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Monitored this issue:

Foreign radioactive waste treatment in Jaslovské Bohunice, Slovakia Transformation from a national to international treatment centre

By Michal Daniska (Nuclear Transparency Watch)

Since 2012-2013 (at the latest) foreign low-level (LLW) and very-low-level (VLLW) radioactive waste is treated at the Radioactive Waste Treatment and Conditioning Technologies in Jaslovské Bohunice (RW TCT), Slovakia, mainly through incineration. The transformation of RW TCT from the exclusively national facility to an international radioactive waste treatment provider was done without prior consultation with, and approval by the public and municipalities which, according to available sources, might have found out about it only in 2018-2019 (i.e., after approx. 5 years).

The foreign radioactive waste share at incineration varied between approx. 35-45% during 2015-2019. Foreign radioactive waste treatment, especially by means of incineration, was originally categorically rejected by the vast majority of the affected municipalities. However, multiple municipalities later turned their position by 180 degrees on the condition, among others, that they received economic and non-economic incentives. Unusually strong refusal arose also among the public, e.g., more than 3 000 citizens signed a petition against a capacity increase of RW TCT and demand prohibition of foreign radioactive waste treatment in Slovakia. Meanwhile, the operator applied for an increase of the RW TCT treatment limits from 8343 to 12663 t/ year in total (including an increase from 240 to 480 t/y by incineration) and a second incineration plant has been constructed. There is evidence supporting claims that Slovakia itself does not need such an increase of treatment capacities and that the second incineration plant might be purpose-built to better fit the specific radioactive waste from the closed Caorso nuclear power plant in Italy. The Slovak Atomic Act allows import, treatment and conditioning of foreign radioactive waste, on condition that the radioactivity level of the imported waste equals the radioactivity level of the reexported (after treatment and conditioning) material. Since the change of government in March 2020, the new Minister of Environment has been trying to ban foreign radioactive waste incineration by law. A corresponding compromise legislative bill has been submitted in the Slovak parliament at the end of May 2021.

Historical context

RW TCT is a part of a larger nuclear site near Jaslovské Bohunice, Slovakia, that also includes the nuclear plants NPP A1 and V1 (both being decommissioned), V2 (in operation), interim SNF storage and other nuclear installations. In addition, a new nuclear reactor is planned in this locality (EIA process completed in 2016). NPP A1, commissioned in 1972, was the first nuclear power reactor in the former Czechoslovakia. Being operated only for 5 years, NPP A1 was permanently shut down after two serious accidents in 1976 and 1977. Shortly after, the process of decommissioning slowly begun, continuing to these days. The core of the RW TCT was designed to ensure the process of treatment of radioactive waste produced during the decommissioning of NPP A1. As a result of gradual development, the RW TCT in its current state includes e.g., two incinerators for solid, liquid radioactive waste and saturated sorbents; facilities for super-compaction of solid radioactive waste; metallic radioactive waste remelting; fixed radioactive waste pre-conditioning; concentration of liquid waste; solid radioactive waste sorting; bituminisation and so on. The first of the two incinerators is a shaft furnace type (as in Seibersdorf, Austria), was built between 1993-1999 and has been operated since 2000. The second incinerator has a rotary kiln, its project dates back to February 2017and has been constructed between 2019-2021. Although it has not been commissioned yet, this is likely to change in the upcoming months.

RW TCT is owned and operated by JAVYS (Jadrová a vyraďovacia **s**poločnosť = Nuclear and decommissioning company), a state-owned stock company (the Ministry of Economy of the Slovak republic holds 100% of the company stocks). Originally, RW TCT belonged to Slovenské elektrárne (i.e., “Slovak power plants”), then a state-owned company operating all power plants in Slovakia including the nuclear ones and the related infrastructure. JAVYS was founded by separating it from Slovenské elektrárne in 2005 and consisted of selected nuclear assets in which the Italian ENEL company, winner of the tender for privatisation of Slovenské elektrárne, was not interested. In addition to RW TCT, these included the decommissioning of NPP A1 and V1 and the Interim Spent Fuel storage (in Bohunice) and the National repository for LLW and VLLW in Mochovce. At the moment, JAVYS is also responsible for the project of a Deep geological repository, holds the de facto monopoly position in interim storage of Slovak spent nuclear fuel, decommissioning and management of radioactive waste and, through a 51% share, takes part in the project for the new nuclear power plant in Bohunice.

Foreign radioactive waste and plans to increase RW TCT capacity

At RW TCT, foreign radioactive waste is treated mainly by incineration which takes place exclusively at the first incinerator, as the second one has not been commissioned yet. This activity dates back to 2013 when 8.8 tons of Czech waste were incinerated. In 2012 the volume of the incinerated Slovak radioactive waste reached its historical minimum after it had decreased from approximately 140t to 50t between 2007-2012. Gradually, the Nuclear regulatory authority of the Slovak republic (NRA SR) issued permissions for incineration of (1) 39.64t radioactive waste from the Czech nuclear power plants Temelín and Dukovany (31.10.2013); (2) 7t +16m^3 institutional radioactive waste from Italy (03.09.2015); (3) 145.2t radioactive waste from Temelín and Dukovany (27.11.2015); (4) 800t ion-exchange resins in urea formaldehyde and 65t sludge from the decommissioned nuclear power plant Caorso, Italy (04.06.2018); (5) 21.7t institutional radioactive waste from Germany (22.01.2019) and (6) 617m3 institutional radioactive waste from Italy (25.01.2019). In total, incineration of approx. 1600 tons of foreign radioactive waste (Czechia, Italy, Germany) was contracted, out of which approx. 300 tons have already been incinerated between 2013 – 2020. In comparison, approx. 1200 tons of Slovak radioactive wastes were incinerated between 2007-2020. In the period 2015-2019, a total of approx. 110-130t were incinerated annually, out of which the Slovak radioactive waste represented 60-85t, the share of foreign waste at incineration oscillated between 34-46% (43-56 tons annually). Although the current legal limit for radioactive waste incineration is 240 t/year, it is allegedly in practice not technically feasible to incinerate more than 130-150 t/year at the first incineration plant. In case the capacity increase is approved (from 240 t/year to 480 t/year) and the second incineration plant becomes operational, the volume of incinerated radioactive waste in practice may increase to approx. 420-460 t/year (i.e., approx. 3,5-fold increase if compared to the current state), and the foreign radioactive share at incineration might exceed 70%.

