

CHAPTER 2

CAN WE TRACK SOURCE MATERIALS BETTER – DO WE NEED TO?

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Uranium is a naturally occurring element found in low levels within all rock, soil, and water. This is the highest-numbered element to be found naturally in significant quantities on earth. It is considered to be more plentiful than antimony, beryllium, cadmium, gold, mercury, silver, or tungsten, and is about as abundant as arsenic or molybdenum. It is found in many minerals including uraninite (also called pitchblende, the most common uranium ore), autunite, uranophane, torbernite, and coffinite. Significant concentrations of uranium occur in some substances such as phosphate rock deposits and minerals such as lignite and monazite sands in uranium-rich ores (it is recovered commercially from these sources).

All of this is to say that uranium is found in most countries at least in some concentrations, and in many countries in fairly rich deposits. Uranium has been mined in many countries around the world, including Australia, Brazil, Argentina, Portugal, France, East Germany, Bulgaria, Czechoslovakia, Niger, Gabon, Namibia, South Africa, Zaire (Democratic Republic of the Congo [DRC]), Russia, United States, Canada, Kazakhstan, Uzbekistan, China, Mongolia, and Sweden. New mines are under development in Malawi, Zambia, and Uganda, to name a few.

It should be obvious that uranium, as a source material, can be used within even a small commercial research reactor to create quantities of plutonium that

can in turn be used to create weapons. This could be done in such a way as to circumvent international safeguards. The case of the Osirak Reactor bombed by the Israelis on June 7, 1981 under Operation OPERA was deemed by Israel *and* Iran to be such a case. Ironically, the Iranians had bombed the reactor on September 30, 1980, but had not destroyed it. Israel was more successful. Why was it necessary to bomb the reactor? Iraq had obtained large quantities of natural uranium either through open commercial means or through stealth. This material would have been transmuted into plutonium 239 in the reactor. Both Iran and Israel felt the need to deal with the threat before it became a certainty.

Israel well understood this method because it had itself apparently followed a similar path. Under Operation PLUMBAT in 1968, the German freighter *Scheersberg A* disappeared on its way from Antwerp to Genoa along with its cargo of some 200 tons of uranium oxide (yellowcake). When the freighter reappeared in Iskenderun, a Turkish port, the cargo was missing; it had been transferred at sea to an Israeli ship. It is believed that this uranium was transferred to the Dimona facility in Israel for use in the research reactor.

More recently, A United Nations (UN) report dated July 18, 2006, said there was “no doubt” that a huge shipment of smuggled uranium 238 uncovered by customs officials in Tanzania in October 2005 was transported from the Lubumbashi mines in the Congo. A senior Tanzanian customs official said the illicit uranium shipment was found hidden in a consignment of coltan, a rare mineral used to make chips in mobile telephones. The shipment was destined for smelting in the former Soviet republic of Kazakhstan and delivered

via Bandar Abbas, Iran's biggest port. It is unlikely that this cargo would have made it to Kazakhstan. It would have been diverted for use in Iran for purposes we can only suspect.

Prima facie, these cases would call for more controls over source materials, including uranium and the other principal source material, thorium. Thorium, which can also be used to produce materials suitable for weapons applications, is found in small amounts in most rocks and soils, where it is about three times more abundant than uranium and is about as common as lead. The current thorium mineral reserve estimates are shown in Figure 1.

Country	Current Thorium Mineral Reserves (in Tons)
Australia	300,000
Brazil	16,000
Canada	100,000
India	360,000
Norway	170,000
South Africa	35,000
United States	160,000
Others	95,000

Figure 1. Current Thorium Mineral Reserves Estimates.

