Thinking Outside the Box

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Lewis Carroll, in Alice's Adventures in Wonderland, said that you have to run very fast just to stand still. And, of course, if you stand still, you run the risk of the world passing you by. The World Nuclear Transport Institute I represent celebrated its 10th anniversary last year – we haven't stood still. Indeed the very fact of a World Nuclear Transport Institute is a manifestation of industry thinking outside the box.

The World Nuclear Transport Institute, or the WNTI as it is popularly known, was formed to fill a need – to provide a dedicated vehicle for the radioactive transport and packaging industry sectors worldwide, to exchange information and ideas, all with a view to working toward consolidated industry positions on the key issues affecting safe, efficient and reliable transport. WNTI was also intended to be a strong voice for industry in those international and national bodies where deliberations on such transport safety issues take place.

The very fact that companies, sometimes in competition with each other, were prepared to come together in this way, reflects two important points: firstly, it represents an acknowledgement on industry's part that above all else, safe, effective and reliable transport is the sine qua non, the absolute essential. And second, the creation of WNTI is a recognition that the ability to assure safe, efficient and reliable transport of radioactive materials is enhanced to the extent that industry is able to collaborate to this end. This is thinking outside the box.

Another important attribute of safety is "stability". Everyone likes to know where he or she stands. Or, to put it in the negative, too frequent change can breed uncertainty, or instability. The radioactive materials packaging and transport industry thrives within a stable regulatory framework for safety. For a stable regulatory regime allows operators to be properly trained; it allows operators to become familiar with safety requirements, and to be at ease with them. Stability is conducive to safety and efficiency. And yes, stability is good for business too – for stability in package and transport requirements allows sufficient time for a fair return on investment in expensive package design, manufacture, licensing and use over time.

Stability need not, however, be the enemy of creativity, nor the denier of new thinking, or of necessary change. Rather, the point I want to make is that stability allows the space to learn the lessons of experience; for it is from experience that ideas can spring. Experience either can teach us that we've got it right and so, would do well to stick with what we know; or, from experience we can dare to think new thoughts of how to do things better or to do them more efficiently. Stability allows space for thinking outside the box. We may thus conclude either that we ought to stick within the box, or instead, we have good cause to continue our explorations outside.

Let's look at one or two concrete examples to illustrate the point. Uranium concentrates have been packed for transport, since the earliest days of commercial mining, in 210 litre drums. I am not sure if anyone can remember anymore why it should be in drums – was it because it was the closest package at hand all those years ago and seemed fit for purpose?

In any event, it has been the 210 litre drum for decades. And those drums have been shipped in ISO containers, secured in the containers over the years by a variety of means from wood dunnage to strapping. Sure enough the 210 litre drum has been a work-horse; and industry is comfortable with it. For long there has been stability in the packing of uranium concentrates, and no end of experience. And so, the old adage comes to mind – "if it ain't broken, then why fix it?"

But the world of uranium production is a very different one today than it was fifty years ago. The production volumes today bear no comparison with the distant past, and those volumes are expected to grow spectacularly in the years ahead in line with rapidly expanding world demand. Uranium production and transport today has become a global enterprise, with mining operations in far-flung corners of the world, from North America to Central Asia, Africa and Australia; and often far removed from conversion, enrichment and fuel fabrication and assembly facilities.

The means of transport also have changed dramatically over the decades. It used to be that the whole of a ship's hold was the container – today the container is a 20 or 40 foot box. Modern ships can carry thousands of these containers at a time. And international shipping is a highly complex, time-sensitive business often involving sophisticated transport hub and spoke routing systems.

Does it continue to make sense to put round pegs – 210 litre drums – in square holes – ISO containers? Does this remain the most-efficient, cost effective way safely to transport uranium concentrates? Is there an opportunity here for thinking outside the box? Are there lessons to be learnt from the packaging of bulk powders of other kinds?

I flag this up as but one example of how stability, and the experience that accumulates within a steady state, can provide nourishment for creative thinking. At the very least, a taking stock of where we are at can confirm the continued efficacy of what we have. But nothing should be taken for granted just because it has always been done that way – remember, by standing still the risk is that the rest of the world may pass you by.

