NFLA Policy Briefing No.217

Date: June 18th, 2021
Subject: Increased nuclear transports in the UK and around Europe – risks and concerns

1. Introduction

The NFLA remains concerned about the continuing growth of transports of radioactive materials across various transport modes – road, rail, sea and air. This briefing by the NFLA Secretary provides a consolidation of this activity and outlines the range of concerns with such issues. A major change to the UK / European nuclear emergency planning regime came into place in 2019/20, and there were some minor changes to nuclear transport safety regulations, the Carriage of Dangerous Goods. Nuclear transport is of particular concern to the NFLA as radioactive materials are at their most vulnerable when they are being transported off site, as they are away from dedicated safe storage facilities and are in an 'uncontrolled' environment where they face a greater level of risk.

2. Executive Summary

This report notes that there has been a significant increase in the transport of nuclear materials driven by a number of factors – the aging nature of the existing Trident nuclear weapons system requiring increased maintenance of them and its upcoming replacement; the consolidation of nuclear materials and radioactive waste from many nuclear sites to the Sellafield facility for storage prior to the proposed creation of a deep-underground radioactive waste repository; and some international factors that are also looking to consolidate waste from other countries into 'safe' locations.

The report is concerned that there is some perceived stress in the defence nuclear industry over the quality of road vehicles and potential challenges in having enough specialist staff to service nuclear weapon convoys. This though has now become increasingly difficult to verify as the UK Government has increased the security level on some of these matters to prevent their publication under the Freedom of Information Act. This precludes an important and informed wider debate as to whether defence nuclear emergency planning and transportation remains completely fit for purpose. NFLA calls for greater openness and transparency so that the public is satisfied with the safety of defence nuclear transports and generic health and safety arrangements in the defence nuclear sector.

NFLA notes NDA policy seeking to consolidate radioactive waste has led to a significant increase of road, rail and sea transports. Learning outcomes from recent serious accidents with a number of conventional rail transports need to be actively considered by the civil nuclear sector and the entire rail industry. Whilst they were undertaken safely, NFLA was never happy with a considerable number of nuclear material train transports from Dounreay to Sellafield that took place in recent years. Periodic, minor incidents have occurred showing that a level of risk still remains with them.

The report also highlights a number of serious incidents involving ships transporting nuclear materials and wider concerns NFLA continue to have over such 'mixed' shipments which do not have the same level of safety and security as say the NDA's PNTL fleet. There remain a small number of air transports that also take place, and the report considers the safety of them.

THE LOCAL GOVERNMENT VOICE ON NUCLEAR ISSUES:
COUNCILS WORK FOR A SAFE, PEACEFUL & RENEWABLE FUTURE

C/o Nuclear Policy, Level 3, Town Hall Extension, Library Walk, Manchester, M60 3NY
Tel: 0161 234 3244 E-Mail: s.morris4@manchester.gov.uk Website: http://www.nuclearpolicy.info

The report calls for a general reduction in such transports and a review by the Ministry of Defence and the Nuclear Decommissioning Authority into alternative policy responses where practical. Whilst a catastrophic accident has not yet occurred, risks always remain in transporting dangerous cargoes of radioactive materials around the country, and across the world.

3. Nuclear transports (and risks from them) considered in this report

There are a wide range of different civil and defence nuclear material transports that take place on a regular basis within the UK (as well as globally), as well as through the Irish Sea and international oceans, and by air, particularly in recent times to the United States and Canada.

This report considers some of the following transports:

- The safety of nuclear weapon road convoys.
- The future transport of redundant submarine reactors from Rosyth and Devonport to Capenhurst by road.
- The report highlights the sheer number of road transports involving nuclear materials as well.
- The transport by rail of spent nuclear fuel from existing and decommissioned reactors, with particular focus on the rail transports of radioactive materials from Dounreay to Sellafield. It highlights learning points from recent conventional rail transport accidents.
- The transport of radioactive materials by sea around the British Isles and globally to fulfil international contracts.
- The transport of highly enriched uranium materials stored at Dounreay by air to a site in South Carolina, United States. There is also reference to a historical list of accidents involving planes with nuclear weapons.

4. A risk assessment of nuclear transports

This table summarises the wide range of civil and defence nuclear transports that take place around the country and the world.

Type of transport	Probability	Consequence	Type of risk
Road transport of low-level radioisotopes	Very Low	Very Low	Leakage of material / vehicle involved in a crash or other incident would need to be contained, but probably over a small area.
Road transports of spent nuclear fuel	Low	Low / Medium	Leakage of material from a spent fuel nuclear flask may only happen in extreme scenarios and would require a local containment response, and perhaps some localized evacuation. A serious crash and fire may require a wider response.
Road transports of nuclear weapon material	Low	Low / Medium	Leakage of material from a spent fuel nuclear flask may only happen in extreme scenarios. In such scenarios it would require a local containment response, and perhaps some localized, larger-scale evacuation (at least a 600 metre area) depending on where the incident took place
Rail transports of spent nuclear fuel	Low	Low / Medium	Leakage of material from a spent fuel due to an accident or malicious incident is unlikely, apart from in an extreme scenario. If leakage took place it would require a containment

			response, and perhaps some localized, larger-scale evacuation depending on where the incident took place. Rail accidents in general occur much less than road accidents.
Rail transport of 'exotic materials' including plutonium	Low	Low / Medium	Leakage of material from a spent fuel due to an accident or malicious incident is unlikely, apart from in an extreme scenario. If leakage took place it would require a containment response, and perhaps some localized, larger-scale evacuation depending on where the incident took place.
Sea transports of MOX fuel and spent nuclear fuel	Low	Low / Medium	Leakage of material from the spent fuel flasks due to an accident or malicious incident is very unlikely, apart from in an extreme scenario. If leakage took place it could pollute the marine environment and require a complex emergency response, which could take some time to organise depending on the location of any such incident.
Sea transports of other radioactive materials	Low	Low / Medium	Leakage of material from such transport incidents are unlikely, apart from in an extreme scenario. If leakage took place it could impact on the marine environment and require a complex emergency response, which could take some time to organise depending on the location of any such incident.
Air transports of highly enriched uranium	Low	Low / Medium	Leakage of material from such transport incidents is unlikely, apart from in an extreme scenario. An air crash involving such a plane could create a wide area of damage to contain and require wider-scale evacuation, depending on location.
Air transports of defence nuclear materials	Low	Low / Medium	Leakage of material from such transport incidents is unlikely, apart from in an extreme scenario. An air crash involving such a plane could create a wide area of damage to contain and require wider-scale evacuation, depending on location.

4. Ministry of Defence (MOD) nuclear weapon convoys

Ever since the development of the UK's nuclear weapons programme, the MOD have needed to undertake regular road transports as part of the maintenance programme for the warheads and other components. The warheads are made at the Atomic Weapons Establishment (AWE) facilities in Aldermaston and Burghfield in West Berkshire. However, they are stored at Coulport

and then deployed within the Trident submarines at the Royal Naval Faslane Base in Argyll and Bute off the west coast of Scotland, a distance of well over 400 miles.

NFLA and a number of groups have been concerned about these transports for some time, and this report notes core concerns that have been articulated in three detailed NGO reports – the Nuclear Information Service's booklet 'Playing with Fire – nuclear weapons incidents and accidents in the UK' (1), ICAN UK's booklet 'The Nukes of Hazard' (2) and Nukewatch Scotland's booklet 'Unready Scotland – the critical gap to the transport of our nuclear weapons'. (3) The Nukewatch Scotland report led to a full review of the safety of such transports as they come in and out of Scotland. This followed a full debate in the Scottish Parliament and a direct request from the Scottish Government.

