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Staring Facts in the Face

presentation paper

Lorne Green
Secretary General, WNTI

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Dedicated to the safe, efficient and reliable transport of radioactive materials

I propose to talk about the nuclear fuel transport industry, perceived risk, real risk, and about the consequences of transport accidents. My remarks on risk, and on safety consequences, will be directed specifically to the transport of nuclear fuel cycle materials. But first a few words about nuclear power and the nature of the nuclear fuel cycle transport business.

Nuclear power and the nuclear fuel cycle transport industry

Nuclear power currently supplies some 16% of the world's demand for electricity and will become increasingly important if the world is to satisfy its growing demand for electricity and at the same time meet its environmental obligations. Whether or not particular countries choose to generate electricity from nuclear power they still benefit from it. All countries, developed and developing, derive benefit from technologies that contribute to the reduction of CO_2 emissions. If nuclear power is to play its part in meeting the energy needs, and the clean air needs of peoples everywhere, the industry must be able to transport its materials to where they are needed. Transport of such cargoes provides crucial linkages between suppliers, processors, users, and the consumers who benefit from these commodities.

Many countries which include nuclear electricity generation in their energy mix rely on foreign sources for the supply of the necessary services and materials to support the fuel cycle because they do not have their own facilities The business is therefore becoming increasingly international with the fuel cycle services provided by several countries around the world. If society is to derive the full benefit of peaceful uses of nuclear energy then the provision of that energy should be cost-effective. And that means that cost-effective transport of radioactive materials is critical to this purpose. Safe, efficient and reliable transport is essential both to public confidence and to economic competitiveness. Economic competitiveness relies to an important extent on the optimal use of existing facilities, packagings and efficient transport.

No form of transport is subject to a stricter international regulatory regime to ensure safety and security. The international standards developed at the International Atomic Energy Agency (IAEA) are reflected in the standards and regulations of the transport modal organisations such as the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO), regional transport regimes such as the ADR, RID and ADN for road, rail and inland waterways in Europe, and the regulatory regimes of the IAEA Member States themselves. Industry co-operates in the periodic review of this regulatory safety regime, and is fully committed to implementing transport safety regulations and standards. After all, no stakeholder in the international transport safety regulatory regime has a greater interest in safe transport than those who are doing the transport. It is the transporter who is in the front line of the actual transport – it is the truck driver, the railway worker, the ship's crew, who is closest to the materials being transported. There is no room for complacency or a hesitant approach by the nuclear transport industry to balanced transport regulations. The most immediate loser in the event of failure would be the industry and its workers themselves.

Perceived risk

The smallest incident involving the transport of radioactive materials, no matter the lack of any real or potential radiological consequences, has the potential to play to people's latent fears. There are many who have sincerely held concerns about the transport of radioactive materials. Sometimes this concern derives from a lack of information, or understanding, about the reasons for and the nature of the transport and how safe it really is.

A little story. Two men went to the zoo for the very first time. They come upon the giraffe, a creature they never before had seen. One man says to the other: "I simply do not believe it". Sometimes people cannot, or will not, recognise a fact even when it stares them in the face!

Evidence suggests that the anti-nuclear view is not a majority position, but it is, nevertheless, a fervently held view by a small but vocal minority. It would be difficult and mistaken to under-estimate the importance of public attitudes to nuclear transport. The value of an idea, of course, has little to do with the sincerity with which it is held. To illustrate, some time ago I was stopped on the street near my office here in London by a young person with a clipboard – you know the scene; usually you are about to be solicited to sign up to some worthy charity or other. I agreed to submit myself to the young woman's questions.

"Did I favour clean air," she asked. That was an easy one – "Of course," I replied, "doesn't everyone?" Next question: "Did I support sustainable development?" Another easy one. "Unquestionably," I answered. Next question; "Was I opposed to nuclear power?" This time I hesitated. "Before I answer that question," I said, "will the next question be whether I was also opposed to coal, petroleum or gas power?" "No," she replied, "only nuclear power." "Well, I said, "you've introduced a negative into your line of questioning, and before I can answer, I'd like to know more about this anti-nuclear power thing." She seemed to be thrown off her stride somewhat. "To tell you the truth," she admitted, "I don't really know much about nuclear; but I can assure you that we are anti-nuclear, and for one pound a week or four pounds a month, you too can join our organisation which definitely is anti-nuclear." You may guess that I did not sign up.