But there are already requirements for reporting the sale and transfer of source materials from one country to another. International Atomic Energy Agency (IAEA) member states do report these shipments, and they are generally effective, as long as the parties want them to be. The question is how to enforce these requirements. It seems obvious that in the not too distant past there

has been circumvention, caused by a national program disguised to evade international detection. In the case of the Tanzanian intercept, the shipment was apparently detected by equipment installed at the port under the U.S. Megaports program to detect the potential smuggling of radioisotopes along the Indian Ocean Coast. It may have been merely a coincidence that it detected the uranium ore concentrates, BUT IT DID.

Since uranium and thorium are so abundant; since it is not illegal to sell these materials; since it is easy to ship the materials and possibly to divert them; and since the materials can be used in programs to create weapons of mass destruction (WMD), it seems that additional administrative controls, while possibly helpful, cannot be relied upon to track and control these materials. Diversion will occur, when diversion is desired.

It is because of this, that *tracking* of material needs to rely on detection. In the past, railroads kept track of their rolling stock through administrative controls, and cars were lost on sidings, sometimes for months. Subsequently, an identification system using bar coding was developed so that when cars passed detectors, their last location was known. The problem was that when the cars were not moving, only their last known location was known. More recently, global positioning systems (GPS) have been incorporated into the tracking of cars and also now truck fleets. This provides for location detection even when vehicles are not moving.

In order to detect diversion, producers of uranium could incorporate some advanced technology into the shipping components. This would detect the PLUMBAT-type circumstance as long as the shipper was not a party to the diversion.

No type of “in package” device will detect the nationally-sponsored diversion like that which occurred in Tanzania last year. Presumably, no one would wish to be detected in that case. Iran planned an elaborate mechanism to evade detection, but did not count on the MegaPorts detectors. One would expect future diversions to take this into account.

The next line of defense is to render the possession of the materials harmless. Without unsafeguarded reactors or enrichment plants, the possession of source materials is meaningless. North Korea could not use the spent fuel from its reactor as long as the reactor was under IAEA safeguards. Instead, they built an undeclared enrichment facility and later quit the safeguards regime to pursue their objectives by using the reactor fuel after all. They are clearly able to obtain source materials despite the current controls, both administrative and physical.

More physical detection equipment at seaports *and* airports would be essential to detect the movement of radioactive cargos and to alert officials to potentially unknown shipments. This, unfortunately, would also trigger many alerts based on known and existing shipments. It could slow or even impede the transport of legitimate cargos as carriers and ports prohibit the shipment of cargos so as not to impact their general operations. This leads to more “delay and denial” problems.

Australia and Canada have put substantial administrative controls on their source materials. Strict conditions apply through the bilateral agreements that these countries enter into with other nations. It is certain that their materials will not be diverted to be used inappropriately. If only all countries were to take the same approach. But such is not the case at this

time. The Nuclear Suppliers Group has outlined the mechanisms for the control, transfer, and retransfer of source materials, including export licenses and physical security. This is not enough, however. It has not prevented the diversion of centrifuge technology, although it may have slowed it somewhat.

Uranium and thorium, being so widely distributed, are much easier to mine, process, and ship. The good news is that these radioactive materials can be detected, if sufficient equipment is positioned worldwide. Beyond yellowcake, of course, are the source material products of processed uranium hexafluoride. Unlike yellowcake, only a limited number of countries currently produce uranium hexafluoride products. As a result, monitoring the production and transfer of these materials would be much more practicable than it would be for yellowcake. In fact, it was intelligence on the transfer of Chinese uranium hexafluoride to Iran in the early 1990s that helped tip off the United States and the IAEA on Iran's undeclared uranium enrichment program. This example suggests the leveraged utility of focusing on such transfers.

In conclusion, tracking of source material through either administrative or physical controls is essential. The methods used to date have not prevented and cannot prevent diversion of these materials. Advanced technology could be useful in further detection of attempts to divert but would not be foolproof. IAEA facility safeguards are only useful when applied to all facilities within a willing country. Tracking of source materials cannot in itself prevent development of weapons, but it can be one small tool in the process to detect and slow the diversion of materials.