Overview of nuclear weapons convoys

A nuclear weapon convoy is a considerable cluster of military vehicles, with Police and military support transport, which carries the Trident nuclear warheads, other special nuclear materials and sensitive components for the nuclear weapons programme. The Ministry of Defence (MOD) have published special guidance for the emergency services and local authorities – LAESI (Local Authorities Emergency Services Information) on the safety issues of such road convoys, which are updated annually. In addition, the MOD also holds periodic emergency exercises to consider how to respond to a significant emergency affecting such a convoy.

Nukewatch note: "The Trident warheads are carried in large crates inside the green trucks. They are fully assembled and complete. The core of the warhead is a ball of plutonium or uranium. This is surrounded by specially developed conventional high explosives which could be ignited to create the critical mass necessary for a nuclear detonation when affected by launched and targeted." (4)

The MOD say there is little risk of a nuclear detonation, and there has not been a catastrophic accident in the history of the UK nuclear weapons programme. The MOD note, in the low probability of an accident creating a fire or explosion (which they argue is remote), an evacuation of a radius of 600 metres to avoid being avoided by blast and fragments from the explosives. More concerning than that would be the dispersal of alpha emitting plutonium and uranium particles that, if ingested, could have serious health consequences. (5) A downwind shelter zone covering a 45-degree sector out to a distance of five kilometres in such incidents would be drawn up, and the public would be advised to take shelter indoors to reduce the risk of radioactive contamination. (6)

As the map below shows, nuclear weapon convoys pass close to, or even through, large towns and cities. Concerned groups have commented that it would be immensely difficult to evacuate a large urban population in time to avoid the potential consequences of a catastrophic traffic accident or a malicious attack incident involved a convoy. In addition, the MOD's LAESI accident guidelines do not explain whether, in a traffic accident, vehicles would be quarantined, sent on their way or gridlocked in the contaminated zone.

This matter is of real interest to Local Authorities as, under the Civil Contingencies Act 2004 they have a duty to conduct risk assessments of all identifiable threats and risks to public safety. They also have a duty to inform the public about these threats and risks.

Map of routes, taken from MOD LAESI guidelines and publicly available:

'Playing with Fire' – accidents involving nuclear weapon convoys

The Reading-based Nuclear Information Service (NIS) published a detailed report looking at a wide range of nuclear weapons incidents and accidents in the UK. The report, known as 'Playing with Fire', provides a sober and, in places, quite alarming assessment of the fragility of the safety of the UK's nuclear weapons programme. (7)

In the chapter on nuclear weapon road convoys, the report outlines 22 'significant' incidents have taken place to such transports, including 1 fire, 8 vehicle accidents, 12 other incidents involving vehicles and 1 incident involving a lightning strike. The NFLA Secretariat encourage all Local Authority and Emergency Service Emergency Planning Officers to consult this report, which provides detailed analysis of serious, and near catastrophic, incidents that have taken place with convoys since they began in the 1960s, right through to the present day. In one of the most alarming incidents, the report provides a detailed case study of a convoy slipping off the road in icy conditions in January 1987 in West Dean, Wiltshire. The review of this incident criticised the MOD for undertaking a convoy movement in such inclement weather. It remains alarming though that the MOD still transport convoys during periods of icy and cold weather, high winds and driving rain and snow. Convoys have also continued to take place during the Covid-19 pandemic despite the pressures placed on public services during this health emergency. (8)

NIS identified a range of incidents where convoys have had vehicle breakdowns on route, as well as minor collisions, map-reading errors, computer software bugs, bad weather and protest actions all creating significant safety issues.

NFLA support the three key recommendations of the NIS report:

- The MOD should introduce procedures for publicly reporting accidents involving nuclear weapons. "Secrecy is always bad for safety". A quarterly report should be provided by nuclear safety regulators.
- Place MOD nuclear programmes under the external regulation of the Office for Nuclear Regulation to ensure improved safety, openness and transparency.
- The UK should support an international ban on nuclear weapons. The ultimate way to prevent such accidents is to eliminate these weapons.

The report concluded with this comment from the Patron of NIS, Jonathon Porritt:
"…if you have read your way through…this Report without feeling deeply disturbed, with your fears about the feasibility of a nuclear incident or conflagration amply enforced, then you must somehow have succeeded in arriving at the following rationale: 'Notwithstanding the inevitable accidents and near-misses, we've somehow avoided any nuclear disasters for the last 70 years – so who's to say we're not going to be able to continue in the same old way for the next 70 years?'" (9)

ICAN UK's 'Nukes of Hazard' report on the dangers to town and cities of an accident from a nuclear weapons convoy

The International Campaign to Abolish Nuclear Weapons (ICAN) was established in 2007. In 2017 ICAN was awarded the Nobel Peace Prize for its work in pursuing the Treaty on the Prohibition of Nuclear Weapons. NFLA is a member of the ICAN coalition.

In 2016, ICAN UK commissioned the environmental journalist Rob Edwards to provide a detailed analysis of the risks to the public in the event of the need to evacuate large towns and cities due to a serious accident of a weapons convoy.

The report scoped five potential accident sites close to Birmingham, Preston Wetherby / NE Leeds, Newcastle and Glasgow where convoys regularly pass by. The report calculated there are a total of 2.8 million people who could be at risk from a convoy. In these 5 areas, there are a total of 1,181 schools, 131 railway stations, 56 hospitals, 47 major roads, 12 universities and three airports. Any of which could be in an evacuation zone in the event of an accident close to one of these large cities. (10)

An interesting part of the report is some of the scenarios and the learning points from emergency planning exercises that are undertaken each year by the MOD.

Interesting parts of the report include:

- An exercise scenario of a serious road crash between the convoy and a lorry near the busy Raith interchange at Bellshill near Glasgow. In the crash, the lorry punched a hole in the side of a nuclear weapons truck, and radioactivity leaked into the air from damaged warheads, starting to spread over nearby communities. In the scenario, up to 100 people were contaminated with radioactivity, seven suffered serious injuries and two are killed. Thousands more are put at risk from a "deadly cloud of radioactive dust".
- The ICAN UK report picks out seven MOD emergency exercises where significant problems took place. It should be noted getting such information out into the public area has been very difficult, usually requiring much effort in seeking Freedom of Information requests or imaginative Parliamentary questions from MPs. The ICAN report also highlights real concern that the MOD may be suffering from an acute shortage of skilled engineers and specialist staff that maintain the convoys.

Since the ICAN report was published, the MOD has increased the level of security of such DNSR (Defence Nuclear Safety Regulator) reports to 'secret', meaning the information cannot be released even under the Freedom of Information Act. The decision to change the security level of such documents may be linked to perceived increases to terrorism threat levels and so forth, but the growing trend of problems around staffing issues could, for all the NFLA and other groups know, be getting worse, and the public simply does not know. In such circumstances, this increases the need for greater involvement of the emergency services and local authorities to more concerted levels of emergency planning.

The ICAN report notes that both local authorities and fire brigades are not specifically informed when weapon convoys go through their jurisdiction. As such therefore, they are unable to undertake pre-planning or put appropriate staff on standby. The issues of secrecy have also been blamed for a MOD decision, taken as long ago as 2012, to dispense with radiation warning signs on lorries carrying materials including plutonium and highly enriched uranium. The ICAN report further makes the case that the MOD's priority in an incident could be more concerned with securing its weapons than with public health and safety, suggesting some of the delays that regularly have come up in emergency exercises "could be attributable to military insistence on retrieving the weapons before allowing access to the civil emergency services."

