Decommissioning Uzbekistan's first research reactor

By Kendall Siewert

A sandy vacant lot lined by greenery in Tashkent, Uzbekistan may look like it's ready to welcome a new construction project, but this empty space is the result of the decommissioning of IIN-3M, a retired research reactor.

"A decision was made to decommission the IIN-3M reactor, since it had rarely been used in recent years, the equipment was obsolete and it was located near an airport that officials were considering expanding," said Fakhrulla Kungurov, Laboratory Head at the Institute of Nuclear Physics of the Uzbekistan Academy of Sciences. "No nuclear installation had ever been decommissioned in Uzbekistan before. The IAEA supported us during each step of the process, assisting in instances where we lacked the necessary experience and knowledge."

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Decommissioning the IIN-3M reactor at Uzbekistan's Radiation and Technological Complex (RTC) began in 2015 and ended in 2019. This process involved decontaminating, dismantling and demolishing the facility to release it, and its site, from regulatory control. The reactor had ceased operation in 2013 after being primarily used to test semiconductors and other devices since 1975. It is one of two research reactors in the country, with the second still in operation.

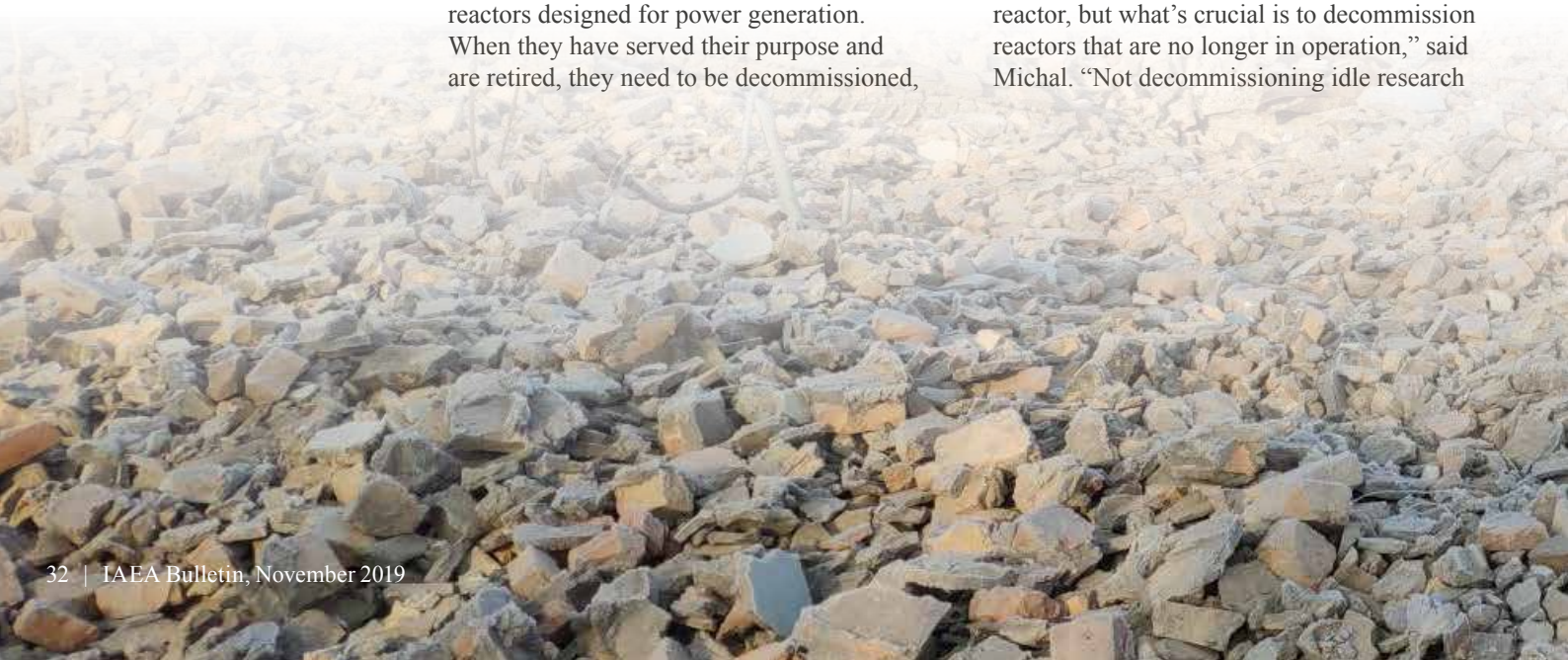
Research reactors provide a neutron source intended for applications in, for example, industry, medicine, research and education and training, in contrast to other larger nuclear reactors designed for power generation. When they have served their purpose and are retired, they need to be decommissioned, just like any other nuclear installation. The objective of decommissioning is to remove all sources of radioactivity, contaminated material and other structures so the site can be used for other purposes.