The public did not participate in the authorization processes for import and incineration (treatment) of foreign radioactive waste in Slovakia held by NRA SR which resulted in the six permits mentioned above. The available information does not indicate that mayors of the affected municipalities were aware of the ongoing foreign waste incineration until about 2018. However, at least since 2014 the mayors have been considering the risk of such activities, although only as a theoretical option in the future. During various EIA processes, the municipalities regularly (as a precaution) expressed their disapproval of foreign radioactive waste treatment in the Bohunice locality until 2019. Nevertheless, until 2017/2018, the municipalities were not explicitly notified of the ongoing foreign waste treatment during the EIA processes. The EIA process "*Radioactive Waste processing and treatment technology by JAVYS, a.s. at Jaslovské Bohunice location*" (December 2012 – November 2014), during which the already existing and operated RW TCT was assessed for the first time on the basis of modern EIA legislation. During a public hearing, which took place in March 2014, the mayors directly and indirectly asked about the possibility of treatment of radioactive waste from locations other than J. Bohunice. In response, JAVYS did not inform about the foreign waste treatment (e.g., incineration) that had already been carried out (8.8 tons from the Czech Republic incinerated in 2013) or that had already been contracted. The statement was formulated in a conditional way, as if the treatment of radioactive waste for other companies (aside from the Slovak Bohunice and Mochovce nuclear power plants) was not a reality yet. Although it was admitted that contracts for radioactive waste treatment and conditioning were being sought, it was not directly mentioned that this would come from abroad. In addition, "*foreign radioactive waste treatment*" was not even once explicitly mentioned, neither in the EIA plan, EIA report nor during the public hearing. Finally, the Environmental Impact Statement (EIS) from this EIA process (issued in November 2014, with minor changes valid until today) explicitly states that RW TCT serves the treatment and conditioning of VLLW, LLW and ILW from (1) decommissioning of the Slovak NPPs A1 and V1; (2) operation of Slovak nuclear installations; or (3) institutional radioactive waste (IRW) and captured radioactive waste (CRW). The list of purposes does not explicitly mention treatment (incineration) of foreign wastes. In March 2021, the Slovak Ministry of Environment confirmed that "the ongoing foreign radioactive waste treatment (incineration) is inconsistent" with the EIS mentioned above. However, the treatment of foreign radioactive waste at RW TCT continues.

It was not until the beginning of 2018 that information on the treatment of foreign radioactive waste resonated for the first time among municipalities and a part of the public. There were two main sources – (1) a press conference of then opposition MPs Mr. Matovič and Mr. Krajčí about incineration of radioactive waste from the decommissioned Italian Caorso nuclear power plant, and their failed attempt to ban incineration of foreign radioactive waste by law (February 2018) followed by (2) publishing the EIA plan "*Optimisation of treatment capacities of radioactive waste treatment and conditioning technologies JAVYS, a.s. at Jaslovské Bohunice*" (March 2018) where foreign radioactive waste treatment was mentioned among the purposes of RW TCT. However, the treatment and especially incineration of foreign radioactive waste gained more significance and repeated media attention only in the middle of 2020, after the February 2020 elections and the consequent change of government (Mr. Matovič and Mr. Krajčí became the Prime Minister and the Minister of Health, respectively).

EIA processes

The environmental impact assessment (EIA) project "Optimisation of treatment capacities of radioactive waste treatment and conditioning technologies JAVYS, a.s. at Jaslovské Bohunice" stands for capacity increase of RW TCT, from 8343 to 12663 t/year in total (all technologies). It also covers the second incinerator and an increase of the incineration limit from 240 to 480 tons per year (corresponding to the real incinerated volume increase from approx. 130t/y, the technical limit of the first incinerator, to approx. 420-460t/y if both incinerators are in operation); capacity increase of the metallic radioactive waste remelting from 1000 to 4500t/y, and so on. In April 2018, the vast majority of the municipalities categorically refused foreign radioactive waste treatment, especially incineration, and the proposed RW TCT capacity increase, reasoned with arguments of (protection of) a healthy environment for their citizens. An individual EIA process for the second incinerator only was launched in September 2018 under the name "*Optimisation of incineration capacities of the nuclear installation Radioactive Waste Treatment and Conditioning Technologies*", thus accelerating the authorization process of the second incinerator. JAVYS justified the second incinerator with an expected approx. 50% increase in production of domestic combustible radioactive waste in 2020-2023 and the necessity to have an operational incinerator capacity within the assessed limit of 240 tons/year in order to "*meet emerging requirements for radioactive waste treatment from decommissioning and also from the operation of NPPs in the Slovak Republic*". Based on this justification, the majority of the municipalities approved the second incinerator on condition that the limit 240t/y (for both incinerators together) will be preserved and no foreign waste will be incinerated at the second incinerator. These conditions, explicitly accepted by JAVYS, were transposed into the final ruling issued in this individual EIA process. Under these conditions, the municipalities did not obstruct the authorization process and already in June 2019 the NRA SR could have issued a construction permit and the construction of the second incinerator could have begun.

Since the second incinerator has not been commissioned yet, the condition prohibiting incineration of foreign radioactive waste has de facto never been applied. However, now, when the incinerator is constructed and almost ready to be commissioned, efforts to remove the restriction are being made. This might be done in an indirect way when the EIS from the EIA process "*Optimisation of treatment capacities of radioactive waste treatment and conditioning technologies JAVYS, a.s. at Jaslovské Bohunice*" (without the foreign waste treatment restriction at the second incinerator) comes into effect and thus the EIS from EIA process "*Radioactive waste processing and treatment technology by JAVYS, a.s. at Jaslovské Bohunice location*" and the ruling from the individual EIA process for the second incinerator effectively expires. It is also important to point out that JAVYS agreed to exclude foreign waste treatment at the second incinerator in December 2018, i.e., in a situation when the EIA process "*Optimisation of treatment capacities of radioactive waste treatment and conditioning technologies JAVYS, a.s. at Jaslovské Bohunice*" was already in progress and permits for incineration of foreign waste valid today had already been issued by NRA SR or the permits had already been requested.

In 2019-2020, the volumes of incinerated Slovak radioactive waste reached approx. 60 tons per year (1/8 of the proposed increased limit 480t/y) which means an approx. 25% decrease if compared to the period 2016-2018 (approx. 80-85 t/y). These data contradict the claims of JAVYS from 17.12.2018 when it expected an approx. 50% increase in Slovak radioactive waste production in the period 2020-2023 and used it as the primary reason for justification of the second incinerator. Also, according to the National policy for management of spent nuclear fuel and radioactive waste in the Slovak republic (2015), the current capacity of treatment lines (i.e., without the second incineration plant) is sufficient (with reserves) for treatment of waste from both operation and decommissioning of the Slovak nuclear installations. These conclusions are consistent with the data about volumes of incinerated Slovak waste (60-85 t/y in 2015-2019) which is far below the technical capacity of the first incinerator (approx. 130t/y).