Above all, serious accidents can and do happen. The ICAN report notes that, given an average year of 2014, Department of Transport figures show that heavy goods vehicles (HGVs) were involved in 6,873 road accidents, of which 265 were fatal and 982 were serious. Some 559 HGVs skidded, 245 overturned and 75 jack-knifed. What if one of these involved a weapons convoy?

The report concludes by asking the question of whether the public can be reassured about these risks and whether such risks are tolerable. It makes two obvious and important points:

- "We all know accidents happen. Common sense suggests that, sooner or later, no matter what precautions are taken, a convoy will crash or be attacked, and communities will be contaminated and disrupted. The question is not if, but when.
- Whether the risk is 'tolerable' is not a judgement that should be left to the MOD alone. It is one for the millions of people through whose towns and cities the convoys pass. They have the right to decide what's tolerable – and what's not."

Nukewatch Scotland 'Unready Scotland' report – emergency planning gaps and a lack of public information?

The third report in this area was put together by Nukewatch Scotland. It involved a considerable number of enquiries to local authorities which were taken up by Mark Ruskell MSP and his staff. It argues there is a critical public information gap in the response to the transport of nuclear weapons. (11)

The report involved a survey of Scottish Councils on or near known convoy routes, as well as a number of other smaller-scale enquiries and research by Nukewatch and other related campaigns over the years that convoys have taken place. It notes: "Although the focus of this report is on

Scotland because of the particular circumstances of devolution as well as increased public awareness here, communities on or near convoy routes in England are facing the same risks."

The report particularly focuses on the Civil Contingencies Act, which provides a legislative framework across the UK, with specific additional roles at the devolved level for the Scottish, Welsh and Northern Ireland Governments. One of the legal duties on Category 1 responders, which include the emergency services and local authorities, is the provision of public information on the risks from emergencies, with a particular reference to Councils to provide relevant information and advise the public on what to do in the event of emergencies.

The Nukewatch report concludes that there have been significant changes to the practical, statutory and political environment relevant to nuclear weapon convoys.

These include:

- An unarticulated and unresolved tension between the Civil Contingencies Act and the Scottish devolution settlement. This comes from defence being a reserved matter, but the response to an incident requires a multi-agency approach. Nukewatch argue the responsibility for providing useful public information in this area is largely being ignored by Category 1 responders and the Scottish Government. Meanwhile, the Scottish Government is not offering specific guidance to such emergency responders, which the Act allows it to do.
- Due to the work of groups like ICAN, there is a growing focus on the humanitarian consequences of nuclear weapons, not just with a direct use of them, but also in their manufacture and associated risks, such as transportation.
- Such increased public awareness leaves the Scottish Government facing a serious question. Does it continue to be satisfied with the status quo in the face of the increasingly widespread understanding of the threat posed by the warhead transport, or does it address the situation openly?

Nukewatch Scotland recommended that the response of the Scottish civil authorities to the risks presented by nuclear weapon convoys required a move away from the status quo. The report recommended that the Scottish Government establish a review of the civil authority response to the threat of an incident or accident involving a weapons convoy.

Since the report was publicised a full debate was held on it in the Scottish Parliament, and the Scottish Government agreed to commission a review of the safety arrangements in Scotland around the convoys to be conducted jointly by the Scottish Police and Fire service inspectorates. (12)

This Joint Constabulary report concluded that there are 'strong plans' in place to deal with the consequences of a serious accident and collaboration between responding agencies is good. The report argues that learning points are focused on 'fine tuning' training, clearance and information sharing between agencies.

The Scottish Government welcomed the report, but Nukewatch Scotland commented:
"There are however a number of critical flaws in the review. The agencies concerned have been all too ready to accept without due diligence statements from the UK Ministry of Defence, without engaging with other recognised expertise, as we had recommended. This is especially true on the question of risk assessment. The MoD's single factor risk assessment – that the likelihood of an incident is remote is accepted without any mention of the second factor in any standard risk assessment, the potential severity of consequence. The review also fails to register adequately the unique hazards posed by the transport, and it relies too heavily on generic emergency responses."

There is also no mention of the increase in public concern about the convoys. For those living near Faslane/Coulport there is the Clyde Emergency plan which at least gives basic information to the public about how to act in case of an incident. Also, fixed nuclear sites are governed by the REPPIR regulations. Astonishingly, the review does not deal with the fact that no such framework exists for the convoys. Members of the public who are aware of the convoys need practical information about what to do in the case of an actual accident to keep them and their families safe. This review does not give this information or indicate where it might be found or accessed." (13)

In consideration of the Joint Constabulary report, NFLA focused on 'learning points' that seem to be a little more serious than just 'fine tuning'. The 14 areas for improvement included:

- Public Health England recognised that a radiation emergency would place strains on available resources to monitor radiation, as well as those to collect and analyse samples.
- The Scottish Ambulance Service warned that the demand for radiation monitoring equipment after an accident may be great and could be a challenge for them to source.
- In addition, the Scottish Ambulance Service is not pre-informed by the Ministry of Defence or other emergency responding agencies when road convoys travel up through Scotland. Neither are Local Authorities, despite both being important to the multi-agency emergency response.
- Food Standards Scotland recognised a nuclear emergency could place a strain on their existing resources.
- The Marine Scotland agency admitted that they needed to clarify arrangements on protocols for 'safe collection, storage and transport of samples'.
- A number of important emergency procedures had still to be 'finalised' by the Scottish Fire and Rescue Service, on areas as important as operational guidance and intelligence sharing.
- Police Scotland were criticised in the report for only conducting a 'verbal briefing' for officers prior to convoy movements. There were also concerns over a lack of clarity regarding access to sensitive information.
- For local authorities the only recommendation for substantive action was to provide wider participation of all relevant local authorities in nuclear / radiological related training and exercising. For NFLA that is quite disappointing as it feels they should be given more pro-active involvement with notification of such convoys.

NFLA also makes the obvious point that none of these areas of improvement would be coming about but for the pressure placed on public agencies from an ongoing challenge of concerned NGOs, Members of the Scottish Parliament and the NFLA that led to this report being commissioned in the first place. NFLA also called on the Scottish Government to oversee a full review and audited progress from each agency that they have undertaken these 'areas for improvement'.

4. MOD submarine ILW road transports

Over a period of almost two decades, the NFLA was heavily involved in a MOD policy process that considered what should happen with the considerable number of redundant nuclear-powered submarines. These are laid up at the Royal Naval sites of Rosyth in Fife and Plymouth Devonport.

After a long period of stakeholder discussion, it was decided that the reactor pressure vessels (RPVs) were to be 'cut out' of each submarine and then would then be transported to the Urenco Capenhurst site in Cheshire by road transport. The MOD have to demonstrate to the regulators that this process is done safely and so at present are developing a demonstrator project with one submarine at the Rosyth base. This work began in December 2016, but it has not gone as quickly as had been expected, and it is being further delayed due to the challenges of the Covid-19 pandemic. Once the demonstrator project has been completed, there is expected to be fairly regular transports by road from Fife and Devon to Cheshire. There are currently 19 redundant submarines, with a further 8 to be included as they end their operational life. (14) In their latest update, published in May 2021, the MOD note that they are currently demonstrating and refining their dismantling approach and have removed Low Level Waste (LLW) on the retired submarines HMS Swiftsure and HMS Resolution. LLW removal work continues now on a third submarine, HMS Revenge. Once LLW is removed, the Reactor Pressure Vessel (which is classed as Intermediate Level Radioactive Waste or ILW) can be removed. (https://www.gov.uk/guidance/submarine-dismantling-project)

The MOD said on their factsheet on proposed road transports of the RPV that there would be 3 transports in the first year and then 1 or 2 a year from the following year onwards. The MOD commented that: "The RPV and the container (that will protect the RPV) will be very heavy so transporting them will require a long wheelbase heavy transport vehicle which spreads the load over a number of axles. It will be longer than a typical HGV but for most RPVs it is expected to only be a little wider." (15) A photograph of this very long vehicle can be found on the factsheet.

