

## “Worst Cases” Reimagined in a Post-COVID Context

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**Abstract:** *We argue that the post-Fukushima nuclear safety debates in the United States and Europe fundamentally altered the definition of nuclear safety. In the United States, the industry effectively took control by strengthening technical measures as the solution to nuclear safety concerns. In France, technical solutions were part of the process, but they were less dominant than in the United States and were overshadowed by larger organizational shuffles. The European Union, in contrast, engaged in a drawn-out debate over the very definition of nuclear safety, resulting in a stress test initiative that, while cumbersome and frustrating to many, included truly deliberative elements and ultimately revealed just how precarious the definitions of control and nuclear safety were.*

**Keywords:** *Fukushima, disaster, nuclear energy, nuclear policy, France, EU, USA.*

What has the Fukushima disaster taught us about nuclear emergency response, both in individual states, and in terms of transboundary cooperation? Our contribution to the *Legacies of Fukushima: 3.11 in Context* compares post-Fukushima initiatives in the United States, in France, and among the European institutions, and attempts to show in some detail the transformation of control. In the following, we summarize our analysis.

In the United States, the Japanese nuclear crisis was transformed into an institutional crisis, enveloping the Nuclear Regulatory

Commission and, in particular, its evacuation recommendation that was based on its own initial assessment of the spent fuel pool situation, not on the Japanese government’s crisis assessment. Early initiatives by US nuclear industry actors included a collaboration that resulted in a vision statement titled, “The Way Forward.”<sup>1</sup> This vision statement remained grounded in a technocratic rationality that sought an effective technical fix for reducing the risk of a nuclear disaster to manageable proportions. This group’s technocratic outlook did not grasp the importance of the less obvious situated expertise and improvisational skills inevitably involved in any successful disaster response.<sup>2</sup>

Secondly, the industry’s initiative “Diverse and Flexible Coping Strategies” (FLEX) targeted specifically a loss of power and reactor cooling capability.<sup>3</sup> FLEX was, on the one hand, an extension of the industry’s response to 9/11, when the industry restricted access to sites, installed additional barriers, expanded protective perimeters around nuclear facilities, increased on-site security personnel, and installed high-tech surveillance and equipment for safeguards.<sup>4</sup> On the other hand, the industry designed FLEX in anticipation of new NRC rules on better emergency preparedness and response. FLEX essentially consists of strategic stationing of vital emergency equipment, such as generators, battery packs, pumps, air compressors, and battery chargers. This equipment was set up in multiple locations at each plant and at secure offsite locations, specifically, two regional hubs (one in Memphis, Tennessee, and one in Phoenix, Arizona). The FLEX program also focused on guiding emergency responders in adequately

using these new FLEX capabilities, including substantial maintenance, testing, and training activities. We conclude that FLEX was a result of the industry's own gap analysis that determined potential vulnerabilities to "external events" and then identified possible modifications to ensure the working of a plant's key safety functions. The US nuclear industry advertised FLEX as the ultimate solution for responding to nuclear accidents that cross regulatory, administrative, and geographical boundaries. However, FLEX was set up before the NRC even developed guidelines for such a program, for example, with regard to specific quality requirements for equipment. Furthermore, the NRC has little authority to shape the design of such voluntary plans.

In conclusion, we argue that in the years since 2011, the Fukushima accident has amplified a jurisdictional ambiguity about the roles and responsibilities of the US nuclear industry and its regulator.<sup>5</sup>

In France, the Fukushima accident also triggered massive new emergency preparedness and response programs. Just after the accident, the largest nuclear plant operator, *Électricité de France* (EDF) created a Nuclear Rapid Response Force (*Force d'Action Rapide du Nucléaire*, or FARN), a nuclear emergency force capable of deploying to the site of a nuclear accident in less than 24 hours. Created already in 2011, FARN was capable to intervene in 2012, and became fully operational in 2016. In January 2014, the French Nuclear Safety Authority (*Autorité de Sûreté Nucléaire*, ASN) introduced the "hardened safety core" policy, which relied on technical improvements. Its implementation, however, required enhanced management during an emergency, and integrated the industry proposed emergency force, FARN.<sup>6</sup> In addition, the French government adopted a national emergency plan for the first time in 2014. The plan was developed jointly by the secretary of defense and national security, the French

Nuclear Safety Authority, the Institute for Radiological Protection and Nuclear Safety (IRNS), government experts and the three nuclear operators (AREVA, Commissariat à l'Énergie Atomique, and *Électricité de France*). The plan aimed at "strengthening defenses in low-frequency extreme nuclear events such as Fukushima, and at enhancing the protection of the population in the event of a nuclear emergency."<sup>7</sup> With its language of wartime mobilization, the plan effectively shifted the French government's focus from increased radiological protection and safety to the reestablishment of control and authority over its territory and population.<sup>8</sup>

