Illicit Trafficking in Radiological and Nuclear Materials. Lack of Regulations and Attainable Disposal for Radioactive Materials Make Them More Vulnerable than Nuclear Materials.

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Illicit trafficking in nuclear and radioactive materials is far from a new issue. Reports of nuclear materials offered for sale as well as mythical materials such as red mercury date back to the 1960s. While such reports were primarily scams, it illustrates the fact that from an early date there were criminal elements willing to sell nuclear materials, albeit mythical ones, to turn a quick profit. In that same time frame, information related to lost and abandoned radioactive sources began to be reported. Unlike reports on nuclear material of that era, these reports on abandoned sources were based in fact – occasionally associated with resulting injury and death.

With the collapse of the Former Soviet Union, illicit trafficking turned from a relatively unnoticed issue to one of global concern. Reports of unsecured nuclear and radiological material in the states of the Former Soviet Union, along with actual seizures of such material in transit, gave the clear message that illicit trafficking was now a real and urgent problem. In 1995, the International Atomic Energy Agency (IAEA) established an Illicit Trafficking Data Base to keep track of confirmed instances[1]. The IAEA chose a broad definition of illicit trafficking – "the unauthorized acquisition, provision, possession, use, transfer, or disposal of nuclear and other radioactive materials – whether intentional or unintentional and with or without crossing international borders" and in addition, "unsuccessful or thwarted acts…, the loss of materials and the discovery of uncontrolled materials.". By means of this broad definition, Illicit Trafficking is deemed to include not only radioactive materials that have been offered for sale or crossed international boarders, but also such materials that are no longer under appropriate regulatory control.

The events of September 11, 2001 (9/11), took concerns related to illicit trafficking in radioactive materials to an entirely new level. No longer were concerns regarding nuclear materials limited to proliferant states acquiring such materials for their clandestine nuclear program, the concerns were now expanded to include international – and home grown – terrorists. In a like manner, concerns regarding other radioactive materials were seen in a whole new light. Before 9/11, radioactive sources had been seen as a risk to health and safety. After 9/11, radioactive sources became a high level national security concern. The need to stop the illicit trafficking of nuclear and radioactive materials is undeniable and urgent. Particular so, given the potentially serious

[1] According to IAEA several hundred incidents were reported in the open press but not confirmed and therefore, were not included in the IAEA statistics, IAEA Annual Report for 2006.

consequences, the known interest of terrorist groups in acquiring such materials, and the vulnerability to theft and diversion of such materials.

As an outcome of 9/11, the United States took a closer look at illicit nuclear trafficking as well as a reassessment of the safety and security of nuclear and other radioactive materials both in the United States and Globally. This reassessment launched heightened controls and security domestically and increased our efforts internationally to prevent illicit nuclear trafficking. This reassessment also brought about the Global Threat Reduction Initiative which aims to further reduce the threats of weapons usable nuclear materials as well those of radioactive sealed sources[2].

The United States was not alone in seeing illicit nuclear trafficking in a new light after 9/11. The XLV General Conference of the IAEA adopted a resolution CG (45)/RES/14 of September 21, 2001 on measures to take against illicit trafficking in nuclear materials and other radioactive materials. Bearing that Resolution in mind, on November 30, 2001, the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (OPANAL) member states adopted a resolution calling on all OPANAL member states "to adopt measures to prevent and impede the illicit trafficking of nuclear materials for terrorist actions and other non-peaceful uses."[3]

Now, over five years after 9/11, we should make an effort to reflect on the changes that have occurred and to consider where additional steps to stop illicit nuclear trafficking should be taken and if they should be taken, who should take the lead. While national level regulations set the direction, effective action must ultimately take place at the working level. This brings to mind the question has industry truly done enough – a subject we will revisit at the conclusion of this paper.

This paper will focus on the issues related to a subset of the materials involved in illicit trafficking in nuclear and radioactive materials, that of radioactive sealed sources. Such a focus doesn't indicate a lack of concern for illicit trafficking in nuclear materials. Concerns over trafficking in nuclear materials are clearly justified by the potential for nuclear proliferation and nuclear terrorism. The focus on radioactive sealed sources is based on our belief that insufficient attention has been paid to trafficking incidents involving such sources which constitute the majority of trafficking cases. According to the IAEA's Illicit Trafficking Data Base, as of December 31 2005 there were 827 confirmed cases reporting by the participating states[4], including 250 incidents (or 30%) involved nuclear and other radioactive materials and 566 (or 68%) involved other radioactive materials, mostly radioactive sources, and radioactively contaminated materials.