The obvious issues with transporting the RPV to Capenhurst will be to work out how to negotiate such a large vehicle through narrow, rural roads off the motorway network. It is likely to involve

assistance and monitoring from at least the Police, and a logistics plan which may require some road closures. Such road transports with similar transports in the civil nuclear sector have taken place successfully as reactor sites are decommissioned. They will require detailed discussions with the local authority and with emergency planning officers. The size of the transport will make them very visible and regulatory approvals are a core part of the safety assessment. NFLA and Fife Council will also want to know what strategies will be in place to deal with a road accident or malicious incident with them.

Whilst the issues associated with the transport of the submarine compartments is principally related to its impact on rural communities, as the waste is ILW and well-contained it poses a relatively low radiological risk.

Whilst these transports may go to the Capenhurst site for interim storage, there remains no guarantee that a deep underground repository will be constructed for their long-term storage. If such a repository is constructed, then further road transports will be required for them to be moved to such a facility. NFLA will continue to monitor this issue as and when the transports are planned.

5. Issues around civil nuclear material transports

The rest of this Policy Briefing will consider the transport of civil nuclear waste, which also takes place on regular occasions throughout the year, mainly by road and rail, but also by sea and even by air to other countries.

As older nuclear reactors are decommissioned – and all Magnox reactors as well as the Dounreay reactor are now commencing this process – decisions have to be made for where to locate interim waste storage, as well as longer-term storage. NDA policy is for intermediate and higher activity waste to be sent to the Sellafield site and to be managed at this site ready for longer–term storage.

This therefore requires quite considerable numbers of road, rail and occasional sea waste transports, which may well increase in the medium term. In terms of longer-term storage, the policy position of the UK and Welsh Governments is for the construction of a deep underground repository through a 'volunteerist' community process. The eventual location of this may lead to a considerable number of new transports, particularly if a site is a considerable distance from Sellafield, where currently higher activity waste is going for treatment and waste packaging. The Scottish Government's policy is to keep the bulk of its waste 'near site, near surface', but 'exotic materials' deemed not part of this policy, such as a considerable amount of the radioactive materials at Dounreay, are being transported to Sellafield.

According to the World Nuclear Association, ***about 20 million consignments of radioactive material take place around the world each year.*** (16) The Office for Nuclear Regulation calculated around half a million packages containing radioactive materials are transported to, from or within the UK on an average year, though a recent 2017 survey (the most recent records the NFLA could find) suggests it is now around 150,000 transports. (17) These range from small levels of medical materials through to large amounts of spent fuel from civil nuclear reactors.

National and international regulations are in place seeking to protect people and the environment from the effects of radiation during the transport of radioactive material, both routinely and when transport accidents occur.

The most important part of the transports is the design of the package to be sufficiently robust to survive an accident or malicious incident. Protection is also achieved by:

- Containment of radioactive contents.
- Control of external radiation levels.
- Prevention of criticality.
- Prevention of damage caused by heat.

In terms of the management of radioactive waste, NFLA has a long-held series of environmental principles. One of them is to make the priority of waste policy to concentrate and contain waste, rather to dilute and disperse it. The transport of radioactive waste should be reduced as far as is possible and practical. NDA integrated waste policy suggests though an increase in such transports.

This table from the WNA website outlines the types of civil nuclear transports that take place:

From:	To:	Material	Notes
Mining	Milling	Ore	Rare: usually on the same site
Milling	Conversion	Uranium oxide concentrate ('yellowcake')	Usually 200-litre drums holding 400 kg, in standard six-metre transport containers
Conversion	Enrichment	Natural uranium hexafluoride (UF_6)	Special UF_6 containers, Type 48Y
Enrichment	Fuel fabrication	Enriched UF_6	Special UF_6 containers, Type 30B
Fuel fabrication	Power generation	Fresh (unused) fuel	Type A casks unless MOX fuel (Type B)
Power generation	Used fuel storage	Used fuel	After onsite storage, large Type B casks
Used fuel storage	Disposal*	Used fuel	Large Type B casks
Used fuel storage	Reprocessing	Used fuel	Large Type B casks
Reprocessing	Conversion	Uranium oxide	Called reprocessed uranium (RepU)
Reprocessing	Fuel fabrication	Plutonium oxide	
Reprocessing	Disposal*	Fission products	Vitrified (incorporated into glass)
All facilities	Storage/disposal	Waste materials	Sometimes on the same site

* Not yet taking place

While nuclear transports are undertaken with a considerable amount of risk assessment and due care, it does not mean accidents do not happen. Figures from the Office for Nuclear Regulation calculate that there have been 1034 reported incidents to nuclear transports between 1958 and 2012, at an average of around 35 – 40 each year. (18) Some of these have been due to human error, some due to faulty equipment, and some due to unplanned accidents. Moving nuclear materials remains one of the nuclear industry's riskiest activities, and NFLA are concerned that such transports appears to be increasing as decommissioning accelerates.

A 2017 study by Public Health England considered the radiological impact of the normal transport of radioactive material in the UK by road and rail. In terms of road transport, 76% of these are the transport of medical radioisotopes, 20% are from the civil nuclear industry and 4% from industrial sources. All rail transports are by the civil nuclear industry. The total number of packages containing radioactive materials transported by rail in a year between 2014 and 2016 was estimated to be about 1,500; the number of consignments was estimated to be about 750. The majority of these packages were Type B flasks transported to nuclear power stations.

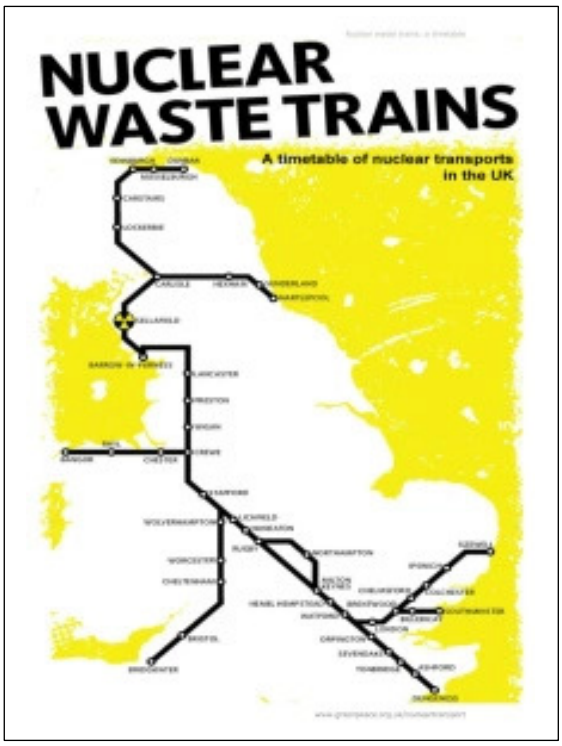
The study concluded:
"In general doses to workers and members of the public from the normal transport of radioactive material in the UK by road and rail are low and well below the respective annual dose limits of 20 mSv for workers and 1 mSv for members of the public. In comparison the average annual dose for members of the UK population from all sources of natural radiation, medical exposure, nuclear weapons fallout, radioactive discharges and occupational exposure was 2.7 mSv in 2010 (Oatway et al., 2016)." (19)

NFLA notes and welcomes that the large majority of nuclear transports over the past 50 years have been successfully and safely delivered to their destination, and that radiation doses to workers in the industry and the general public remains low. The industry is well regulated in this area. However, the reports still show incidents and accidents do occur and the further sections of this report outlines wider NFLA concerns including some specific examples.

