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Spent nuclear fuel in the crates in 2020

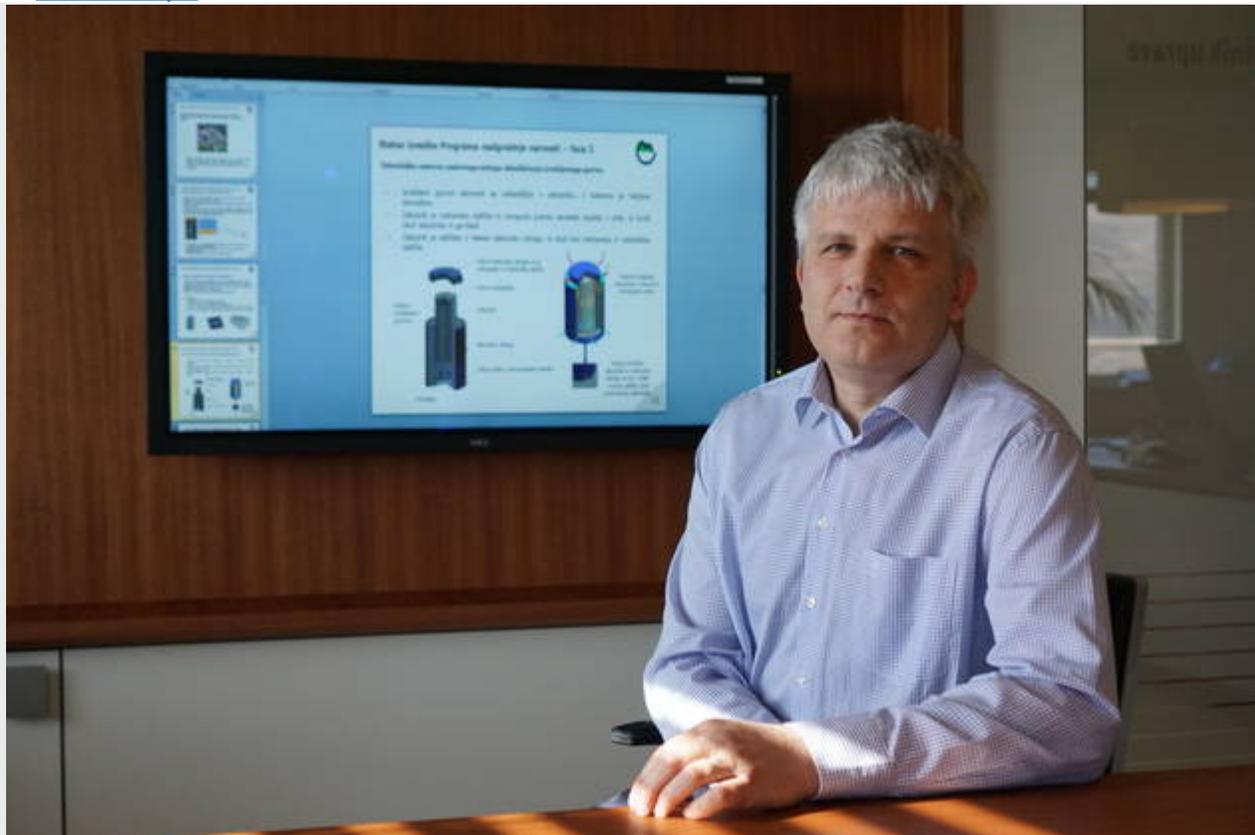
Dry Storage at Neko: The Fukushima accident has accelerated the transition to safer storage.

[Janos Zore](#)

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- [Nek](#) ,
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- [Božidar Krajnc](#)



Božidar Krajnc, Director of Engineering in Nek Photo: Janoš Zore / Delo

Krško - This March marked two important milestones in the area of nuclear waste. East of the Krško Nuclear Power Plant (NEK) preparatory works for the construction of a low and medium-level radioactive waste landfill (LILW) were started, while the management board of Neka signed a contract for the construction of a dry spent nuclear fuel storage (IG).

While the construction of a half-billion euro worth of landfill LILW (impurities from reactor coolant and waste generated during maintenance work in Neko) brings a definitive solution to waste that can

even be approached for a short period of time (the landing starts in 2021), a gradual transition on dry storage of spent fuel (protection against life-threatening gamma radiation is a thick layer of water, concrete or earth) only a temporary solution to a decade of remote final disposal in a very expensive landfill.

