencies and independent experts over the effectiveness of the use of probabilistic risk assessments.
- The reports noted above by civil society groups on the full lessons of the Fukushima disaster needs to be fully reflected on for its extrapolation to the UK and EU by all those involved in UK nuclear emergency planning.

### 13. References

- (1) NFLA Policy Briefing 100, 'The Fukushima disaster and UK nuclear emergency planning: the need for fundamental change?' 14<sup>th</sup> September 2012  
[http://www.nuclearpolicy.info/docs/briefings/NFLA\\_NB\\_100\\_Nuclear\\_emergency\\_planning.pdf](http://www.nuclearpolicy.info/docs/briefings/NFLA_NB_100_Nuclear_emergency_planning.pdf)
- (2) NFLA seminars involving presentations on nuclear emergency planning have taken place over the past three years in Manchester, Glasgow, Cardiff and Newry. For further information on these presentations please contact the NFLA Secretariat on [s.morris4@manchester.gov.uk](mailto:s.morris4@manchester.gov.uk).
- (3) Department of Energy and Climate Change, Non Governmental Organisations Forum website  
<http://www.gov.uk/government/groups/non-governmental-organisation-forum>
- (4) The most recent update is in NFLA Policy Briefing 131, 30<sup>th</sup> March 2015  
[http://www.nuclearpolicy.info/docs/briefings/A245\\_\(NB131\)\\_NFLA\\_200315.pdf](http://www.nuclearpolicy.info/docs/briefings/A245_(NB131)_NFLA_200315.pdf)
- (5) Research by Professor Kenichi Oshima of Ritsumeikan University and Professor Masfumi Yokemoto of Osaka City University, as quoted in article on Russia Today website, 27<sup>th</sup> August 2014  
<http://rt.com/news/183052-japan-fukushima-costs-study/>
- (6) NFLA Media Release, 10<sup>th</sup> March 2015  
[http://www.nuclearpolicy.info/docs/news/NFLA\\_Fukushima\\_anniversary.pdf](http://www.nuclearpolicy.info/docs/news/NFLA_Fukushima_anniversary.pdf) using information from articles in the Western Mail, 7<sup>th</sup> March 2015 <http://www.walesonline.co.uk/whats-on/whats-on-news/fukushima-nuclear-power-tsunami-wylfa-8788727> and Daily Post, 7<sup>th</sup> March 2015 <http://www.dailypost.co.uk/news/north-wales-news/wylfa-b-stories-fukushima-warning-8786088>
- (7) Japan Times, 'Survey robot breaks down in Fukushima No 1 reactor in under three hours', 11<sup>th</sup> April 2015  
<http://www.japantimes.co.jp/news/2015/04/11/national/science-health/survey-robot-breaks-down-inside-fukushima-no-1-reactor-in-under-three-hours/>
- (8) Daily Mail, 13<sup>th</sup> April 2015, <http://www.dailymail.co.uk/news/article-3037218/Fukushima-s-ground-zero-robot-sent-inside-melted-reactor-tsunami-hit-plant-sends-pictures-breaks-down.html#ixzz3XIPXmd3X>
- (9) IanFairlie.com 10<sup>th</sup> April 2015  
<http://www.ianfairlie.org/news/fukushima-evaporating-tank-contents-is-not-the-solution/>
- (10) Japanese Government METI files -  
[http://www.meti.go.jp/earthquake/nuclear/pdf/140424/140424\\_02\\_008.pdf](http://www.meti.go.jp/earthquake/nuclear/pdf/140424/140424_02_008.pdf)
- (11) The Times, 28<sup>th</sup> March 2015 <http://www.thetimes.co.uk/tto/news/world/asia/article4394978.ece>
- (12) Asahi Shimbun, 23<sup>rd</sup> May 2015  
<http://ajw.asahi.com/article/0311disaster/fukushima/AJ201505230059>
- (13) Global Research via ENE News / NHK, 1<sup>st</sup> June 2015  
<http://www.globalresearch.ca/fukushima-record-levels-of-radioactivity-detected-in-seawater-spiked-more-than-200-times-at-sampling-location/5422751>
- (14) Green Cross International, 'Green Cross Study Trip to Fukushima confirms that the nuclear plant still leaks radioactivity', 31<sup>st</sup> October 2014 <http://www.gcint.org/news/green-cross-study-trip-fukushima-confirms-nuclear-plant-still-leaks-radioactivity>
- (15) Presentation to the NFLA Welsh Forum by Brian Jones, Vice Chair, CND Cymru on Fukushima Study Tour, October 2014  
[http://www.nuclearpolicy.info/docs/events/071114/Fukushima\\_Green\\_Cross\\_Study\\_Tour.pdf](http://www.nuclearpolicy.info/docs/events/071114/Fukushima_Green_Cross_Study_Tour.pdf)
- (16) NFLA Media Release, 25<sup>th</sup> February 2015  
[http://www.nuclearpolicy.info/docs/news/NFLA\\_Naoto\\_Kan\\_visit.pdf](http://www.nuclearpolicy.info/docs/news/NFLA_Naoto_Kan_visit.pdf)
- (17) Fukushima Booklet Publication Committee, '10 Lessons from Fukushima – Reducing risks and protecting communities from nuclear disasters', 11<sup>th</sup> March 2015  
<http://fukushimalessons.jp/en-booklet.html>
- (18) Nuclear Transparency Watch, 'Position paper of NTW on Emergency Preparedness and Response (EP&R) situation in Europe, February 2015  
<http://www.nuclear-transparency-watch.eu/wp-content/uploads/2015/04/NTW-Report.pdf> and <http://www.nuclear-transparency-watch.eu/wp-content/uploads/2015/04/EPRExecutiveSummaryEPR.pdf>
- (19) *ibid*
- (20) Spencer Wheatly, Benjamin Sovacool and Didier Sornette, 'of Disasters and Dragon Kings: A Statistical Analysis of Nuclear Power Incidents & Accidents', Physics and Society, April 2015  
<http://arxiv.org/abs/1504.02380> - as noted in WISE / NIRS Nuclear Monitor, May 7<sup>th</sup> 2015
- (21) M. V. Ramana, 'Beyond our imagination: Fukushima and the problem of assessing risk', Bulletin of Atomic Scientists, 19<sup>th</sup> April 2011 <http://thebulletin.org/web-edition/features/beyond-our-imagination-fukushima-and-the-problem-of-assessing-risk>
- (22) He Zuoxiu, 'Chinese nuclear disaster highly probable by 2030', 25<sup>th</sup> October 2013  
<http://www.chinadialogue.net/article/show/single/en/5808-Chinese-nuclear-disaster-highly-probably-by-2-3>