6. Transport of spent fuel / exotic materials by rail

The transport of spent nuclear fuel by rail is a more common occurrence on the rail network than the public perhaps is aware of. Most spent nuclear fuel is transported to Sellafield for treatment and waste packaging. This leaflet from the Nuclear Trains Action Group shows some of the main rail routes taken from the main operating and decommissioned civil nuclear sites in the UK. (20)

As the leaflet shows this takes in some major areas of population including London, Bristol, Edinburgh, the West Midlands, the north west of England, the north Wales coast and Tyne and Wear. Additional routes not shown on the leaflet include much of the rail network of the west of Scotland and the remote Inverness to Thurso line.



Since 2011, the Nuclear Decommissioning Authority (NDA) have also instituted a series of rail transports to bring 'exotic' radioactive materials from the Dounreay site to Sellafield for treatment and storage. NFLA has consistently opposed these transports, believing it is far better and safer to leave the material safely stored at Dounreay. The main incentive for the NDA appears to be budgetary in that it would be cheaper to transport the material by train to Sellafield than build new waste storage stores at Dounreay. (21)

The local campaign group, Highlands Against Nuclear Transports (HANT) note:
"The flasks are loaded at Dounreay and taken by road to Georgemas Junction and at journey's end they are offloaded at Barrow-in-Furness and taken by road to Sellafield. The total distance is 400 + miles and the transport can take up to 20 hours passing remote rural areas and heavily populated areas, and including close proximity to schools, residential areas and other areas where people are present. And of course the potentially disastrous effects in the event of an accident on humans and the environment." (22)

Recent conventional rail accidents which have an impact on all rail transports

Whilst conventional rail accidents in the UK have generally reduced in recent years, one particular recent accident in August 2020 in rural Scotland, and the learning outcomes from it, could be of real concern for the future safety of rail transport, particularly for rail freight containing sensitive materials like radioactive exotic fuels and radioactive spent fuel.

On August 12th, 2020, a ScotRail High Speed Train derailed after colliding with debris following heavy rainfall. Three people died in the incident, with six badly injured. The crash took place on a remote part of the track with the nearest town a few miles away at Stonehaven. Whilst a drain had been constructed to assist with removing water from the track, it proved insufficient to deal with the amount of torrential rain that on the day had affected much of the Scottish rail network.

A final Network Rail accident report admitted that the impact of climate change on its network "is an area that is accelerating faster than our assumptions". The report also showed that the rail industry must improve its response to extreme weather. (23) The report pointed out that much existing rail infrastructure is 150 years old and rebuilding it to modern standards that are completely 'climate resilient' would be prohibitively expensive. Most concerning within the report is that it says cutting failures from torrential downpours, like the one in this incident, “rarely come with early warning signs”.

In its response to the incident, the RMT trade union General Secretary Mick Cash commented:
“The tragic loss of life and damage at Carmont sets out that there are clear deficiencies in Network Rail’s approach to the effects of severe weather and its effects on the ageing rail infrastructure. Network Rail must learn from this incident and take the necessary steps to ensure that they are preventing incidents from happening. That means a robust and regular inspection, maintenance and improvement programme that means our railway infrastructure is fit for a future where extreme weather may become more regular and more challenging. We need a well-maintained railway that will need a hands-on approach to maintenance and improvements and not just leaving matters to predictions and forecasts.” (24)

The impacts of more severe bouts of inclement weather due to climate change has to be of real concern for transporting dangerous goods on the rail (and indeed road) network in the future. NFLA calls on the new NDA Transport Division to take into account the challenges climate change could have on the resilience of the rail network and cooperate closely with Network Rail.

Accidents and derailments do continue on the UK and international rail network, sometimes involving nuclear flasks. Here are a few relevant examples:

- On the 10th April 2021, a fortunately largely empty ScotRail train being used to check platform to train stepping distances was wrongly sent from the up line to the down line at a cross over to the south of Dalwhinnie station. However, before the train was able to be stopped, the rear three bogies derailed due to the points being moved under the train. This is the type of remote train network that Dounreay-bound trains travel on. (25)
- On 11th November 2020, a freight train containing 34 wagons loaded with cement powder derailed as it was passing through Sheffield station at around 12 mph (19 km/h). A total of 16 wagons derailed after passing the north end of Platform 1. The leading ten wagons and the rear eight wagons remained on the track. One of the derailed wagons tipped onto its side and spilled some of its cargo onto the track. A preliminary examination found that a series of rail fastenings, intended to maintain the correct distance between the rails, had broken. Train services were disrupted for several days while the wagons were recovered, and the consequent track damage repaired. (26)
- On the 14th January 2014, a train transporting an empty nuclear transport wagon collided with a car straddling the level crossing at Silverdale on the Cumbria/Lancashire border. Although the car driver was uninjured as he managed to abandon the vehicle, it was hit hard by the train from Sellafield, which carried the car around 300 metres down the track, but there was no derailment of the locomotive or nuclear wagon. (27)
- A rail freight wagon carrying nuclear waste was derailed at a depot in Drancy, 3 km northeast of Paris on 23rd December 2013. The wagon carried spent fuel from the Nogent nuclear power plant destined for AREVA's reprocessing plant at La Hague in Normandy. Although no leakage of radiation was measured at the accident location, the Nuclear Safety Authority (ASN) reported that subsequent testing by AREVA revealed a hotspot on the rail car that delivered a dose of 56 microsieverts. (28)
- In September 2013, an accident took place outside Barrow docks involving three nuclear transport wagons on a spur line, with each wagon carrying an empty spent fuel flask being returned from Japan. Two of these wagons were derailed, causing a partial blockage of the main railway line serving Barrow. The wagons were reported have been travelling at approximately 5 mph when the derailment occurred. The third transport flask had remained upright and, following the rectification of the partially derailed flask, the two flasks were returned to the Ramsden Dock nuclear shipping terminal at Barrow for inspection. Righting the fully derailed flask took a further four days because of what was described by Network Rail as a process that was "extremely challenging due to the location and the ground

conditions in the area". According to CORE, an in-house investigation by DRS concluded that the derailment occurred as a result of an error by train crew. (29)

- On July 18, 2001, a freight train carrying hazardous (non-nuclear) materials derailed and caught fire while passing through the Howard Street railroad tunnel in downtown Baltimore, Maryland, United States. The fire burned for 3 days, with temperatures as high as 1000 ℃ (1800 ℉). The State of Nevada, USA, released a report analysing the incident and it considered a hypothetical spent nuclear fuel accident based on the Baltimore fire. This concluded a steel-lead-steel cask would have failed after 6.3 hours and a monolithic steel cask would have failed after 11-12.5 hours. This could provide contamination over an area of 32 square miles with substantial public health challenges and economic costs. (30) In a 2006 US Nuclear Regulatory Commission response to this report, the results from its analysis "strongly indicate that neither spent nuclear fuel (SNF) particles nor fission products would be released from a spent fuel transportation package carrying intact spent fuel involved in a severe tunnel fire such as the Baltimore tunnel fire." (31)

These selected examples show that, whilst accidents and incidents are rare, they do occur and have included cargoes with radioactive materials on board. The industry is adamant the nuclear flasks on board UK trains could take a major rail crash and still not leak.