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[2] GTR Fact Sheet, www.doe.gov/media/ViennaGTRFactSheetFinal
[3] OPANAL CG/419, Xvii Regular Session, November 30, 2001

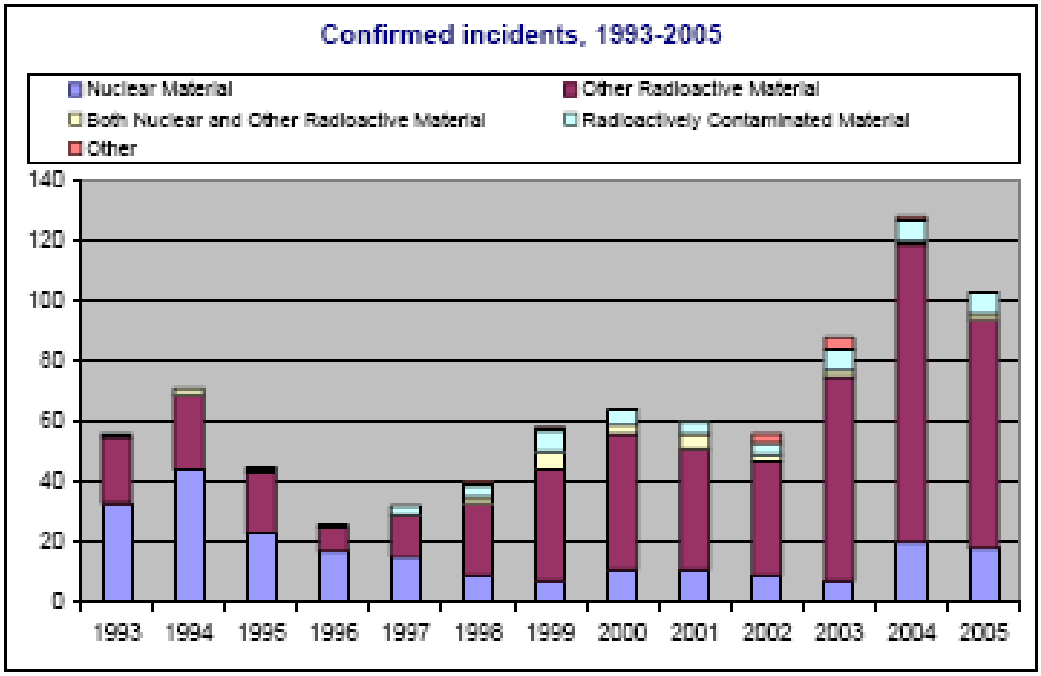

Fig. 1. IAEA Illicit Trafficking Data Base. 2006 Annual Report.

Experts in the *Lugar Survey on Proliferation Threat and Response* (June 2005) agreed that an attack with a Radiological Dispersion Device (RDD) was the most probable form of nuclear terrorism the world could expect over the next decade[5]. At the same time radiological materials are used in wide a variety of applications, located in virtually every country and in general, radiological materials are far easier to access than nuclear materials.

The international system for accounting and control of nuclear materials that could be used for nuclear explosive purposes is well established. As a direct extension of U.S. President Eisenhower's vision of utilizing atomic energy for the benefit of all mankind, the International Atomic Energy Agency was established together with its system for safeguarding the peaceful uses of fissionable materials. The system for safeguarding source and special fissionable materials at the state and facility level is robust and well understood.

On the other hand, the system for control of radiological materials has not been developed to the equivalent level. Additionally, inadequate or nonexistent regulatory structures for radiological materials in many states further exacerbate this problem. Currently, even in states with systems for managing radiological sources, there are no clear disposal paths for many types of sources. This situation is largely responsible for ever-increasing numbers of unused, unwanted sources that could readily be obtained by terrorists or contribute to a significant radiological accident. Establishing clear disposal

[5] Lugar.Senate.gov/reports/NPSurvey.pdf

paths for radiological sources that have reached the end of their useful lives would reduce the likelihood of terrorists obtaining such material for use in an RDD or other tragic event.

