

*by Dana Sacchetti*

# The Big Fix

## *Global Cleanout to Combat Serbia's Radiological Legacy*



(Photo: IAEA)

A soft summer rain falls on a decrepit, rusting warehouse in the suburbs of Belgrade, Serbia. From the outside, all appears normal, nothing more than a shabby storehouse set against a small patch of trees. But inside, a pile of decades-old radioactive waste in deplorable condition has sat for decades, posing a threat to the health and safety of people and the environment. More than a thousand sealed radioactive sources remain inside — a half-century's stock of radioactive refuse from the former Yugoslavia and Serbia. But the full picture of what's inside this radioactive storehouse is a mystery, since precise records haven't been kept.

Such is the scene at the Vinča Institute of Nuclear Sciences, a large research campus that served as the nerve center for former Yugoslavia's nuclear research activities since the late 1940s.

Just a few kilometres from the Danube, the site has endured different periods of upheaval and influence, including varying degrees of Cold War-era intervention by the US and the Soviet Union. In 1959, the USSR supplied Vinča with the nuclear fuel and technical assistance to construct Vinča's 'RA' reactor, a 6.5 megawatt, heavy-water moderated research reactor capable of using fuel highly enriched in U235. The RA reactor was actually the second to operate at Vinča, and was preceded by the country's first nuclear reactor, a heavy-water zero-power critical assembly (which is still in operation). There has been much speculation as to the original intentions for the facility under Yugoslavia's then-leader Josip Broz Tito, and some research seems to indicate that a modicum of weapons research may have been conducted at Vinča in its early days.

Changes in government, the breakup of Yugoslavia, and the NATO bombing campaign in 1999 are all factors that conspired to keep Vinča's management, direction, and focus in a constant state of flux. These dynamics brought Vinča to where it is today; and serve as a prime example of capable scientists and sophisticated equipment falling prey to political winds of change.

Concerns about Vinča on the part of the international community grew in the mid-1990s, when IAEA teams were dispatched upon Serbian request to inspect the site. These visits were instrumental in alerting the outside world about the state of the nuclear fuel on site, and the inherent risk to health and safety of those around Vinča.

As part of the IAEA and global community's push to support reduced enrichment for research and test reactors, along with concerted efforts to return highly enriched uranium (HEU) fuel to the country of origin, an extraordinary level of international cooperation has coalesced to clean up Vinča.

The first major step in the Vinča project took place earlier this decade, when the most urgent threat to proliferation was dealt with. In 2002, an international operation to return 48 kilograms of unirradiated HEU fuel of Soviet-origin came about after protracted negotiations between then-Yugoslavia, the US, Russia, the IAEA, and other parties. The transport of the fuel was conducted amid intense security, with over 1200 armed guards ushering a convoy of trucks to the Belgrade airport for a flight to Russia, where the HEU would then be down-blended to a low-enriched form. IAEA safeguards inspectors watched over the procedure by gauging the fissile material, inspecting records, and applying seals to the shipping containers.

## The Current Workload

Since return of the unirradiated HEU, the foremost priority has been to deal with two and a half tons of Russian-origin irradiated, spent nuclear fuel elements, which were initially used in the RA reactor. As the reactor last went critical in 1984, the SNF has been stored for decades in aluminium barrels in an adjoining spent fuel pool. However, the pool's water chemistry has been poorly maintained, leading to corrosion of the fuel element's aluminium cladding and leakage of fission products into the storage pool, though not into the environment. The water's condition is further degraded by an accumulation of sludge, increasing the pool's turbidity and lending it an inky black colour.

So the push is now on to repackage and repatriate the spent fuel for return to Russia, and the strong support and involvement of the Serbian Government has been instrumental in moving this project forward. An agreement between Serbia and Russia that governs the transfer of the fuel was signed this past June, and work is set to begin in autumn. Yet the task is fraught with complexities, and long lists of preparatory steps need to be taken to facilitate the fuel repackaging and removal work.