In the 1980s, the UK Government and the then Central Electricity Generating Board (CEGB) undertook major studies trying to show the nuclear flasks that contain radioactive waste on trains could tolerate a large crash. Such studies have been challenged by a number of independent experts, such as the late John Large. He has noted that that some radioactive waste on such rail transports could catch fire and disperse tiny particles of plutonium into the air. He has also pointed out that the tests designed to ensure the safety of nuclear transport flasks had no scientific basis. They included dropping a flask nine metres on to a hard surface, which is equivalent to an impact of 30mph. Large argued that when the flasks start travelling at 60mph, the impact speeds in accidents would be much greater. Collisions with oncoming trains could reach combined impact speeds of 120mph or more. (32)

NFLA notes some pf the trains on the UK network are capable of speeds of up to 170 mph in the UK, though the rail industry seeks to place nuclear rail transports from avoiding most of these high-speed lines. NFLA also remain concerned, as do many local community groups, about the effects of the radiation that escapes the flasks while they pass by passengers platforms, even if the NDA and the UK Government argue it is not enough radiation to be harmful. (33)

In addition, with the NDA policy on integrated waste management, and the likely defueling of reactor fuel over the next few years from Advanced Gas Nuclear Reactors (it has just been announced Dungeness will close, whilst Hunterston B and Hinkley Point B will close in early and mid-2022), suggest rail transport of radioactive material will continue to increase over the next decade. The MOD also infrequently transports spent submarine reactor fuel by rail to Sellafield from Devonport and Dounreay.

7. The international transport by sea of nuclear materials –

NFLA is also aware of a considerable trade in sea transportation of nuclear materials around the world.

'Group 1' INF sensitive nuclear material sea transports organised by INS / NTS

The NDA's shipping subsidiary INS (now a part of the NDA's Transport Division and called Nuclear Transport Solutions) has been responsible for transporting materials around the world, particularly MOX fuel to international customers, as well as some 'exotic fuels' from Scrabster (via the Dounreay site) to Barrow (and on to Sellafield).

In recent years, the shipments from Barrow to Japan were considerable, transporting MOX reprocessed fuel assemblies. The most recent of these was in 2017, taking fuel assemblies manufactured in France to the Takahama Power Station in Japan. INS note such shipping are fitted with special security equipment for transporting MOX fuel and for mutual protection they travel together, each escorting the other. The ships also carry officers from the UK Civil Nuclear Constabulary (CNC), who provide on-board protection and are specially trained to protect nuclear

facilities and materials. (34) In late 2020, the first of three shipments took place of high-level radioactive waste in the form of vitrified residues to Germany. A total of three shipments will go to federal storage facilities at Biblis in Germany. This Vitrified Residue Returns programme is a key component of the NDA's strategy to repatriate high-level waste from the UK, fulfil overseas contracts and deliver UK Government policy. (35)

In 2019, some of the 'exotic fuels' that the NDA wished to transport from Dounreay to Sellafield were also sent on a couple of shipments from Scrabster to Barrow. NFLA and civil society groups like HANT and CORE (Cumbrians Opposed to a Radioactive Environment) were particularly alarmed by these shipments as the shipping area near the islands off the west coast of Scotland, known as 'The Minches' is known as a particularly difficult shipping channel to navigate. NFLA Scotland members raised these issues in a meeting with NDA and Dounreay staff, as well as in letters to the NDA Chief Executive.

Many of these shipments have raised concerns over the risks and dangers of transporting plutonium and other higher active radioactive materials over such large distances, which at times can take place during severe inclement weather. They are likely to have involved armed staff being on the shipments and CORE have raised a number of times the aging nature of some of the fleet transporting these materials. As well as the safety issues of transporting such material across the open seas, there is also the issue of international sea piracy in the open ocean environments.

In a 2019 media release, CORE sought to comment on the confident assertion made by INS / NTS of how safe these shipments have been without a 'lost time accident' arguing this is misleading, offering three examples taken from the minutes of Site Stakeholder Group meetings. (36) CORE have also argued that attempts to keep these shipments as 'under the radar' does not work, as they, American and Japanese observer groups have been able to track these ships movements. If small NGOs can track such a shipment, there clearly remains a possibility a more malicious group could do so. (37)

NFLA are relieved there have been no major incidents or accidents involving these shipments, but the sensitivity and risks around them could be avoided if they were significantly reduced or did not take place at all.

Lower-level 'Group 2' and 'Group 3' nuclear material sea transports and related issues -
NFLA has particularly been concerned with a lower level of shipping transporting radioactive materials over large distances following a number of concerning incidents.

These include:

- Fire on the Atlantic Cartier in Hamburg Port – one of the most concerning incidents of an accident of a mixed 'roll on roll off' cargo vessels were a fire on board the Atlantic Cartier on May 1st, 2013. The seriousness of this incident necessitated a full NFLA Policy Briefing 120 which looked at the many serious safety incidents of such shipping. In this incident, a fire broke out on the vessel whilst it was docked at Hamburg port. Three tugs, two fireboats and over 200 firefighters took several hours to fully control the fire and douse the flames to make it safe. As well as containing a cargo of some 70 cars (30 of which were badly damaged), the Atlantic Cartier was also transporting 9 tons of uranium hexafluoride (UF6), a radioactive highly volatile and toxic compound most commonly used as an intermediate material in the production of nuclear fuel. The vessel also had 180 tons of flammable ethanol and 4 tons of explosives at the time the fire broke out. The nuclear fuel was being taken to the uranium-enriching facility in Lingen, Lower Saxony. Such radioactive material shipments through Hamburg port are quite regular. In this incident, local firefighters were made aware of the nuclear fuel quickly and managed to remove the relevant containers to a safe storage area, thus narrowly averting a significant radiation incident. It should be noted as well that whilst this emergency was taking place there was, quite close by, an opening outdoor service of the German Church Council at Hamburg‟s Lutheran Cathedral. This involved over 35,000 participants and the German President Joachim Gauck. The annual May Day parade was also taking place in the centre of Hamburg at which many thousands of people were participating in. (38)
- Breakdown and problems with the MV Parida – On 7th October 2014, a fire took place on the funnels of the ship MV Parida, containing radioactive waste from Dounreay which was bound

for storage in Belgium. This waste shipment was part of a contract between Dounreay Site Restoration Ltd and the Belgian nuclear authority SCK/CEN, involving the repatriation of 123 stainless steel drums of nuclear fuel in solidified cement. The incident involved a precautionary evacuation of an oil rug close to the incident. Additional concerns were raised by several groups and the Scottish Environment Minister Richard Lochhead over the transport taking place during severe weather and gale-force winds. (39)

- Problems with the MV Priscilla - On 18 July 2018, the Netherlands registered general cargo vessel MV Priscilla ran aground on Pentland Skerries, Scotland. For about 2 hours prior to the accident, the officer of the watch had been unaware that the Priscilla was drifting away from the planned passage. When the officer of the watch realised what had happened, the route chosen to regain the navigational plan resulted in the vessel heading directly into danger. The accident happened because the officer of the watch was distracted from the critical task of monitoring the passage by watching videos on his mobile phone. (40)
- MCP Altona incident – On 23rd December 2010, the MCP Altona cargo ship carrying 350,000 kgs of uranium ore concentrates owned by the Canadian company Cameco encountered severe weather between Hawaii and the Midway Islands on route to China. The ship was damaged in the storm and its crew later noticed that some of the containers had shifted and been damaged. The ship's captain could not get authorisations for a 'safe harbour' and the ship returned to Canada. During this event an undefined number of drums had fallen, burst open and discharged their powdered contents. Cameco says the clean-up of the radioactive materials on board cost close to $10 million, and that it is owed additional sums for damage to its cargo, berthing of the ship and other expenses totalling another $9 million or more. Faced with the suit, the Altona's ship owner went bankrupt. It is not clear what the health impacts were for the crew involved in this incident. (41)

NFLA has worked on a number of these reports with the independent marine radioactivity consultant Tim Deere-Jones. NFLA is aware of, and fully supportive of, a new report Tim has drafted for KIMO International, which will be published shortly. This report will be a definitive consideration of such dangerous shipments around the North West European region.