There were two public hearings during the EIA process "*Optimisation of treatment capacities of radioactive waste treatment and conditioning technologies JAVYS, a.s. at Jaslovské Bohunice*" - on 26.08.2019 and 16.12.2019. Among others, JAVYS declared on 26.08.2019, foreign waste treatment as "a complementary activity" (compare this to a 34-46% share of foreign waste at incineration in 2015-2019 and a possible expected increase to over 70% in the future); on 16.12.2019, JAVYS claimed that the foreign radioactive waste share at incineration was 12% only. The public obtained real data about volumes of incinerated waste only in the middle of 2020 after a time-consuming investigation.

At present, after a position change in 2019, the majority of the affected municipalities and the association of municipalities explicitly approved both the RW TCT capacity increase and foreign radioactive waste treatment (up to a 30% share) on the condition (among others) that new economic and non-economic incentives for municipalities in the region are established. Two county towns (Hlohovec, Piešťany) and 10-15 other municipalities continue opposition. More than 3000 citizens signed a petition against capacity increase of the RW TCT and demand a prohibition of foreign radioactive waste treatment in Slovakia.

The affected villages that now consent to the project received 10000€ each from JAVYS in December 2019. On the contrary, the opposing affected villages received only 2500€ or 0€. The following year in December 2020, after this fact was published in the media, all 9 affected municipalities received 10000€ each from JAVYS.

The Caorso contract

The Caorso contract for incineration of more than 30-year-old 800 tons of ion-exchange spent resins in urea formaldehyde and 65 tons of radioactive sludges (5881 tanks) from the shutdown Italian nuclear power plant Caorso, holds an exceptional position among the 6 contracts for foreign waste incineration at RW TCT. The main reason is the allegedly challenging nature of this waste due to urea formaldehyde, that is said to lead to difficulties during incineration in the shaft furnace of the first incinerator and a suspicion that the second incinerator with a rotary kiln might be purpose-built to better fit the waste from Caorso. These claims are supported by (1) the original construction contract stating that the second incinerator must be capable of incineration of ion-exchange spent resins in urea-formaldehyde which shall be proven by successful hot tests with 100 tons of ion-exchange resins in urea-formaldehyde and 20 tons of other waste; (2) the Caorso contract was signed in 2015, but hot tests at the first incinerator took place only in 2019, after a brand new pre-conditioning line was commissioned; (3) the hot tests at the first incinerator took unusually long (21.01.2019 – 02.07.2019) and large volumes (43 tons reduced by preconditioning to 15,5 tons) were incinerated; (4) almost a threefold reduction of waste mass through pre-conditioning; (5) the contracting process for construction of the second incinerator took place 20 months after the Caorso contract was signed (February 2017 vs. June 2015); (6) incineration at the second incinerator does not result in alpha cross-contamination of the (foreign radioactive waste) ashes; (7) the residual capacity of the first incinerator (i.e. after incineration of the Slovak waste) is approx. 60 t/y, which does not seem to be sufficient to meet the Caorso contract deadline in 2023 (assuming the contract volume 865 ton and also other contracts, e. g. 617m^3 of institutional wastes from Italy); (8) although JAVYS in 2018 accepted the condition prohibiting foreign waste treatment at the second incinerator, this restriction will probably expire before the incinerator is commissioned and thus might not be effectively applied.

However, the alleged connection between the second incinerator and the Caorso contract has not been confirmed, neither by JAVYS nor by the nuclear regulator NRA SR. The Caorso contract itself was, after a significant portion of relevant data had been redacted, published online only in November 2020. Since the change of government in 2020, the new Minister of Environment Ján Budaj has been trying to ban foreign radioactive waste incineration by law. These efforts encounter a significant obstacle represented by huge financial penalties in case the Caorso contract is terminated. Transparency is lacking about the relation between the Caorso contract and the second incinerator (and the preconditioning line) as well as in the Caorso contract itself.

Challenges related to the foreign waste

Correct and complete impact assessment of the foreign radioactive waste treatment is a challenging task. For example, tracking down where all foreign radionuclides might end up could be highly relevant. One of the reasons is that the ratio of radioactivity retained in ash after incineration compared to radioactivity of the input waste is variable and on average approx. 65%, i.e., far below 100%. At the same time wastewater from wet filtration of flue gases from radioactive waste incineration, which might contain a significant share of foreign radionuclides, ends up permanently in the radioactive waste repository in Mochovce. In order to analyse the fraction of foreign radionuclides that remain in Slovakia and how these missing radionuclides are replaced by Slovak radionuclides (possible change of national radionuclide inventory) the public requested, mostly unsuccessfully, data about radioactivity streams during waste preconditioning, incineration and post-treatment (e.g., how much radioactivity is carried to the waste water) and the production of secondary radioactive waste. These data are crucial in order to analyse the impact of the foreign waste treatment, especially by incineration. However, when requested, the nuclear regulator NRA SR could not provide (did not have) detailed data about activity streams in the treatment process. The data cannot be obtained from JAVYS either, since it claims not to be a liable entity according to the Freedom of Information Act.

Financial impacts should be assessed in detail as well. For example, the foreign waste owners do not participate in the future decommissioning of the RW TCT (especially the incinerators and the pre-conditioning line), so that the corresponding costs will be covered by the National Nuclear Fund that collects money from Slovak electricity consumers. Do Slovak taxpayers not subsidise the foreign waste treatment in any (hidden) way (incl. construction, operation and future decommissioning costs, indirect costs – e.g., if the incinerator lifetime were negatively affected by the foreign radioactive waste treatment)?

One can also argue that foreign radioactive waste treatment challenges the ALARA principle. Slovakia is not legally or morally responsible for foreign radioactive waste, so it is reasonable not to incinerate/treat it and thus avoid any kind of unnecessary negative effects or risks. The Public Health Authority of the Slovak republic, Section of radiation protection justified its 2017 legislative proposal to ban foreign radioactive waste incineration with this argument.

Lack of transparency

In this case, the crucial issues are mainly transparency, public access to information, evidence-based decision making and effective public participation, which, among others, represent key principles of the Aarhus Convention and the European Council Directive 2011/70/EURATOM. We consider it important to take into account that JAVYS is not a private but state company and that most technologies of the RW TCT received necessary permits when the public and the municipalities implicitly assumed that RW TCT served management of the Slovak radioactive waste only and waste from decommissioning of NPP A1 in particular. First of all, the public discussion about foreign radioactive waste treatment should have taken place prior to services being possibly offered to foreign customers, not years after foreign waste treatment in Slovakia started. The eventual ongoing discussion, which was initiated mainly by the public and the municipalities (instead of JAVYS or the government), is strongly affected by the risk of huge financial penalties in case the already signed contracts are terminated. This significantly reduces the set of options (de facto) available for discussion and subsequently impacts the results. With this, Slovakia is in non-compliance with its domestic and international legal obligations (e.g., EU Aarhus, EIA and Habitat Directives and the Aarhus Convention).