IAEA Director General Mohamed ElBaradei visited the facility in early July 2009, to assess the progress at Vinča. "The unused nuclear waste is in poor condition and needs to be moved as soon as possible. The situation is under control for now, but it could be very dangerous from a safety and security point of view," he commented.

To remove, characterize, and repackage Vinča's spent fuel, technologically unique operations will have to be performed. Sludge in the pool needs to be removed, custom fuel handling equipment needs to be designed and fabricated, and enhanced radioactivity monitoring systems need to be installed before repackaging begins. The fuel also needs to be stabilized and undergo thorough analysis before it can be removed. Finally, roads leading to the spent fuel storage room need to be reinforced to increase loading capacity and access for the trucks, cranes, and steel casks that will be used in the operation. Over 50 experts and technicians have been assigned for the task ahead. A target date of the end of 2010 has been set for the shipment, and work is set to begin in autumn 2009 to begin the fuel repackaging portion of the project.

"For the Vinča project, we've needed access to huge, expensive technologies to move this massive amount of fuel back to Russia," said John Kelly, the IAEA Special Programme Manager tasked with coordinating the Agency's work.

**The Vinča Institute of Nuclear Sciences is the site of an aging research reactor initially built with cooperation from the USSR in the 1950s. The site has fallen out on hard times in recent years, however, there are radioactive dangers in need of urgent attention.**

(Photo: IAEA)





Two hangars chock-full of more than 1000 disused radioactive sealed sources and other radioactive waste have sat for decades in degraded condition. The sealed sources and waste need to be removed from the two aging hangars and conditioned for secure and safe storage in new long-term storage facilities.

(Photo: IAEA)

## Radioactive Waste

Yet another important dimension to the Vinča clean-up effort that the IAEA and the international community are helping Serbia with is the construction of new facilities to deal with the legacy of radioactive waste at Vinča. Two hangars chock-full of more than 1000 disused radioactive sealed sources and other radioactive waste have sat for decades in degraded condition. The sealed sources and waste need to be removed from the two aging hangars and conditioned for secure and safe storage in new long-term storage facilities.

All told, the waste will be dealt with by a waste storage facility, a secure storage bunker, and a waste processing facility. These three systems are in various stages of development, but the IAEA has committed to working with Vinča and Serbian regulators to commission these new installations. A sealed source conditioning facility is also on the near horizon. The support to the radioactive waste management improvements includes safety and security assistance, training and experts, facility upgrades, regulatory assistance, and equipment donations. Much like the spent fuel repatriation, the radwaste management project is expected to take several years to complete.

## The Importance of Success

Logistically and financially speaking, the Vinča Institute Nuclear Decommissioning (VIND) project is the largest Technical Cooperation programme in the Agency's history. Several divisions within the IAEA have deployed technical officers to work on the project, which involves the Departments of Safety and Security, Nuclear Energy, Safeguards, Legal Affairs, Procurement Services and Technical Cooperation. The funding aspect has been par-

ticularly challenging and given the complexity of the operation, it is little wonder that the price tag is expected to be \$47.5 million for the full spent fuel repackaging and repatriation portion. The VIND programme in total is projected to reach roughly \$75 million. To date, Serbia, the EU, the Czech Republic, Russia, Slovenia, Italy, UK, USA and the Nuclear Threat Initiative (a non-government donor) have made contributions to the project. The IAEA has also provided support through deployment of equipment, experts, and other assistance.

"With the vast amount of funding needed for the VIND project, pulling together such a disparate donor pool has been nothing short of miraculous," explained Kelly. "But momentum has been the key driver in making progress towards donations — when donors see you actually making progress, then they want to participate. Donors want to invest in success."

VIND highlights the IAEA's unique role and importance in collaborating with and coaxing financial assistance from a diverse donor pool.

"We're working closely with the Serbian government and our goals are identical," said ElBaradei. "We must ensure that there are no similar risks either here in Vinča or elsewhere in Serbia."

Though undoubtedly an expensive venture, the work is necessary, as leaving the site in its current condition is not an option. The VIND project is a prime example of the international community coming together through the IAEA to solve an important and complex safety and security challenge.



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