The Resolution on the Management of Nuclear Waste in Slovenia for the Period between 2016 and 2025 envisages the operation of a dry warehouse for at least 60 years, while the management board of Neka has demanded a hundred years of passive concrete-metal containers with the tender specifications.

"The contract for designing, equipment, building a dry storage building with a 45 x 70 meter framework dimension and for the first two stages of filling the warehouse in the total value of 68.3 million euros, we signed with the US company Holtec at the beginning of March," said President of the Management Board Neka **Stane Rozman** , who adds that the construction will begin in 2019. In the first phase of displacement of spent fuel from a water pool with 1209 fuel elements, in 2020, 592 fuel elements will be filled with 16 containers for dry storage.



President of the Management Board Neka Stane Rožman Photo: Janoš Zore

"The second phase of this project will begin in 2025. It was to be completed in 2028 by filling 16 additional containers with a total of 592 fuel elements. The last phase of transition to dry storage, the third one, is currently envisaged for five years after the termination of operation Let in 2048, "says the director of engineering in Neko **Božidar Krajnc** .

The costs of dry storage will be in the Some Wings from their own production price. Last year it amounted to 30 euros per MWh of electricity produced, and this year it is expected to return to EUR 26, in so far as it was before a number of updates related to the prolongation of the service life of Neka and to the aftermath of the Fukushima accident in 2011.

Tehnološka zasnova pasivnega suhega skladiščenja izrabljenega goriva

- Izrabljeni gorivni elementi se uskladiščijo v zabojniku, v katerem je helijeva atmosfera.
- Zabojnik je mehanska zaščita in omogoča prenos zaostale toplote v zrak, ki kroži okoli zabojnika in ga hladi.
- Zabojnik je zaščiten z debelo betonsko oblogo, ki je tudi mehanska in radiološka zaščita.



Concrete

pavement Spent fuel is now stored in an eleven-meter deep pool where there is room for about 1700 elements. By circulating water with two pumps through the heat exchanger, they leave the residual temperature and keep the water at 28 degrees Celsius.

In contrast to the pool, vertical containers will allow passive or automatic cooling, says Krajnc. The first condition is that every fuel element is under water for at least five years: "The steel container has a spent fuel basket in which 37 fuel elements are inserted. The helium-filled container with a double cover is impermeably closed, welded twice, and inserted into a concrete lining, thick from 40 to 60 centimeters, which is mechanical and radiological protection. At the bottom of the concrete liner there are slots through which the air comes in, which, by raising through the space between the container and the concrete liner, releases the residual heat. "

Among the offerings of three companies that dominate 90 percent of the market, Krško chose US Holtec technology, which, according to Krajnc, has the highest security reserves. Even if there would be a blockage of all air ventilation ducts in the concrete liner, the fuel temperature on the inside with more than a hundred degrees Celsius would increase, while remaining below 570 degrees, the integrity of this would not be compromised.

Another important solution for Holtec used in the Diablo Canyon nuclear power plant in seismically endangered California is to screw the container onto a concrete slab, which would prevent rolling over the largest possible earthquakes in Posavje. The structure for dry storage in security terms,

with the exception of corrosion protection, does not have an essential function, in the United States, similar containers stand outdoors.

Just Slovenel and fill irrational

The old resolution on nuclear waste in Slovenia for the period 2006-2015 predicted the start of dry storage of IG in 2024. The discharge of the pool will be faster due to the Fukushima accident, says the director of the Nuclear Safety Administration **Andrej Stritar** : "The management, after an accident, ordered the management to analyze all options regarding IG. They proposed a faster transition to dry storage, which has been used worldwide for more than two decades and is definitely safer. The fuel pool is vulnerable, with challenges, say, earthquakes and terrorism. I have not heard about bad experiences of dry storage. "

In Fukushima, radioactive substances were leaking out of the pool, says Stritar, because after the accident, when the power plant was not in power, the pool of spent fuel was not cooled for five to six days: "Water has been damaged, causing fuel damage."

Thus, as in concrete containers, there are temporary solutions for spent fuel, after 60 years of commercial use of nuclear technology of final disposal of fuel is not anywhere in the world. The closest are Finland and Sweden.

"This is a global problem," says Stritar: "15 years ago, it was not possible to talk about a common landfill of several countries, and last year a conference was held in Vienna on 70 topics, which was hosted by 70 countries. I believe that in the coming decades the world will find a smart solution. The state of South Australia is seriously considering selling its territory commercially as a landfill of such waste. To seek the ultimate solution for the Slovenian half of the IG from It is completely irrational. "