For the European Union, the Fukushima accident was a crucial test of the union's capacity to act collectively.<sup>9</sup> A few days after the accident, calls for a pan-European nuclear "stress test" initiative started taking shape. Fukushima was portrayed as a clear prompt for Europe to reconsider its commitment to nuclear energy: either review the safety of existing plants or close them down.<sup>10</sup> Stress tests were swiftly included in the agenda of the Council of the European Union and discussed at meetings on March 24 and 25. This was the first time the EU had considered such a multilateral exercise.<sup>11</sup> But in order to conduct the proposed tests, all EU member states, regardless of their use of nuclear energy, first had to agree on some common criteria. Initially, the European Commission lobbied for the tests to take the form of an inspection.<sup>12</sup> This would have established the Commission as the authority that oversees nuclear safety in Europe and would have enabled the Commission to access original data, compare and rank the safety of operating reactors, and "name and shame" those that failed to meet the commonly defined criteria. Ultimately, individual member states refused to sacrifice their sovereign authority to EU institutions. Instead, the use of a peer-review process allowed individual member states to maintain their authority and control over the results,

while at the same time increasing the accountability of individual member states toward one another.<sup>13</sup>

Defining the scope of stress tests required staying within the existing regulatory, jurisdictional, and geographical boundaries, while also challenging them. It was only on May 24 that a consensus on the specifications was reached, which mostly relied on European nuclear regulators' initial proposal in terms of both scope and technical content.<sup>14</sup> In striking contrast to the probabilistic safety assessments that are widely used to determine whether or not a nuclear power plant is safe, stress tests relied on a deterministic approach: regardless of their probability of occurrence, catastrophic accidents had to be accounted for. Parties eventually agreed that the work on stress tests would occur along two parallel tracks: on the one hand, a safety track to assess how well nuclear installations could withstand the consequences of some clearly defined extreme external events; and on the other hand, a security track to analyze security threats and incidents due to malevolent or terrorist acts. In the end, then, the definition of stress tests failed to overcome established jurisdictional boundaries and maintained the distinction between nuclear security and nuclear safety. The three-stage review process that was eventually put in place for the stress tests became an essential part of the nuclear safety directive adopted by the European Council in 2014. Among other things, this defined "a high-level EU-wide safety objective," and set up a "European system of peer reviews" so that periodic assessments could be conducted on themes collectively defined by participant countries as they relate to national safety assessments and on-site emergency preparedness and response arrangements.<sup>15</sup>

In summary, we argue that the post-Fukushima nuclear safety debates in the United States and Europe fundamentally altered not only the definition of safety but also the definition of

what was at stake, who was responsible, who was accountable, and what "control" meant. In the United States, the industry effectively took control by reestablishing technical measures (such as storing more hardware at more physical locations) as the solution to nuclear safety concerns. In France, by contrast, public authorities' ambition to reestablish control over their territory and population in case of a nuclear accident coincided with the nuclear industry's ambition to keep its plants under its own control in all circumstances. While technical solutions were part of the process, they were less dominant than in the United States and were overshadowed by larger organizational shuffles. The European Union as a bureaucratic entity could rely on neither the swift pragmatism of an industry consortium nor the centralized rationality of a single nation state. Instead, its council members, regulators from its member states, and a whole range of industry representatives engaged in a drawn-out debate over the very definition of nuclear safety, who had the authority to set any kinds of standards, and who ought to enforce the fixing of manifest weaknesses. The resulting stress test initiative was a compromise that frustrated many people, yet it was a reaction to Fukushima that included truly deliberative elements: in an effort to increase transparency, seek harmonization, and achieve compliance, the initiative raised the question of what "control" meant. Not only did European bureaucrats struggle, very publicly, over setting acceptable standards for nuclear safety across the heterogeneous nuclear industries of its member states, but the stress test initiative revealed just how precarious the definition of control was. Overtly a debate over safety standards and their enforcement, the initiative put the European institutions' ambition to control nuclear safety to the test. Fukushima finally brought about the acknowledgment that nuclear risks are transboundary and reduced the distinction between members that operate nuclear facilities and those that do not. It also produced a process—the initiative—that at once

questioned fundamental assumptions about nuclear safety and started, even though timidly, a period of Europeanization of its regulatory regime.

The transformation of control is evident in the pervasive shift from an emphasis on technical solutions alone to the acknowledgment of a distributed and diversified notion of control. It is the anticipation of the “unthinkable”, or the expectation of the unexpected, that is slowly generating new ideas about nuclear risks and how to best ensure the safety of nuclear facilities. We propose that a comparative perspective can help highlight the different ways nuclear risks can be conceptualized, mitigated, and prepared for, and it might show different ways of controlling such risks socio-technically, organizationally, and epistemologically.

### **What Can We Learn about Emergency Preparedness and Response from the COVID Crisis?**

The nuclear industry likes to tout its smooth response to the COVID pandemic—many of the new “rules”, such as diligent hygiene, physical distancing, and even personal protective equipment (PPE) had already been in place and practiced in radiological environments. And in many cases, plants have indeed performed admirably under adverse conditions.<sup>16</sup> But as in other areas, the pandemic has also brought to light inequities in the nuclear industry: certainly, “essential workers” in nuclear plants, such as reactor operators, and other senior experts, were either voluntarily isolating or mandatorily getting special protections, with wide variations from country to country. But the less highly qualified workforce active in the industry during the pandemic, especially construction site crews, were left to their own devices, and often ended up contracting and spreading the virus. For example, construction workers often shared accommodations to save

money, which, in times of COVID, exposed them to additional risks. The pandemic holds lessons for such simple, yet neglected, provisions not made in equal measure for the entire nuclear workforce.