8. Air transports of HEU from UK to US and previous incidents

Nuclear weapons continue to be transported on planes by a number of nuclear states, notably the United States and Russia, and there have been recent transports by air of highly enriched uranium, as part of an agreement between the UK and US Governments.

The recent moving of nuclear materials from the UK to the USA concluded successfully in 2019. It involved the removal of 700kg of highly enriched uranium (HEU) from Dounreay to the USA. HEU is a nuclear fuel used by certain nuclear reactors, in research or submarine applications, that enables them to be small in size and to perform very flexibly. However, it can also be used in nuclear weapons and therefore must be handled with the highest levels of security. HEU is being phased out and replaced in civil applications worldwide.

NFLA and the local pressure group Highlands Against Nuclear Transport (HANT) raised concerns over this issue given the short runway at Wick Airport, and that all local roads around the airport were closed during each transport. It was found that the runway at Wick was too short for the transports to take place on a full tank, so they had to therefore be sent on to RAF Lossiemouth for refuelling and onward transport to South Carolina.

As Highlands and Islands MSP John Finnie said, in commenting on these transports:
"Transporting nuclear waste is a risky business. By using two airports you are doubling the take-offs and landing in this country, which doubles the risk. It is disturbing to discover we are now using an extra airbase in heavily populated areas for a stop-off to transport nuclear waste" (42)

In addition, military nuclear materials are flown across the South of England and South Wales around four times a year on average, according to information provided by the Ministry of Defence (MoD) in answer to a Parliamentary Question. The materials, in transit between the USA and the UK, are essential to the UK's nuclear weapons and nuclear submarine programmes.

As the Nuclear Information Service have noted, the flights are known to transport the following cargoes:

- Tritium – a component of nuclear warheads which has a half-life of only 12 years and needs to be replenished regularly. The UK does not have the capacity to produce tritium and has to buy it from the USA.
- Highly enriched uranium for submarine reactor fuel (also used in warhead components) which must also be sourced from the USA. It is believed that the UK supplies enriched uranium (around 20%) to the USA, where it is then further enriched to around 95% for use as fuel and then returned.
- Samples of nuclear materials for tests and assays.
- Components of warheads which require testing using unique facilities at US nuclear weapons laboratories.
- Non-nuclear warhead components which must be transported securely.

These exchanges of nuclear materials and warhead components take place under the auspices of the 1958 US-UK Mutual Defence Agreement, which allows the US to assist the UK's nuclear weapons and naval nuclear propulsion programmes through the supply of special nuclear materials and exchange of information.

The flights arrive at and depart from RAF Brize Norton in Oxfordshire, and the material is then transported by road to the Atomic Weapons Establishment (AWE) in Berkshire, coming close or past large urban populations in the likes of Oxford and Reading. On the reverse trip, loads are transported from Brize Norton by Royal Air Force C17 Globemaster aircraft to the USA. The flights head west from Brize Norton, taking one of two flight paths which take them either over the northern part of Bristol, over Cardiff, and then along the Bristol Channel, or on a route slightly to the north which passes over Cirencester, Newport, the South Wales Valleys, and Swansea before heading out to sea.

Welsh local authorities underneath the flight paths are listed in the Ministry of Defence's Local Authority Emergency Services Information (LAESI) nuclear accident guidelines, and in a previous emergency exercise (known as Astral Bend) a scenario included the emergency services having to respond to an accident involving a flight carrying defence nuclear materials.

It should be noted that when the cargo is unloaded at Delaware on the east coast of the United States it is then transported onwards by road, as it has been claimed that the special packages used by MoD to transport nuclear cargoes do not meet US safety standards for the air transport of radioactive materials.

It is believed that, in addition to nuclear flights between the UK and the USA, flights carrying nuclear cargoes between the UK and France have commenced to allow UK nuclear warhead components to be tested at the Valduc nuclear site in France under arrangements set out in the 'Teutates' UK-France nuclear co-operation treaty. (43)

9. Conclusion

This report has tried to provide a comprehensive consideration of the sheer range of nuclear transports that take place in the UK and around the world on a regular basis. It has surprised the NFLA how extensive this trade is, and it remains of concern to the NFLA that transports appear to be rising, as NDA policy seeks to consolidate radioactive materials and MOD policy requires increased transports by roads of UK nuclear weapons for maintenance and installation, as well as the expected additional demands of the Trident replacement programme.

The NFLA are relieved that the large majority of such transports have been undertaken safely, but if this report indicates anything, it is that there have been a lot of ‘near misses’ whether by road, rail, sea or air. Accidents do happen and malicious attacks still remain a possibility. The range of civil society NGOs noted in this report that track some of these transports are motivated by a joint concern of fear that one day there will be a much more serious accident that puts public safety at jeopardy. If a small NGO can easily track these transports, then a group with more malicious motivation could certainly do so.

NFLA encourages the NDA and MOD in particular to review the necessity of increasing nuclear transports. They are not particularly liked even by those who support nuclear power. The public, when alerted to them, has shown to be in large opposition to such increases in transport.

The review undertaken for the Scottish Government on the safety of nuclear weapon road convoys was welcome, but the NFLA, CND or Nukewatch all note significant learning points for the emergency services and local authorities that we hope are being dealt with. Public safety concerns continue to remain, and it is of real concern that reduced openness and transparency on this issue has made it difficult to understand whether the aging nature of the vehicles involved in these convoys is being adequately resolved. Such measures to prevent a public debate should be reconsidered by the MOD.

The recently published report on the Carmont rail crash is of real concern to the rail industry given the increasing problems severe inclement weather (created by climate change) could damage critical rail infrastructure at short notice. This has to be of concern as well when it comes to the transport by rail of dangerous materials such as nuclear flasks. The increasing speed of new trains should be considered by the industry as well to ensure that any accident involving nuclear flasks does not lead to any leak of such material.

Finally, NFLA looks forward to the KIMO report that is reviewing nuclear shipments and their safety. It has met previously with senior officials in the International Maritime Organisation over its concerns that many mixed shipments containing nuclear materials with other serious safety risks are continuing around the world at a very regular basis.

There is much to consider from this report for the NFLA Steering Committee. The report will also be sent to the nuclear regulators and nuclear transport operators for their full consideration.

10. Recommendations

NFLA recommends the following improvements to nuclear transport policy:

- The civil and defence nuclear authorities should minimise the movement of nuclear materials as much as possible, and they should abide to the proximity principle of storing waste at its point of origin. The ongoing trend upwards of nuclear transports is of real concern to local authorities.
- The civil and defence nuclear authorities should also consult local communities on the movement of nuclear materials which can affect them. There has been a real lack of openness and transparency in this area of nuclear policy.
- Local authority emergency planning officers should be brought into the planning and knowledge of MOD and sensitive civil nuclear material road, rail, sea and air transports, so as to ensure adequate local plans are in place in the event of an accident or a malicious incident.
- The International Maritime Organisation should consider improved regulation on shipping that is transporting nuclear materials as part of other mixed shipments. The level of accidents in this area is alarming, and the NFLA is really concerned a major accident could cause significant and dangerous implications for communities if that matter is not dealt with.
- The issue of climate change creating severe inclement weather conditions and potentially damaging rail, road and port infrastructure needs to be considered by the nuclear transport authorities. The Carmont rail crash has raised significant issues for the rail industry, but other aspects of climate change could impact on nuclear transports.