The second important issue is the difficulty in access to (objective and complete) information, information verification and possibilities to consult with independent experts in the case of the public and municipalities. In practice, the main source of information about activities at the nuclear site J. Bohunice for the general public are the corresponding EIA processes, since the EIA documentation is easier-to-read for non-experts, is published online and often also the public hearings take place in the affected municipalities. On the other hand, documentation from processes held by the nuclear regulator NRA SR is expert-oriented, can be accessed usually only via physical inspection and sometimes is even declared confidential. However, even in the EIA processes, the effectiveness of public participation is limited by information asymmetry between the public and municipalities on one hand, and the project proposer on the other. In case of nuclear installations, this asymmetry is further enhanced because of higher complexity of the problem. Due to limited time, expertise and financial resources the public and municipalities are reliant mostly on information provided by the project proposer, either in the EIA documentation or in reactions to additional questions (raised e.g., during the public hearing). Consultations with independent experts appear to be a theoretical option only, not only because of short procedural deadlines and financial constraints, but also due to a lack of suitable independent nuclear experts and/or insufficient free capacities of these experts. Even the Ministry of Environment failed while attempting to obtain an additional independent expert opinion within the EIA process “Optimisation of treatment capacities of radioactive waste treatment and conditioning technologies JAVYS, a.s. at Jaslovské Bohunice” in autumn 2020.

Effective public participation in the decision-making process requires that the public and municipalities are provided with correct and complete information about the project, its impacts and purpose as well as tools for easy information verification. The public should not be dependent on extensive and time-consuming investigation and information verification based on independent sources only. The situation is negatively affected by the fact that JAVYS claims – counter to jurisprudence under the Aarhus Convention – not to be a liable entity with respect to the Slovak Freedom of Information Act. This is difficult to understand, since this company is state-owned, carries out a public service and receives millions of euros from the public budget (through the National Nuclear Fund) each year, de facto holds a monopoly position in management of radioactive waste and spent nuclear fuel in Slovakia and, on top of that, it is also responsible for the project of a Slovak deep geological repository.

Besides the lack of transparency, public participation deficiency and limited public access to information, the challenges related to foreign radioactive waste treatment include (1) missing publicly available analyses of radioactivity streams, secondary radioactive waste production and corresponding data on the fraction of foreign radionuclides that remain in Slovakia and how these missing radionuclides are replaced by Slovak radionuclides (possible impact on the national radionuclide inventory); (2) non-participation of the foreign parties in the future decommissioning of RW TCT and in the legal responsibility in case of accidents or other indirect impacts; (3) missing publicly available detailed financial analyses including also all indirect costs (do the Slovak taxpayers not subsidize foreign waste treatment in any (hidden) way?); (4) reasonable doubts about the need of the second incinerator (in perspective of the Slovak needs) and the relation between the Caorso contract and the second incinerator (and its preconditioning line); (5) possible conflict of interests – e.g. a significant number of members of municipal councils are employed at JAVYS; (6) financial power asymmetry between the proposer and the public. The distribution of substantial financial benefits from JAVYS to the affected municipalities in 2019 is highly correlated to the (dis)approval of the proposed RW TCT capacity increase by these municipalities; (7) law enforcement – the Ministry of Environment confirmed that “the ongoing foreign radioactive treatment (incineration) is inconsistent” with the still valid EIS. However, the treatment of foreign waste at RW TCT continues. There are concerns about possible salami-slice approach in authorization of the second incinerator and its usage for the foreign radioactive waste treatment.

Michal Daniska

The case studies on Slovakia and Russia (next article) in this Nuclear Monitor are part of a larger report on radioactive waste and transparency, currently under preparation for the Euratom EURAD programme by Nuclear Transparency Watch. The full report is expected to be published in October 2021.

No corrupt nuclear bailouts in the American Jobs and Families Plan

In the last weeks NIRS published a piece showing the cost of federal nuclear bailout proposals**. It's a big, big number — $50 billion. But all of that money would not create a single new job, nor reduce greenhouse gas emissions by a single pound. In fact, as a** new report **released last month found, investing that $50 billion in wind, solar, and efficiency instead would accelerate our transition to a zero-emissions electricity system. And, as we showed last week, a national nuclear bailout would** prevent the creation of 60,000 new jobs **in renewable energy, efficiency, and other clean energy infrastructure.**

So with all of these strikes against it, why are members of Congress pushing so hard to give a slate of old, uneconomical nuclear power plants so much money out of a large, but still limited, budget for energy investments needed for a just transition to a carbon-free future?

There's one tried-and-true way to answer that question: follow the money. We wondered: who would actually receive the money proposed to bail out nuclear reactors? The answer is revealing.

From our analysis, we found that there are 33 reactors at 19 nuclear power plants, located in eight states, which would qualify for the proposed bailouts. Those power plants are owned and operated by only eight large power companies (along with four smaller companies that are minority co-owners of three of the plants). Note: because both proposed bailouts would subsidize the same group of reactors, we combined the amounts for our calculations. As a result, nearly the entire $50 billion–94% of the total–would go to these eight corporations.

However, because ownership of nuclear reactors is highly concentrated, over $35 billion of the bailout (70%) would go to just **three** of those corporations:

- Exelon $24.5 billion (49%)
- Energy Harbor $5.5 billion (11%)
- PSEG $5.1 billion (10%)

All three of these companies have been lobbying for subsidies for their nuclear reactors for years. As we speak, Exelon is pushing for a nuclear subsidy in Illinois and threatening to close four reactors within the next few months if the state legislature does not convene a special session and enact a new law with at least $700 million in nuclear subsidies within weeks.

In fact, both Exelon and Energy Harbor (a spinoff of FirstEnergy), are the subjects of federal corruption cases over billion-dollar nuclear bailouts for which they lobbied in Illinois and Ohio, respectively. In both cases, prosecutors have indicted former company lobbyists and staff to the Speakers of the House of Representatives in each state. Also in both cases, Exelon and FirstEnergy have signed deferred prosecution agreements with federal prosecutors to pay fines and restitution and to cooperate with the prosecutions. As the investigations proceed, more corporate executives, legislators, and lobbyists could be indicted.