More than 60% of operating research reactors are now over 40 years old. The growing number of ageing reactors has resulted in increased decommissioning activity worldwide; there are currently over 220 research reactors in operation, while 443 have been decommissioned.

Countries may choose to decommission research reactors for a variety of reasons, such as the prohibitive costs of extending their lifetime for continuing operation, lack of funding or outdated technology, whereas others may decide to renovate and keep them in operation to continue benefiting from their use. However, an action plan is needed irrespective of whether operators and authorities decide to decommission an existing reactor now or much later in the future.

Upon request, the IAEA offers support and expertise to countries to ensure that they are well prepared to handle decommissioning safely and securely, said Vladimir Michal, a decommissioning team leader at the IAEA. In addition, the IAEA issues safety standards and reference publications that offer guidance and share good practices in this area, he said.

"Countries decide for themselves whether to continue operation or to shut down a reactor, but what's crucial is to decommission reactors that are no longer in operation," said Michal. "Not decommissioning idle research



reactors, or doing so improperly, can result in their structural deterioration and an increased risk for people and the environment."

Putting a plan in place

Today, it is standard practice to incorporate a decommissioning plan into the initial setup of a research reactor, but that was not the case in the 1970s when the IIN-3M reactor and many others were built.

"There was a general perception during the early years of building research reactors that decommissioning could be easily accomplished with minimal resources and planning. However, this is clearly not the case," said Kungurov. "As a consequence, we did not have a plan for the decommissioning process and no information on how to remove or deinstall the equipment, which is where the IAEA's support was vital."

IAEA staff and other international experts travelled to Uzbekistan in August 2012 to evaluate the site of the reactor. The goal of the visit was for experts to assess the state of the facility and gather the necessary information to assist Uzbek officials in preparing for decommissioning.

Based on the results of the 2012 visit and other meetings, IAEA experts worked with the national team to develop a decommissioning plan — including a project schedule and cost estimates — in accordance with the IAEA's recommendations and guidance on decommissioning planning.

"Estimating the costs for decommissioning was one of the most difficult parts of the planning process because our reactor operators had never done it before and it requires a lot of documentation," said Kungurov. All the information on decommissioning the IIN-3M reactor, such as the specifics of the procedures, equipment and tools to be used, was submitted to Uzbekistan's national regulatory body for approval prior to beginning work on the ground.