It has become increasingly obvious that the lack of a cradle-to-grave approach for sealed radioactive sources that have reached the end of their useful life is the main reason that sources are abandoned. This situation is true both in the United States and globally. In the United States the Off-Site Source Recovery Project (OSRP) provides a partial solution to the problem of how to manage life cycle gaps for radiological sources. OSRP is organized under the NNSA's Global Threat Reduction Initiative, NA-21 and is managed by Los Alamos National Laboratory. The mission of OSRP is to eliminate the threats posed by excess, unwanted and abandoned radiological sources to public health, safety and national security. This is accomplished utilizing the following threat reduction options[6]:
Convert: *Find alternative technologies that replace the dependence on radiological material.*
Secure: *Where radiological materials remain useful and in-use, assure a strict degree of control and oversight through effective regulation which equally stresses safety and security.*
Remove: *Where radiological materials are found as a legacy, excess, unwanted, or at risk because of inadequate control, the only assurance of achieving threat reduction is to recover and remove the material to secure storage or disposal.*
It should be noted that the "convert" and "secure" options both require that effective and efficient recovery and removal be established and remain in place, since it is simply a matter of time until the need of removal to ultimate disposal will be required..

The primary thrust of the OSRP has been to recover and remove radiological sources to secure storage or disposal[7]. Since 1999, OSRP has been able to recover about 14,000 sealed sources from nearly 600 sites in 48 States, the District of Columbia, Puerto Rico and several foreign countries. This approach has been highly effective in reducing excess and unwanted sources that have accumulated in the United States and has reduced the burden on regulatory agencies by reducing the amount of radiological material held under license that had non use or pathway to disposition or disposal.

As we begin to look at this issue from a global perspective, through the Global Threat Reduction Initiative or other related efforts, we need to look for ways to provide a cradle-to-grave approach for radioactive sealed sources. Absent such an approach, the threats posed by the global accumulation of unused, unwanted radioactive sources will simply continue to grow. Let's take a look at some of the issues related to sealed sources in developing countries.

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[6] The Global Threat Reduction Initiative – Radiological Materials, Recovery and Removal. Leory Leonard, INMM Annual Meeting, July 2006
[7] OSRP.lanl.gov

Ethiopia makes use of Co-60 sources as part of a program to eliminate sleeping sickness by irradiating (sterilizing) tsetse flies[8]. This is part of a serious effort by FAO and IAEA to combat the plague of sleeping sickness on the African continent. However, in a relatively poor, developing nation that lacks a proper nuclear regulatory agency and lacks established nuclear infrastructure, how, and by whom, will the ultimate disposition of the Co-60 be managed when they reach the end of their useful life?

Ghana is a West African nation that is attempting to improve its ability to export agricultural products by use of irradiation to improve product transportation/shelf life. For example, Ghana makes use of an old, not full strength sealed source for the irradiation of pineapples[9]. While Ghana has accepted the IAEA "Code of Conduct"[10], and provides regulatory and technical support to other West African Countries, the lack of economic resources to implement effective controls is a cause for concern. What will be the disposal pathway for Ghana's sealed sources when they become unused and unwanted?

The cases above underline the concerns that companies are providing used sources to other users without clear mechanism of ownership transfer. There have been a number of programs supported by IAEA when the used sources were provided to the new user. In addition, there have been cases when the transfers are done on bilateral agreement. Will the companies account for this transfer and assume responsibility for the sources transferred to other owners? It seems we prudent to expect that the companies would not donate or transfer a source, especially outside of their own country, to another user without a clearly established disposal path.

It appears that the questions will ultimately become whether industry will impose additional regulations upon itself and become self-regulating with respect to repatriating radioactive material at the end of service life, or whether national authorities at some point will take actions and regulate the industry. Argentina, which is one of the most advanced countries regarding control of radiological sources adopted additional measures to safeguard its radiological materials to a level comparable to that proscribed for nuclear materials. This approach, while highly successful, has led to some minor unforeseen consequences, namely insufficient funds to implement all regulations in full and a lack of inspectors and appropriate equipment to assure compliance This is not an unusual outcome. Regulations imposed by a national regulatory authority may be technically excellent, but their implementation may provide a funding challenge. A more practical approach may be to have the industry to impose regulations upon itself, which could be accomplished within the economics of the industries involved.

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[8] Eradicating Tsetse Flies form Africa. Small Insect Is a Big Problem for Agriculture and Helath. Naututu Okhoya, Africa Recovery, Vol.17 #1, May 2003, p.17

[9] Irradiated Pineapple is US-bound, West African Trade Hub, USAID report 2006

[10] www.IAEA.org/tech-areas/radiation-safety/code-of-conduct