Some people just don't want to let the facts get in the way of their prejudices. Now, I don't criticise that young person for her championing of cleaner air and a better environment for us all. Rather, I salute her. If the idealism of the young were to fall victim to the jaundice of old age, there would be scant hope for the future of our world. What I am critical of, however, is the espousal of positions by those who, by their own admission, know very little and really aren't bothered to learn very much more.

I find that people's perceptions of risks, and their response to them, are a complicated thing, and often difficult to understand. There have, of course, been studies in this area. Twenty years ago, in a book called 'Before its too Late', Bernard Cohen produced a table showing the loss of life expectancy, in days, due to various risks based on statistics. According to Cohen, the single greatest risk to life is to be born male rather than female – males according to Cohen live 2,800 days less on average than females. Thirty pounds overweight can lead to a loss of life expectancy of 900 days, 15 pounds overweight, half that, at 450 days. Small cars versus standard size lead to a 50 day decline in life expectancy, airline crashes, hurricanes and tornadoes one day. All electric power in the United States, including nuclear, leads to a loss of life expectancy of 1.5 days; all electric power in the United States derived from nuclear, .03 of one day. By comparison, drowning statistics suggest a 40 day loss

of life expectancy. But ask people what constitutes the greater risk, drowning or nuclear power plants, and nuclear power probably would come out the loser in many cases. There is no "ban-swimming" movement.

A few years ago, in the lead-up to Christmas, the British newspapers were full of articles warning about the potential health hazards of mobile phones – the risks were considered particularly hazardous to children. A few months later, and after Christmas, the newspapers reported that the largest single gift item purchased in Britain for the Christmas just past, was the mobile phone, with several millions of them sold. There seems sometimes to be a disconnect between perceived and real risk.

Real risk and safety consequences

I would like to turn now to real as opposed to perceived risk as it attaches to the transport of fuel cycle radioactive materials. Transports of such materials, over several decades, have an outstanding safety record; indeed, the transport of such materials could be regarded as a model for the transport of other classes of dangerous goods. I presume this must be reflected in an historic lack of substantial claims made to the insurance industry.

Nuclear fuel cycle materials generally are classified either as front-end or back-end; depending where they sit within the fuel cycle. These materials come in a variety of chemical and physical forms. In the case of front end materials – unirradiated materials, that is, uranium ore concentrate, uranium hexafluoride, uranium oxide powder and fresh fuel are relatively benign and the potential radiological hazard is low. Back-end materials – notably spent nuclear fuel and high level residues – are intensely radioactive and need to be heavily shielded. However, they are inherently stable and refractory and very difficult to disperse. For example, high level residues from reprocessing are vitrified; that is, transformed into a solid glass state and so are inherently stable.

The IAEA transport safety regulations, from which the international transport safety regime flows, are based on the philosophy that radioactive materials being transported should be packaged adequately to provide protection against the hazards of the material under all conditions of transport, including foreseeable accidents. Therefore, it is considered, as far as possible, that:

- safety is vested in the design of the package. This combined with simple operational controls, ensures safety;
- the consignor bears most responsibility for ensuring the safety of the transport, because it is he who prepares the package for transport;
- packages of radioactive materials should be dealt with in the same way as other dangerous goods.

Packages for nuclear materials are subject to stringent test criteria set by the International Atomic Energy Agency. These tests are designed to ensure the integrity of the package in accidents such as crashes involving high impacts, in long duration fires or after submergence in water. The package tests for the more highly radioactive materials are rigorous; for example, the impact tests exceed real-life situations. There is a large body of evidence to support the claim that the IAEA tests are severe tests which cover all the situations which can be realistically envisaged in the transport of spent fuel, high-level waste and other fuel-cycle materials.

In the 1990s, in light of public concern for the safety of maritime transport of radioactive material, a joint working group between the IAEA and the International Maritime Organization was formed and it addressed the adequacy of the IAEA Safety Regulations. Concern also was expressed by some about whether accidents on board ships would expose packages of radioactive material to more severe thermal and mechanical environments than those accounted for by the IAEA test requirements, and that package failure with subsequent release of radioactive material may occur. All of the information studied within this Group indicated that maritime transport would have a low level of radiological risk and low potential of significant environmental consequence. Also, a Co-ordinated Research Project was launched to undertake closer studies to find out whether existing regulations take adequate account of accidents at sea, taking into account both probability and consequence. All this activity led to publication of an IAEA report on the severity, probability and risk of accidents during maritime transport of radioactive material, published in July 2001. The report noted that should in the unlikely circumstance a flask containing such materials not be recovered, the rate of release of radioactive material from it into ocean waters would be so slow that the radiation doses received by people who consume marine foods contaminated as a result of the accident would be negligible compared to background doses. I emphasise that these are conclusions of international experts convened by the International Atomic Energy Agency.