- (23) Department of Energy and Climate Change, 'Nuclear emergency planning: consolidated guidance', last updated 24<sup>th</sup> October 2013 <https://www.gov.uk/government/publications/nuclear-emergency-planning-consolidated-guidance>
- (24) Office for Nuclear Regulation / Health & Safety Executive, 'Radiation (Emergency Planning and Public Information) Regulations 2001 (REPIR)' <http://www.hse.gov.uk/radiation/ionising/repir.htm>
- (25) Joint summary of points made by NGO representatives to the DECC NGO Forum Nuclear Emergency Planning Sub-group, February 2013.
- (26) HSE, 'Revision of Radiation Protection directives', January 2015 <http://www.hse.gov.uk/aboutus/europe/euronews/dossiers/radiationprotect.htm>
- (27) Email sent to the NFLA Secretary by the Emergency Planning Society, of which he is a member. Information on the updated and recently release 2015 COMAH regulations are available from <http://hse.gov.uk/comah>
- (28) Office for Nuclear Regulation, 'Principles for determination of offsite emergency planning areas (formerly known as DEPZs)', January 2014, <http://www.onr.org.uk/depz-onr-principles.htm>
- (29) ONR, 'Sizewell off-site emergency planning area', April 2014 <http://www.onr.org.uk/2014/04/sizewell-offsite-emergency-planning-area>
- (30) Shutdown Sizewell, 'Emergency Planning at Sizewell', March 6<sup>th</sup> 2015 <http://www.shutdown-sizewell.org.uk/emergency-planning-at-sizewell>
- (31) ONR, 'Sellafield REPIR off-site emergency planning area', January 2015 <http://www.onr.org.uk/2015/01/sellafield-repir-offsite-emergency-planning-area>
- (32) Whitehaven News, 'Thousands of homes in nuclear evacuation zone', January 22<sup>nd</sup> 2015 <http://www.whitehavennews.co.uk/news/thousands-of-homes-in-nuclear-evacuation-zone-1.1188115>
- (33) ONR, Nuclear Emergency Exercise Programme, February 2015 to February 2017 <http://www.onr.org.uk/emergexeprog.htm>
- (34) NFLA, Presentation to NFLA seminar on defence nuclear emergency planning by Peter Burt, NIS, September 20<sup>th</sup> 2013 [http://www.nuclearpolicy.info/docs/events/200913/Emergency\\_Planning\\_Presentation\\_NFLA\\_200913.pdf](http://www.nuclearpolicy.info/docs/events/200913/Emergency_Planning_Presentation_NFLA_200913.pdf)
- (35) The Guardian, June 12<sup>th</sup> 2013 <http://www.theguardian.co/world/2013/jun/12/nuclear-convoy-disaster-exercise-emergency>
- (36) Daily Telegraph, January 1<sup>st</sup> 2015 <http://www.telegraph.co.uk/news/uknews/defence/11319848/Dont-panic-How-a-rehearsal-for-a-nuclear-disaster-descended-into-farce.html>
- (37) Sunday Herald 17th May 2015 <http://www.heraldscotland.com/news/home-news/trident-whistleblower-says-nuclear-submarines-are-insecure-unsafe-and-a-disaster-wait.1431860917>