In the case of FirstEnergy and Energy Harbor, there are also multiple state-level investigations of these nuclear bailout scandals. At the heart of that case, FirstEnergy made $61 million in bribes and payments to former House Speaker Larry Householder's political action committee. Through the scheme, FirstEnergy helped win Householder the speakership after the 2018 election, by also buying the support of Republican legislators and Ohio Gov. Mike DeWine. As a result, FirstEnergy was able to get Ohio to enact a $1 billion nuclear bailout, which was key in winning the support of the corporation's creditors in a major bankruptcy proceeding. The bankruptcy settlement resulted in FirstEnergy spinning off its power plants into Energy Harbor, a new, unaffiliated corporation that only owns the unprofitable nuclear and coal power plants. As a result of the federal corruption case, Ohio legislators repealed the nuclear bailout earlier this year, leaving Energy Harbor without the subsidies its creditors were assured it would have when they agreed to the bankruptcy settlement.

In addition to the federal corruption case, states where FirstEnergy operates want to know where the $61 million in bribes came from. In April, under pressure in the federal case, FirstEnergy filed a report with the Federal Energy Regulatory Commission indicating that "all 14 of its power-providing companies" in five

states misappropriated ratepayer monies for a decade. State utility commissions in three of those states–Maryland, New Jersey, and Ohio–are investigating how much money the corporation misappropriated from state residents' power bills to fund the nuclear bailout corruption scheme.

Back to Exelon

The corruption investigation in Illinois stems from two bills that have cost electricity consumers billions of dollars: a 2011 "smart grid" law, and a 2016 energy law. The latter awarded Exelon a 10-year, $2.35 billion subsidy for three uneconomical reactors that Exelon threatened to close without the bailout. Consumers have already paid out $1 billion over the last four years. Exelon awarded jobs to associates and relatives of former House Speaker Michael Madigan and other legislators, in exchange for lucrative legislative outcomes. Despite the ongoing investigation, Exelon is now pursuing subsidies in Illinois for its other eight reactors in Illinois, which it claims are also under economic pressure.

In the same year as the Illinois bailout, Exelon won a massive 12-year, $7.6 billion subsidy for four reactors in New York, and won final approval of a deal that has made it the largest utility company in the country. In those cases, there were eyebrow-raising reports of backroom lobbying, employment favors, and political contributions. And in 2018, Exelon and PSEG (the other big winner from a federal bailout) got New Jersey to enact a $300 million/year subsidy for three reactors in that state. Exelon pulls in about $85 million/year through its ownership stake in two of the New Jersey reactors.

In total, Exelon is receiving nearly $11 billion in nuclear subsidies at the state level. $24.5 billion in federal subsidies may assist Exelon in winning investors' support for its plan to spin off its nuclear business, as FirstEnergy did. But how is any of this going to help the country solve the climate crisis?

With $30 billion of a federal nuclear subsidy accruing to two companies that are the subject of federal corruption cases over state-level nuclear subsidy laws, this could become an even larger scandal. President Biden and Congressional leaders should not risk the American Jobs and Families Plan being derailed over corporate corruption cases. And as we've shown, the infrastructure bills will do more for climate, jobs, and justice *without* a nuclear bailout, and by simply investing in the transition to 100% renewable energy.

There are many reasons why we cannot afford to sacrifice the climate to a nuclear bailout. Our economic future, justice for all communities impacted by climate chaos and the nuclear fuel chain, and our environment all depend on real action and true investment in clean energy, good jobs, and a just transition. Short-sighted corporate interests–once again–block the path towards the liveable, just, and equitable future. We cannot allow the pockets of nuclear corporations and their shareholders to grow as our window for climate action shrinks.

Figure 2: Estimated Subsidies per Corporation under Proposed Tax Credit

Take Action!

We can't let our leaders sacrifice the economy and environment to a corporate nuclear bailout scandal! Tell President Biden, Vice-President Harris, and your representatives in Congress: "No Corrupt Nuclear Bailouts in the American Jobs and Families Plan – Invest

Figure 1: Estimated Annual and Total Subsidies under Proposed Tax Credit

State	Reactor	Generation Capacity (MW)	Annual Generation, 2020 (MWh)	Annual Tax Credit ($)	TOTAL	Owner
CT	Millstone 2	853	6,690,501	$100,357,515	$1,003,575,150	Dominion
CT	Millstone 3	1,220	9,024,354	$135,365,310	$1,353,653,100	Dominion
IL	Braidwood 1	1,183	10,604,454	$159,066,810	$1,590,668,100	Exelon
IL	Braidwood 2	1,154	9,767,222	$146,508,330	$1,465,083,300	Exelon
IL	Byron 1	1,164	9,853,735	$147,806,025	$1,478,060,250	Exelon
IL	Byron 2	1,136	9,671,159	$145,067,385	$1,450,673,850	Exelon
IL	Clinton	1,065	9,462,481	$141,937,215	$1,419,372,150	Exelon
IL	Dresden 2	902	7,966,534	$119,498,010	$1,194,980,100	Exelon
IL	Dresden 3	895	7,512,354	$112,685,310	$1,126,853,100	Exelon
IL	LaSalle 1	1,131	9,535,886	$143,038,290	$1,430,382,900	Exelon
IL	LaSalle 2	1,134	10,159,798	$152,396,970	$1,523,969,700	Exelon
IL	Quad Cities 1	908	8,075,967	$121,139,505	$1,211,395,050	Exelon (75%); MidAmerican (25%)
IL	Quad Cities 2	911	7,636,478	$114,547,170	$1,145,471,700	Exelon (75%); MidAmerican (25%)
MD	Calvert Cliffs 1	866	7,371,348	$110,570,220	$1,105,702,200*	Exelon (50.01%); EdF (49.99%)
MD	Calvert Cliffs 2	842	7,709,209	$115,638,135	$1,156,381,350*	Exelon (50.01%); EdF (49.99%)
NH	Seabrook	1,250	9,865,196	$147,977,940	$1,479,779,400	NextEra
NJ	Hope Creek	1,172	10,592,697	$158,890,455	$1,588,904,550	PSEG
NJ	Salem 1	1,153	7,142,172	$107,132,580	$1,071,325,800	Exelon (43%); PSEG (57%)
NJ	Salem 2	1,142	9,003,389	$135,050,835	$1,350,508,350	Exelon (43%); PSEG (57%)
OH	Davis-Besse	894	7,228,063	$108,420,945	$1,084,209,450	Energy Harbor
OH	Perry	1,240	10,990,962	$164,864,430	$1,648,644,300	Energy Harbor
PA	Beaver Valley 1	907	8,047,731	$120,715,965	$1,207,159,650	Energy Harbor
PA	Beaver Valley 2	901	7,345,662	$110,184,930	$1,101,849,300	Energy Harbor
PA	Limerick 1	1,120	9,133,195	$136,997,925	$1,369,979,250	Exelon
PA	Limerick 2	1,122	10,211,569	$153,173,535	$1,531,735,350	Exelon
PA	Peach Bottom 2	1,265	10,211,819	$153,177,285	$1,531,772,850	Exelon (50.01%); PSEG (49.99%)
PA	Peach Bottom 3	1,285	11,580,515	$173,707,725	$1,737,077,250	Exelon (50.01%); PSEG (49.99%)
PA	Susquehanna 1	1,247	9,332,238	$139,983,570	$1,399,835,700	Talen (90%); Allegheny Electric (10%)
PA	Susquehanna 2	1,247	10,658,665	$159,879,975	$1,598,799,750	Talen (90%); Allegheny Electric (10%)
TX	Comanche Peak 1	1,205	9,781,846	$146,727,690	$1,467,276,900	Luminant
TX	Comanche Peak 2	1,195	9,698,102	$145,471,530	$1,454,715,300	Luminant
TX	South Texas Project 1	1,280	10,409,819	$156,147,285	$1,561,472,850	NRG (44%); San Antonio (40%); Austin (16%)
TX	South Texas Project 2	1,280	11,548,938	$173,234,070	$1,732,340,700	NRG (44%); San Antonio (40%); Austin (16%)
TOTAL		36,269	303,824,058	$4,557,360,870	$45,573,608,700	