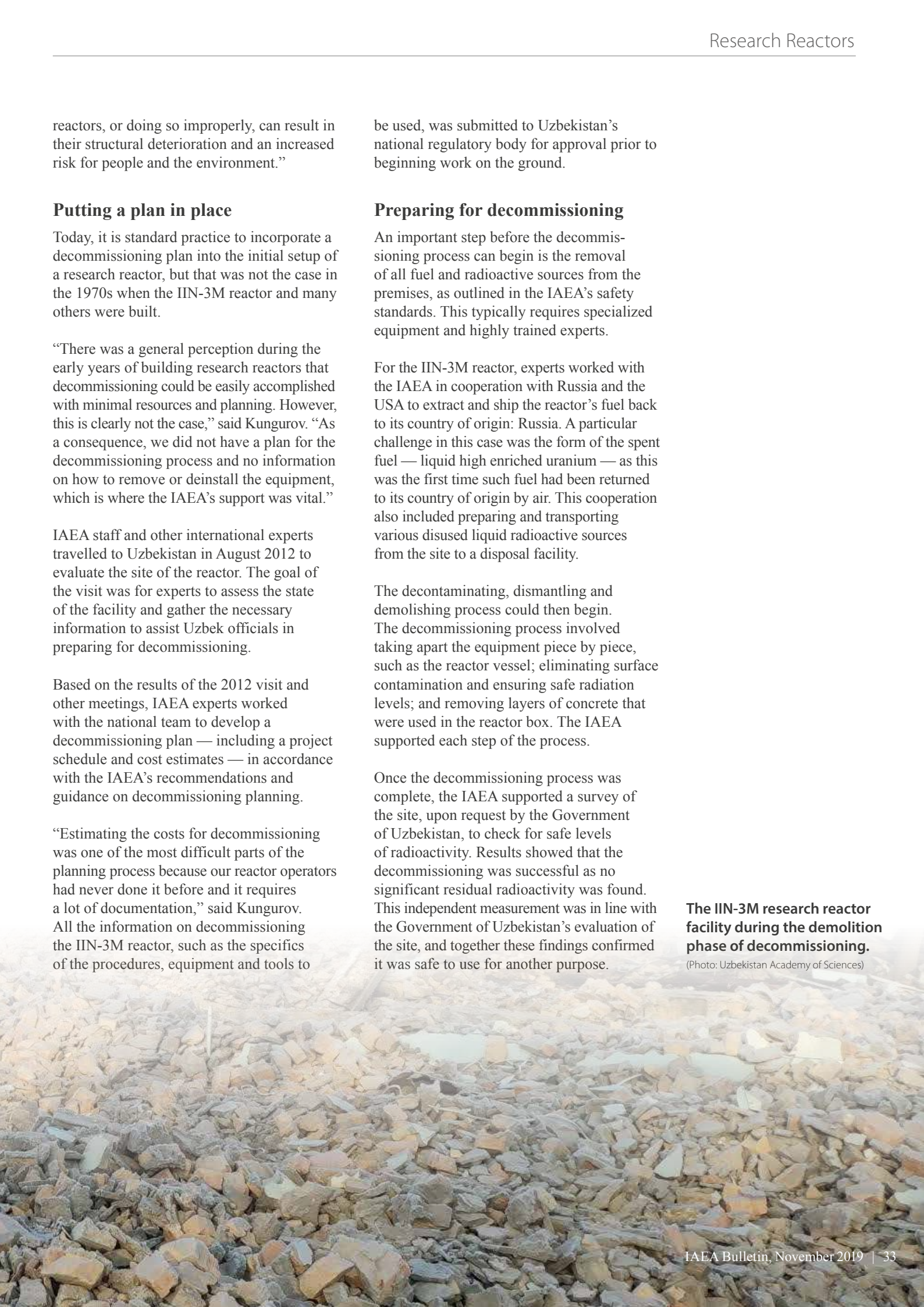
Preparing for decommissioning

An important step before the decommissioning process can begin is the removal of all fuel and radioactive sources from the premises, as outlined in the IAEA's safety standards. This typically requires specialized equipment and highly trained experts.

For the IIN-3M reactor, experts worked with the IAEA in cooperation with Russia and the USA to extract and ship the reactor's fuel back to its country of origin: Russia. A particular challenge in this case was the form of the spent fuel — liquid high enriched uranium — as this was the first time such fuel had been returned to its country of origin by air. This cooperation also included preparing and transporting various disused liquid radioactive sources from the site to a disposal facility.

The decontaminating, dismantling and demolishing process could then begin. The decommissioning process involved taking apart the equipment piece by piece, such as the reactor vessel; eliminating surface contamination and ensuring safe radiation levels; and removing layers of concrete that were used in the reactor box. The IAEA supported each step of the process.

Once the decommissioning process was complete, the IAEA supported a survey of the site, upon request by the Government of Uzbekistan, to check for safe levels of radioactivity. Results showed that the decommissioning was successful as no significant residual radioactivity was found. This independent measurement was in line with the Government of Uzbekistan's evaluation of the site, and together these findings confirmed it was safe to use for another purpose.



The IIN-3M research reactor facility during the demolition phase of decommissioning.
(Photo: Uzbekistan Academy of Sciences)