In France, as the pandemic started, ASN alerted EDF to the situation of employees of contractor companies, and asked the company to clearly define the maintenance or logistical activities for which continuity is “essential” so that there would be no ambiguity for these companies and their employees.<sup>17</sup> In the meantime, civil society organizations, such as the Commission de Recherche et d’Information Indépendantes sur la Radioactivité (CRIIRAD), expressed their concerns about the state of subcontractors, constituting 80% of the nuclear workforce in charge of maintenance activities, not only criticizing material work conditions (the lack of social distancing in the changing rooms, the shortage of hand sanitizer and protective masks, etc.) but also, denouncing the pressures suffered by employees who wanted to exercise their right to withdraw from certain tasks, underlining that the risk of doing their work badly is higher when employees are anxious and stressed.<sup>18</sup>

With regard to emergency preparedness and response, the COVID pandemic has been consequential for the nuclear industry. In the United States, neither FLEX nor post-9/11 force-on-force exercises could be conducted in the traditional way. Similar to plant inspections and maintenance, these exercises were either postponed, or modified (fewer participants, tabletop instead of in-person, etc.). In France, the situation differed slightly, especially in relation to FARN. Initially construed as an exceptional measure to be deployed in “unthinkable” or “extreme” events, as soon as the COVID-pandemic started, FARN became part of nuclear safety. In January 2021, FARN conducted a large-scale exercise at the Paluel nuclear power plant, widely observed and reported by regional and national press.<sup>19</sup> Each

time the pandemic-related safety concerns were raised, FARN has been put forward as a solution capable to remedy all kinds of shortcomings, construed, in a certain way, as an entity immune to its surrounding conditions.

To conclude, it is important to remind ourselves that post-Fukushima emergency response initiatives have been designed in reaction to what were once imagined as “worst-case scenarios” or “unthinkables”. Since the COVID-crisis, “worst cases” and “unthinkables” have been changing. Disaster researchers have long pointed to “cascading effects”, or disasters that happen in close temporal proximity, either related or unrelated to one another. We saw this early on during the pandemic in situations ranging from refugee camps (dealing with the crisis of displacement, humanitarian disasters, and now, additionally, COVID), to natural disasters occurring during the pandemic (earthquakes, fires, floods).<sup>20</sup> In a future post-COVID context, one can’t help but wonder how “worst-case scenarios” will be re-imagined next, along with the definitions that will be given to what is at stake, who is responsible, who is accountable, and what “control” means.

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## Notes

- <sup>1</sup> Nuclear Energy Institute, Institute for Nuclear Power Operations, and Electric Power Research Institute, 2011.
- <sup>2</sup> Kreps and Bosworth, 1993; Mendonca, Beroggi, and Wallace, 2001; Perin, 1998; Weick, 1993 and 1998; Weick, Sutcliffe, and Obstfeld, 1999.
- <sup>3</sup> Nuclear Energy Institute, 2012.
- <sup>4</sup> Some of these efforts have been criticized for inadequately addressing beyond design basis threats: for example, restricting access to prevent a terrorist attack ignores one of the most common failures in complex systems, the insider threat.
- <sup>5</sup> Lyman, 2016.
- <sup>6</sup> French Nuclear Safety Authority (ASN), 2014.
- <sup>7</sup> Premier Ministre. “Plan National de Réponse Accident Nucléaire Ou Radiologique Majeur.” Numéro 200/SGDSN/PSE/PSN, 2014 ; Secrétariat général de la défense et de la sécurité nationale, 2014.
- <sup>8</sup> Blavette, 2014.
- <sup>9</sup> Saraç-Lesavre, 2017 ; Saraç-Lesavre and Laurent, 2019.
- <sup>10</sup> Taylor and Dahl, 2011.
- <sup>11</sup> Jamet, 2012.
- <sup>12</sup> Interview with a high-level officer of the EU Commission who requested anonymity, December 15, 2016, Luxembourg.
- <sup>13</sup> Saraç-Lesavre and Laurent, 2019.
- <sup>14</sup> European Nuclear Safety Regulator’s Group, 2011.
- <sup>15</sup> Council of the European Union, 2014.
- <sup>16</sup> Wendland, 2020.
- <sup>17</sup> French Nuclear Safety Authority (ASN), 2020.
- <sup>18</sup> CRIIRAD, 2020.
- <sup>19</sup> Paris Normandie, 2021.
- <sup>20</sup> For a more recent example, when a major earthquake hit Izmir, Turkey, in October 2020, disaster response measures had not been designed to account for such a situation and the number of COVID cases peaked (Şimşek and Gündüz, 2021).