** EdF has exercised its option to sell its share of Constellation Energy Nuclear Group to Exelon. The transaction is scheduled to complete in 2022, at which time Exelon will own 100% of Calvert Cliffs 1&2.*

Figure 2: Estimated Subsidies per Corporation under Proposed Tax Credit

Corporation	Total Subsidy	Share of TOTAL
Exelon	$22,287,632,282	48.9%
Energy Harbor	$5,041,862,700	11.1%
PSEG	$4,603,448,181	10.1%
Luminant	$2,921,992,200	6.4%
Talen	$2,698,771,905	5.9%
Dominion	$2,357,228,250	5.2%
NextEra	$1,479,779,400	3.2%
NRG	$1,449,277,962	3.2%
TOTAL	**$42,839,992,880**	**94.0%**

Depleted Uranium Exports to Russia – A case of lack of transparency and research[1]

By Jan Haverkamp (Greenpeace, WISE)

From 1996, the uranium enrichment facilities URENCO Almelo (Netherlands) and URENCO Gronau (Germany) regularly sent shipments of depleted uranium (DU) in the form of UF_6 (uranium hexafluoride) to TENEX, later TVEL, in Russia, where this was stored in the open air in Seversk in the Krasnoyarsk region. Protests in Europe then halted these transports in 2009. TVEL is since 2007 a subsidiary of the Russian nuclear giant Rosatom. URENCO carries out enrichment for nuclear fuel production from natural uranium to low-enriched uranium for clients all over the world and has facilities in the Netherlands, Germany and the UK.

In 2019 and 2020, these transports were resumed from the enrichment facility of URENCO Gronau and URENCO UK in Capenhurst.

URENCO Almelo currently has a permit for export, but does not use it. Its DU is sent to France for conversion into stable U3O8 (depleted tri-uranium-octo-oxide or uranium oxide), which is returned to the Netherlands and handed over to the waste management organisation COVRA for interim storage in the VOG facility, awaiting final disposal after 2100.

The claim is that the DU is sent to TENEX, later TVEL, for re-enrichment to natural level and reuse of the resulting double depleted uranium (DDU). Rosatom furthermore claims[2] that DDU and DU are used industrially and that the UF6 also delivers fluorine for reuse purposes. It furthermore, describes in detail how it wants to convert its UF6 stockpile into uranium oxide for waste treatment before 2057.

Our conclusion is that this form of TENORM (technically enhanced naturally occurring radioactive material) should be considered in principle as a waste material, for which full transparency should be assured over its complete chain of management, also when a limited amount of the material may be used as resource. Research on optimization of the management pathways should be part of European research programmes like EURAD.

Our central observations are:

- The involved DU is in Russia not a resource in the sense of sustainable recycling – that is, it is not 100%, nor for a majority of it, recycled and reused.
- The ownership structure of this export of DU to Russia hides this fact. Rosatom / TVEL has taken ownership of the material after export and with that, the material is out of sight of URENCO, its hosting EU Member State (MS) Germany, and of Euratom. It is today impossible for Euratom, Germany or URENCO to confirm whether the material is indeed reused in any form or not.
- Resulting radioactive waste from any management operation should be returned to the country of origin (as happens in the case of reprocessing of spent nuclear fuel). This does not happen in this case.
- Material that is not reused or recycled within a reasonable timeframe constitutes waste and has to be treated as such from the start. It falls under radioactive waste as defined in 2011/70/Euratom and the treatment of DU – whether within or outside the Union – should be considered as waste management.
- This implies that there should be a clear description of incurred streams of all treatment pathways in line with 2011/70/Euratom – and decisions on these treatment pathways should all be based on 2011/70/Euratom and complete knowledge of these pathways, irrespective of whether this treatment takes place within the Union or outside.

Law and transparency

There is no transparency about the pathways of management of the DU exported by URENCO to Russia. There are claims of reuse on the Russian side,[3] but there are no clear descriptions of streams and involved amounts.

The Euratom radioactive waste directive defines radioactive waste as: *"radioactive material in gaseous, liquid or solid form for which no further use is foreseen or considered by the Member State or by a legal or natural person whose decision is accepted by the Member State, and which is regulated as radioactive waste by a competent regulatory authority under the legislative and regulatory framework of the Member State;"* (art. 3(7) 2011/70/EURATOM).

Article 4(2) of the directive states: *"Where radioactive waste or spent fuel is shipped for processing or reprocessing to a Member State or a third country, the ultimate responsibility for the safe and responsible disposal of those materials, including any waste as a by-product, shall remain with the Member State or third country from which the radioactive material was shipped".*

Article 4(4) of the directive explains in more detail: "*Radioactive waste shall be disposed of in the Member State in which it was generated, unless at the time of shipment an agreement, taking into account the criteria established by the Commission in accordance with Article 16(2) of Directive 2006/117/Euratom, has entered into force between the Member State concerned and another Member State or a third country to use a disposal facility in one of them.*

Prior to a shipment to a third country, the exporting Member State shall inform the Commission of the content of any such agreement and take reasonable measures to be assured that:

(a) the country of destination has concluded an agreement with the Community covering spent fuel and radioactive waste management or is a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management ('the Joint Convention');

(b) the country of destination has radioactive waste management and disposal programmes with objectives representing a high level of safety equivalent to those established by this Directive; and

(c) the disposal facility in the country of destination is authorised for the radioactive waste to be shipped, is operating prior to the shipment, and is managed in accordance with the requirements set down in the radioactive waste management and disposal programme of that country of destination."