Let's look at another example taken from a further step along the nuclear fuel cycle - the thermal test requirements for the packaging of non-fissile or fissile excepted uranium hexafluoride. Some years ago it was determined that packages containing uranium hexafluoride, or HEX as it is known, ought to demonstrate that they would survive 800 degrees centigrade of a fully engulfing fire for thirty minutes. International research has been done by experts, some concluded that the bare 48 inch HEX cylinder, as used routinely for many decades, would meet this standard; but an equal number of experts were not so sure. And so, taking the conservative approach, the International Atomic Energy Agency adopted the new test criterion as the standard requiring that the package license applicant demonstrates unequivocally that HEX packages meet the new thermal requirement including the large 48 inch cylinders.

This concentrated minds within industry with an eye to a looming deadline for implementation of the new criteria. So that industry could continue to move HEX in 48 inch cylinders without interruption, a variety of technical solutions to give assurance as to the thermal requirement were examined intensively, and eventually narrowed down to a few solutions – some opted for a special transport unit to provide additional heat protection; others opted for a composite cover, or a thermal blanket – all with the same purpose of satisfying conclusively that the package would meet the thermal criterion. Remember, I observed that in the period leading up to adoption of the new standard, there was a divided view amongst regulators as to whether the bare cylinder, without an additional protection, would meet the 30 minute criterion. The fact is that industry took its responsibility seriously, and at considerable expense came up with the technical solutions to provide the satisfaction that I mentioned. This work consumed much productive effort within the industry. But, the basic question still is out there; would the 48 inch bare cylinder, without the added thermal protection, reliably survive the 30 minute test?

The experience of transporting the 48 inch cylinders with added thermal protection has been accumulating. What we have learnt from that experience is that the additional work involved in putting on the thermal protection, and removing it again, has added steps to the handling operations, has increased worker exposure to the cylinders with increased risk of accidents, and has added to the costs. This begs the question, recalling the inconclusive view of the early research with regard to the bare cylinder as to whether all this really is necessary. Now that we have mounting experience with the cylinder and its added thermal protection, is it time to take stock? Is this another opportunity to think outside the box? What lessons can we learn from experience?

The robustness of packages is based on the risk factors associated with the radioactive materials they contain. For low dose radiopharmaceuticals a cardboard carton may be sufficient; for high-level residues from nuclear power plants, 100 ton plus metal packages are prescribed. Generally, if the material is fissile, and poses a criticality hazard, then more robust packages are called for. However, very low quantities of fissile material, relative to the overall volume of material in which it is contained, do not pose a realistic criticality hazard. This is the case for many fissile waste streams from fuel processing and decommissioning operations. These wastes normally are destined for recovery or safe disposal, and need to be transported. While there are fissile excepted provisions in the current IAEA transport safety regulations, they bear some new

thinking, based on experience, to take account of the actual situation in industry. More realistic provisions for materials containing low concentrations of fissile materials that pose no realistic criticality risk could greatly reduce the need for re-packaging and reduce the number of packages needed for transport. This would improve safety, reduce dose uptake, and provide significant financial benefits to both industry and the regulator.

It is a basic principle of transport safety regulation that safety is vested primarily in the package, and not the mode of conveyance. I don't think this basic fact is as well known and understood as it should be. It is lost, sometimes, on those who voice their concerns about radioactive materials transport. Some time ago, at a major international conference on transport safety, I heard someone make a statement in which was said that while they accepted the maritime transport of radioactive materials had an outstanding safety record, and that the likelihood of a transport accident involving radioactive materials was very small, if nevertheless there was such an accident, then the consequences would be catastrophic. This concern took no account of the essential difference between the transport conveyance – be it truck, train or ship – and the package. It simply does not follow that because there could be damage to the conveyance, that the inevitable result would be a serious radiological incident. The essential point here is that safety is vested primarily in the package, and not the conveyance. The robustness of the package is dictated by the risk properties of the materials it contains. Safety standards for packages are set internationally by the International Atomic Energy Agency (IAEA). Packages designs are subject to a rigorous internationally-established test regime; a test regime that takes account both of normal and conceivable realistic accident conditions to demonstrate conclusively that the package will provide adequate protection. Packages will only be licensed for use by national competent authorities on the basis of a convincing safety case.