That major international scientific study concluded, and I quote: "Since the probabilities of severe ship collisions and severe ship fires are small, and since the individual radiation doses that might result in the event of such collisions or fires are smaller than normal background doses, the risks posed by maritime transport of highly radioactive material such as irradiated nuclear fuel, vitrified high-level waste and mixed oxide fuel in Type B packages are very small."

It may not be widely known but, whether we like it or not, we are all constantly being exposed to natural background radiation, notably from rocks such as granite which give rise to radioactive radon gas in our houses, from cosmic radiation from outer space and from natural radiation in some foods, for example Brazil nuts. And, of course, we are all prepared to be X-rayed from time to time. One of the safest places in the world to be, if one's concern is radioactive exposure, is on board a dedicated vessel at sea carrying packages of high level waste. Why should this be? Because the packages are so robust they do not emit radiation and there is virtually no natural radiation from the sea and the radiation from the land is avoided.

Of course in this post September 11 world it would be remiss of me not to say something about transport security. Security of transport for radioactive materials was not invented since 11 September 2001; it has for long been integral to transport operations and planning. It is only prudent, of course, that procedures and operations be reviewed in light of the contemporary situation and this process has been going on internationally and nationally. I would observe that the features of the packaging of highly radioactive fuel cycle materials, the physical properties of these materials themselves, and their associated handling, are such as to render them of no effective use to those with malign purposes.

The system works. In over 40 years no nuclear fuel cycle transport incident has resulted in significant radiological consequences for health or the environment. That's not only the industry speaking. In July the International Atomic Energy Agency hosted a major international conference on the safety of transport of radioactive materials; there were over 500 participants from 82 States, nine inter-governmental organisations and five non-governmental organisations, including the World Nuclear Transport Institute I represent. The one week Conference was presided over by the former Australian Ambassador to the IAEA. In his conference

findings, the President reported that, and I quote, “The application of the regulatory requirements in a safety-conscious work environment by the transport industry – consignors, carriers, and consignees – has resulted in an outstanding safety record for the transport of radioactive materials. In fact, over several decades of transport, there has never been an in-transit accident with serious human health, economic or environmental consequences attributable to the radioactive nature of the goods.”

Of course there will be those who say, “We hear you, and are prepared to concede the real risk of radiological incident is minima but the consequences of such an incident could be so devastating that it is not a risk worth taking.” At the July IAEA Transport Safety Conference I heard a senior diplomat from a coastal state say the following: “I accept that the likelihood of an accident during maritime transport is minimal, but the potential catastrophic damage is great if there were an accident”. Since this seemed to run counter to so much safety information at the Conference, and to the fact of the outstanding safety record, I approached a radiation expert on the same delegation as the diplomat to enquire what, in his scientific view, was the potential for catastrophic radiological damage in the event of a maritime accident. His reply: “I believe the potential of such damage to be nil.”

Although there is general agreement that nuclear fuel cycle transport could never give rise to serious real radiological consequences some claim that perceptions could result in economic damage, for example a shipping accident which had no real effect could nevertheless have an impact on fishing or tourism. Clearly this is an issue which has to be addressed by better communication with the public and media to dispel these false perceptions.

Conclusions

I want to leave you with the following messages:

- the transport of fuel cycle radioactive materials is an absolutely essential business; one which contributes to the international objective of bringing peaceful applications of the atom to the benefit of peoples the world over;
- the transport of fuel cycle materials is an international business;
- it is a safe business with an outstanding safety record over several decades;
- it is a business subject to a very stringent international transport safety regulatory regime;
- it is a business committed to co-operating to implement fully international regulations and one which has a vested interest in transport safety.

Lastly, it is a business which relies on and values the support of the companies you represent, and is pledged to transparency in the interest of fostering the relationships with your companies to everyone’s benefit.

WNTI

WORLD NUCLEAR TRANSPORT INSTITUTE

7 Old Park Lane, London W1K 1QR
United Kingdom
Tel: +44 (0)20 7408 1944
Fax: +44 (0)20 7495 1964
Website: www.wnti.co.uk