11. References

(1) Peter Burt, Nuclear Information Service, 'Playing with Fire: nuclear weapons incidents and accidents in the UK', February 2017. https://www.nuclearinfo.org/article/vanguard-astute-safety-aldermaston-burghfield-faslane-coulport-transport-reports/playing

(2) Rob Edwards, ICAN UK, 'The Nukes of Hazard', 15th March 2017 http://acronym.org.uk/2017/03/15/nukes-of-hazard-nuclear-bomb-convoys-on-our-roads/

(3) David Mackenzie and Jane Tallents, Nukewatch UK, 'Unready Scotland – the critical gap in our response to the transport of nuclear weapons', 20th August 2017 https://www.nukewatch.org.uk/about-us/unready-scotland-nukewatch-report/

(4) Nukewatch UK, https://www.nukewatch.org.uk/convoys/

(5) Ministry of Defence, Local Authority Emergency Services Information Edition 11, April 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643525/20170831-LAESI-Ed_11.pdf
(6) Rob Edwards, New Scientist, 'Road crash could set off nuclear blast', 5th July 2006 https://www.robedwards.com/2006/07/road_crash_coul.html
(7) See reference (1)
(8) See for example, Glasgow Live, 7th March 2021 https://www.glasgowlive.co.uk/news/glasgow-news/unmarked-military-convoy-carrying-nuclear-19984204
(9) See reference (1)
(10) See reference (2)
(11) See reference (3)
(12) Scottish Joint Constabulary Preparedness Review of the Road Transport of Nuclear Weapons, June 2019 https://www.gov.scot/binaries/content/documents/govscot/publications/corporate-report/2019/06/road-transportation-of-defence-nuclear-material-in-scotland-preparedness-review/documents/road-transportation-of-defence-nuclear-material-in-scotland---preparedness-review---report/road-transportation-of-defence-nuclear-material-in-scotland---preparedness-review---report/govscot:document/Road+Transportation+of+Defence+Nuclear+Material+in+Scotland+-+Preparedness+Review+-+report.pdf
(13) Nukewatch, 28th June 2019 https://www.nukewatch.org.uk/scotgov-convoy-review-some-progress-but-fails-to-reassure/
(14) Ministry of Defence, Submarine Dismantling Project, July 2016 https://www.gov.uk/government/news/mod-selects-nuclear-storage-site-as-submarine-dismantling-project-progresses
(15) Ministry of Defence, RPV Transport and Handling, August 2016 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/374896/Factsheet_5_RPV_Transport_20141112_V1_0.pdf
(16) World Nuclear Association, Transport of radioactive materials http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/transport-of-nuclear-materials/transport-of-radioactive-materials.aspx
(17) Public Health England, Radiological Consequences Resulting from Accidents and Incidents involving the Transport of Radioactive Materials in the UK – 2012 Review https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/345814/PHE-CRCE-014.pdf
(18) A L Jones & T Cabiana, Public Health England, Survey into the Radiological Impact of the Normal Transport of Radioactive Material in the UK by Road and Rail, March 2017 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/603504/RORI_reportNB280317.pdf
(19) As per reference (15) – the report was funded by the Office for Nuclear Regulation and published by Public Health England.
(20) Nuclear Trains Action Group leaflet on 'Nuclear Waste Trains', July 2014. https://mariannewildart.files.wordpress.com/2014/07/nuclear-waste-trains-map.jpg
(21) NFLA Radioactive Waste Policy Briefing 33, NFLA response to NDA consultation on exotic fuels and nuclear materials stored at Dounreay, March 2012 https://www.nuclearpolicy.info/docs/radwaste/NFLA_RWB_33_Dounreay_exotic_fuels.pdf
(22) Highland Against Nuclear Transport – http://www/hant.co.uk
(23) Network Rail, Resilience of Rail Infrastructure – interim report to the Secretary of State for Transport following the derailment at Carmont, near Stonehaven, 1st September 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/928593/resilience-of-rail-infrastructure-interim-report.pdf
(24) RMT Media Release, 19th April 2021 https://www.rmt.org.uk/news/rmt-response-to-raib-interim-report-into-carmont-tragedy/
(25) Rail Advent, 23rd April 2021 https://www.railadvent.co.uk/2021/04/dalwhinnie-train-derailment-scotrail-hst-wrongly-diverted-across-dalwhinnie-crossover.html
(26) Rail Accident Investigation Branch report, 30th November 2020 https://www.gov.uk/government/news/freight-train-derailment-at-sheffield-station
(27) David Lowry and Mycle Schneider, International Panel on Fissile Materials, 21st January 2014 http://fissilematerials.org/blog/2014/01/nuclear_train_accident_in.html
(28) ibid
(29) ibid
(30) State of Nevada report, 25th February 2003 http://www.state.nv.us/nucwaste/news2003/pdf/nv030225c.pdf
(31) US Nuclear Regulatory Commission report on spent fuel transport response to the Baltimore Tunnel Fire Scenario, https://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6886/index.html
(32) Rob Edwards.com, 2nd September 2001 https://www.robedwards.com/2001/09/nuclear_waste_t.html

(33) The Drive, 24th September 2020 https://www.thedrive.com/news/36668/crashing-a-100-mph-train-into-a-nuclear-fuel-container-is-our-kind-of-science
(34) Nuclear Transport Solutions case study on Japan MOX shipments, https://nucleartransportsolutions.com/case-study/safely-delivering-mox-fuel-to-japan/
(35) Nuclear Transport Solutions case study on German waste shipments https://nucleartransportsolutions.com/case-study/shipment-of-high-level-waste-from-the-uk-to-germany/
(36) CORE media release, 19th September 2019 http://corecumbria.co.uk/news/all-at-sea-safety-claims-by-barrows-nuclear-shipping-terminal/
(37) CORE media release, 21st June 2016 http://corecumbria.co.uk/news/barrow-ships-return-home-from-5-month-world-voyage-raises-major-doubts-on-the-security-of-the-plutonium-cargo-shipped-from-japan-to-the-us-and-the-wisdom-of-undertaking-future-shipments/?doing_wp_cron=1621438124.4791080951690673828125
(38) NFLA Policy Briefing 120, 4th March 2014 https://www.nuclearpolicy.info/docs/briefings/A234_(NB120)_Marine_nuclear_transportation.pdf
(39) NFLA Media Release, 8th October 2014 https://www.nuclearpolicy.info/docs/news/NFLA_KIMO_Parida_incident.pdf
(40) Marine Accident Investigation Branch, 3rd October 2018 https://www.gov.uk/maib-reports/grounding-of-general-cargo-vessel-priscilla#:~:text=Accident%20Investigation%20Report%2012%2F2019&text=On%2018%20July%202018%2C%20the,aground%20on%20Pentland%20Skerries%2C%20Scotland.&text=The%20accident%20happened%20because%20the,videos%20on%20his%20mobile%20phone.
(41) North Shore News, 26th September 2011 https://www.nsnews.com/local-news/radioactive-spill-ship-in-legal-limbo-off-north-vancouver-2914481
(42) Daily Mirror, 1st April 2018 https://www.mirror.co.uk/news/uk-news/top-secret-flights-carrying-nuclear-12287170
(43) Nuclear Information Service, 1st March 2016 https://www.nuclearinfo.org/article/nuclear-materials-transport/23-nuclear-flights-between-uk-and-us-five-years-0