So, looking outside the box – when confronted by uncertainty about the safety of radioactive materials transports, I suggest that industry not limit itself to reassuring words about the undeniably excellent safety record of transport over decades, with no radiological incident in transport causing substantial damage to health or the environment. Instead, I suggest that when confronted by the potential transport accident scenario, industry acknowledge right away that yes, transport accidents can and do happen, and odds are will happen again. But – and this is the essential point –transport incidents are not the same thing as radiological incidents.

I found myself on a panel a few years ago where this very point was being made. My fellow panelist, an opponent of radioactive materials transport in his region, was citing figures for the number of road accidents per million miles involving trucks, and of them, the percentage that had been of a catastrophic nature. It followed, therefore – to his way of thinking – that one could reasonably deduce that a certain percentage of transports involving radioactive materials would be involved in an accident and, therefore, it was a risk not worth taking. He said nothing about the package. For my part, I talked about the package and its safety features, the rigorous international safety test criteria to assure the package would survive realistic regular and accident conditions of transport, and the need to present a convincing safety case to competent authorities before a license would be issued. I did not deny the statistical possibility of transport accidents; more important, however, I suggested, was to focus on the likely consequences of accidents. This prompted a lady in the audience to raise her hand –Why, she asked, did my fellow panelist not talk about the safety characteristics of the package – of the fact that safety is vested primarily in the package and not in the transport conveyance. It was the first time, she said, that she had heard anyone talk about the package rather than the conveyance.

I would like to carry the communications theme a little further in the spirit of thinking about public communications outside the box; or otherwise put, testing some possible well-worn assumptions about how best to win the hearts and minds of people to the virtues of nuclear packaging and transport. A few years ago, in the United Kingdom, a survey was undertaken to determine who the British public considered the 100 greatest Britons of all time. You can imagine some of the names – the football superstar David Beckham, Princess Diana, the Beatles. Scientists hardly figured in the top one hundred.

I don't think people place as much trust as they did in people in authority, including the scientist, as they did when I was young. We live in a more sceptical age, a 24-7 communications age when people increasingly rely on the 10 second sound bite for their information. Busy people often do not seem to have the patience to follow a lengthy reasoned argument. It is not even the age of television news channels anymore – the new media: the internet, Facebook, YouTube, text messages are the latest thing. Just look at the example of the American presidential election last year in which hundreds of millions of dollars were raised through millions of small donations over the internet, and one candidate announced his choice of vice-presidential running mate to millions of internet supporters by telephone text message before announcing it to the news media.

We ignore the new media at our peril. Even as we are giving our background press briefings to the traditional print and television media, young people – and I don't just mean teenagers - are uploading images onto YouTube; they are texting each other, and engaging in chatter on Facebook. How good are we in a mature industry at monitoring the new media to understand what the emerging generation are thinking and saying? How good are we at communicating to them through

the media they value? How good are we at crafting our communications messages in ways that are convincing to them?

The scientist, the engineer, works in a world of empiricism, of facts; but society at large also functions in a world of values, beliefs and attitudes. To be convincing we must be able to communicate to people in a way that resonates with them. And we can do it – we have a great message to tell: clean, reliable and ample base load energy for the future. And a safety culture that is second to none. The opponents of nuclear energy, or those who would impede the necessary transport related to the provision of nuclear energy, don't have a monopoly on virtue. Who has a greater stake in safety than those who work within the industry – aren't we every bit as concerned about the safety of our partners, children, and communities?

Ladies and gentlemen; for those of us committed to the safe, efficient and reliable transport of radioactive materials, we should embrace with confidence the possibilities of thinking, and of communicating, outside the box. Yes, stability in regulation and operations does enhance safety; but we have to run very fast just to stand still. And if we stand still, the rest of the world will pass us by. The nuclear industry, and its packaging and transport sectors, are at the forefront of leading edge technology – offering enormous hope to respond to one of the greatest challenges of the 21st century – the provision of abundant, reliable, and clean, base load energy. So, let's embrace the 21st century, and not be bound by 20th century ways of doing things and of communicating what we do, just because, well, we've always done it, or said it, that way, and it seemed good enough. Take stock from time to time, test well-worn assumptions, of course stick with the tried and true if, upon examination, the tried and true stand the test of time. But, if through taking stock, new ideas emerge, then, let's embrace them with confidence and with enthusiasm.

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