Furthermore, the Euratom directive obliges in art. 10 transparency concerning radioactive waste.

In Russian law, the definition of radioactive waste is "*materials and substances not subject to further use, and equipment, articles (including spent ionizing radiation sources), in which the content of radionuclides exceeds the levels established in accordance with the criteria defined by the Government of the Russian Federation*" (clause 8, article 3).[4] This is a much more shady definition, whereby the issue of responsibilities for waste material and waste as by-product are not defined. It may therefore well be that where there is responsibility for exported DU for the state of origin under 2011/70/Euratom, there is none under Russian law.

Transfer of ownership and responsibility

In the current set-up, ownership of this TENORM is transferred from URENCO to TVEL / Rosatom. Nevertheless, 2011/70/EURATOM stipulates that "*the ultimate responsibility for the safe and responsible disposal of those materials, including any waste as a by-product, shall remain with the Member State or third country from which the radioactive material was shipped".* Logically, because URENCO Gronau does not reuse this material, for URENCO Gronau and Germany, this depleted uranium in the form of UF_6 is a waste material for which it has ultimate responsibility – also when others claim (but not prove in the form of accountable and accounted for pathways) use as resource. After all, 'ultimate responsibility' when the material is (partially) not reused in any way but ends de facto as waste, can never be shed. This has several consequences:

- The transfer of ownership does not release the Member State from which the material was shipped (e.g., Germany) from its ultimate responsibility for the depleted uranium and waste as by-product when it is not actually reused;
- For that reason, the Member State needs to have a full, proven and accountable overview of whether the material is indeed reused or not, and what is happening with all waste fractions, including by-products;
- The Member State should provide full (public) transparency about this – including the actual chains of handling – and the Member State should be involved in reducing the risks of that handling;
- The Member State should be involved in research about the handling of this stream of TENORM, in spite of (debatable!) claims that want it to be labelled as resource.

Resource or waste

Russia currently holds more than 1 million tonnes of DU in the form of UF_6, around half of the world's stockpile (Nikitin, 2020). It is unclear how much DU is held in stabilised form (in Russia, mainly DU3O8 – depleted tri-uranium-octo-oxide). Rosatom is planning to convert its complete stockpile of UF6 to DU3O8 before 2057. Re-enrichment after that date would require re-conversion into UF_6.

To determine whether the to Russia exported DU may be considered to be a resource (in that case falling out of the scope of the Euratom radioactive waste directive), it is important to establish how much of the material is indeed reused for other purposes, which waste by-products are produced and which part remains for how long in storage without being reused.

Besides the earlier mentioned publication from Bellona / Rosatom, there is no public information available about this, nor any publicly available formal plans from TVEL / Rosatom.

According to Nikitin (2020), under Russian law, the material is seen as a "strategic reserve for the existing nuclear power industry" because of the possibility of re-enriching the material or use in fast breeder reactors.

From different sources, the following potential uses of DU can be found:

- *Reuse of fluorine*
  Nikitin (2020) puts a large emphasis on this. This is only possible when the uranium in the UF_6 is stabilised in the form of uranium-oxides and the fluorine is extracted. The resulting (radioactive) uranium would then only be further useful in metallic form (weapons, balancing, other) and breeder reactors, but not for re-enrichment. Given the fact there is no market lack of fluorine, it is highly unlikely that UF_6 for that reason would be kept as "strategic reserve" and hence justify labelling the DU as resource. Basically: declaring UF_6 a resource because of the need for toothpaste is nonsense.

- *Re-enrichment to natural level*
  Given the limited availability of natural uranium in commercially viable extractable ores, re-enrichment of DU could squeeze out some more uranium for use in the nuclear fuel chain. Officially, re-enrichment is listed as justification for the export of DU by URENCO, and URENCO receives natural uranium back in return for the delivered DU.[5] It is unclear, however, whether this is indeed re-enriched DU or whether this is an equivalent of non-enriched natural uranium. Given the extremely energy intensive nature of enrichment, it is for cost reasons likely to be the latter.
  When typical 0,2 – 0,25% DU from the enrichment facility of URENCO is re-enriched by TVEL to a level of 0,72%, 1 ton of depleted uranium yields around 0,25 tons of enriched uranium (natural level) and 0,75 tons of double-depleted uranium.[6] This means that ¾ of the exported DU will remain in Russia in the form of double-depleted UF_6, whilst maximally ¼ can be reused again by URENCO as natural level uranium for further enrichment purposes. URENCO then, in turn, delivers from these 0,03 tons of enriched uranium (nuclear fuel level) and another 0,22 tons of DU, which could yield another 0,06 ton of natural uranium and 0.007 ton of enriched uranium, etc. After many cycles, re-enrichment of DU could yield in total around 4% of the initial DU as fuel for nuclear power. 96% remains behind as double depleted uranium.

- Use of DU in breeder reactors
  Rosatom has declared on several occasions that the DU is to be used as plutonium breeding resource for its breeder reactors. It is currently operating two fast breeder reactors in Beloyarsk. In its Belona paper, it states that the DU is to function as a reserve for the next millennia for its '" fast" energy industry[7]. However, Rosatom already has an enormous stockpile of DU from its own sources, sufficient for covering many centuries of use in the theoretical case it would decide to continue to expand this extremely expensive way of electricity generation. For all substances that currently would fall under the definition of waste, one can dream up some kind of reuse in millennia from now, but they remain waste. Normally spoken, when a substance cannot be used within one generation – be it either because of lack of technology to reuse it or because of abundance – it is usually considered waste. Substances like paper, aluminium or steel have a reuse cycle within several years after being discarded. For that reason, fictional reuse in millennia from now cannot be used as an argument. As soon as next generations will have to take care of the management of material with toxic, radiotoxic or otherwise problematic properties, this material should be considered waste that is handed over to those next generations. Next to that, given the fact that fast breeder technology has proven so far to be an extremely expensive and risky way to generate electricity (accident risk, proliferation risk), there is a very realistic chance that nothing or only a minute part of Rosatom's current stockpile of DU would indeed ever be used in fast breeder reactors.

- *Use of DU for DU weapons*
  Rosatom (in Nikitin (2020)) does not mention this potential use of DU. It is unlikely, however, that Russia is not using DU in production of armour-piercing weaponry, similar to that used by NATO and the US during the wars in Bosnia and Iraq. It may be that Rosatom does not mention this, because potential dual use of material would make it fall under EU export restrictions to Russia.[8] Apart from this dual-use problem, it is unlikely that reuse in the weapon industry would amount to more than a few percent of the total stockpile of DU currently available in Russia. DU from the EU would for that reason continue to expand the stockpile and should not be considered to be reused this way.

- *Use of DU for balancing purposes (ships, aircraft)*
  Also, this potential reuse of DU is not mentioned by Rosatom (in Nikitin (2020)). The reasons are probably comparable with the use for DU weapons: potential military dual-use and the very minute amounts necessary in comparison with the available stockpile.

- *Use in radiation resistant concrete*
  Rosatom (in Nikitin (2020)) does mention 'the manufacture of special radiation-resistant concrete'. From the description it remains unclear how much DU is used for this purpose in Russia, but the description of 'casks and protective screens for storage and transportation of SNF and [...] also [...] radiation-proof ballast for the geological burial of SNF' indicate that this concerns also speculative use of small amounts, especially because Russia has currently no active deep geological disposal programme for spent nuclear fuel (which it considers "resource" into eternity and not waste).

If all potential reuse of DU from EU sources in Russia is summarised, less than 10% will be reused in any form within the coming one or two generations. Over 90% will be passed on to the third generation and (very far) beyond for management and disposal.

This management includes (temporary) storage of UF6, which currently happens in Russia at environment temperatures in large open air storage places. This constitutes a risky situation, and research would be needed to get a full picture of the risks (chance and impact) of failure of containers in, for instance, surrounding forest fire situations, in which corroded containers could start leaking and the UF_6 would sublimate, causing a large HF cloud. Given the obligation of ultimate responsibility of the Member State of origin for this waste under the 2011/70/EURATOM, research would be needed into lowering this risk.

Then, Rosatom intends to convert this UF_6 to a more stable DU_3O_8 before 2057. Although there is already quite some experience with this conversion within the EU (e.g., in France / Orano, Cadarache), the legal responsibility for this waste would oblige the EU Member State of origin, i.e. Germany, also to research the actual conversion and following of temporary storage and potential final disposal in Russia, including potential risks and risk reduction options.

In the Netherlands, DU_3O_8 resulting from DU from the enrichment facility of URENCO in Almelo is considered waste and is stored in the VOG temporary storage at COVRA in Borssele, awaiting final disposal in a potential deep geological disposal. Because of the long half-time of U_{238}, this disposal has to be virtually permanent.

URENCO DU is waste

The production of TENORM waste in the EU delivers still poorly researched long-term issues. The fact that part of this TENORM is transferred outside of the EU only further complicates the situation, but should in essence not change the 'ultimate responsibility' of Euratom Member States (2011/70/EURATOM art. 4(2)) for proper handling and disposal of this radioactive material that appears as waste from industrial processes within the European Union. Especially the longevity and toxicity of the material (with a half-life of uranium-238 of 4.5 billion years) urges for research into proper disposal of this material, when it *de facto* will not be further used.

This is especially relevant for the exported depleted uranium from URENCO to Russia. There is currently no transparency about whether any fraction of this material is actually *de facto* reused, what happens with the remaining fraction in case it is reused, and which proper handling and deposition methods must be found and optimised. Also, when this material has to be considered as waste (as we argue), or certain fractions of it, repatriation of resulting wastes after processing needs to be taken into account, as well as handling methods that should be in place.

Given the fact that this DU will in Russia either be demobilised as uranium oxide before 2057 and stored for an unspecified multi-generational time, or for a tiny fraction reused under the production of radioactive wastes as by-product, we argue that the status of this from the EU to Russia exported DU should by default be that of waste.

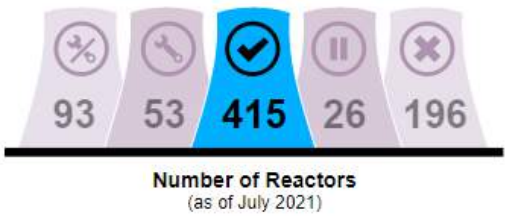
Jan Haverkamp, 2021

This case study is part of a larger report on radioactive waste and transparency, currently under preparation for the Euratom EURAD programme by Nuclear Transparency Watch. This is expected to be published in October 2021.

1. In dedication to Rashid Alimov († 2020), who delivered vital input for this chapter, but succumbed to COVID-19.
2. See: Nikitin, Alexander, Oleg Muratov and Ksenia Vakhrusheva, Depleted Uranium Hexafluoride (current situation, safe handling and prospects), St. Petersburg (2020) Bellona Foundation; https://network.bellona.org/content/uploads/sites/3/2020/08/Depleted-Uranium-Hexafluoride.pdf – Although this publication was published under the name of Bellona, the content was provided and overseen by Rosatom
3. Nikitin, Alexander, Oleg Muratov and Ksenia Vakhrusheva, Depleted Uranium Hexafluoride (current situation, safe handling and prospects), St. Petersburg (2020) Bellona Foundation; https://network.bellona.org/content/uploads/sites/3/2020/08/Depleted-Uranium-Hexafluoride.pdf
4. From Nikitin (2020), page 17 – this refers to Federal Law of November 21, 1995 No. 170-FZ on use of nuclear energy.
5. https://greenpeace.ru/wp-content/uploads/2019/10/Wirtschaftsministerium-NRW-an-GAL-Gronau-12.09.2019-UAA-Gronau.pdf
6. https://www.wise-uranium.org/nfcue.html
7. From Nikitin (2020), page 31.
8. Wegener, Bernhard W., *Zur Zulässigkeit von Dual-Use-Exportgenehmigungen für abgereichertes Uran von Deutschland nach Russland gemäß der EU-Verordnung 833/2014 - Rechtsgutachten für die Bundestagsfraktion Bündnis 90/Die Grünen*, Erlangen (2020) Friedrich-Alexander-Universität Erlangen-Nürnberg; https://kotting-uhl.de/site/wp-content/uploads/2020/10/Gutachten-Endfassung-final.pdf

NUCLEAR NEWS

World Nuclear Power Status



in American Jobs and a Just Transition to 100% Renewable Energy by 2035"

Source: https://www.worldnuclearreport.org/

In the last month there were no new connections to grid, construction starts or closures. The numbers of the World Nuclear Power Status are therefore the same as published in the last Nuclear Monitor.