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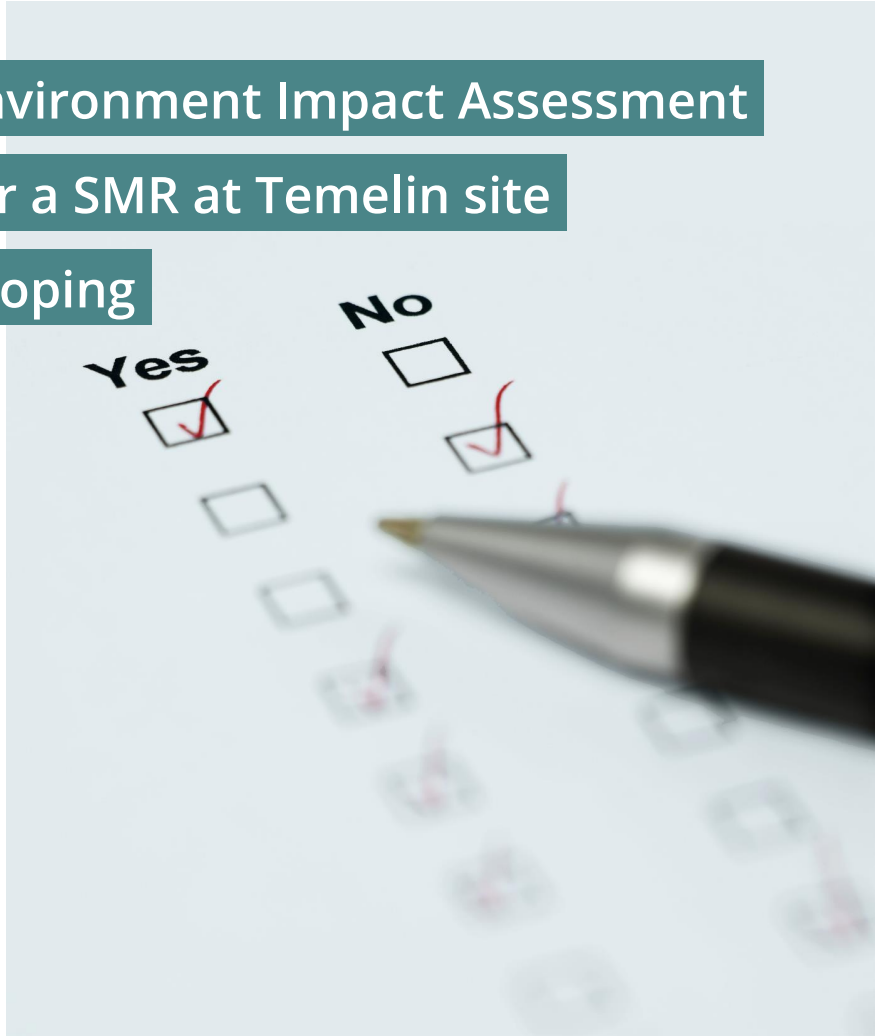
Environment Impact Assessment for a SMR at Temelin site

Scoping



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NEW NUCLEAR SOURCE
A SMR AT THE TEMELÍN SITE

ENVIRONMENT IMPACT ASSESSMENT
SCOPING

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EXECUTIVE SUMMARY

The Czech Republic has notified Austria about the Environment Impact Assessment (EIA) procedure under the Espoo Convention and the EU EIA Directive for the project “New Nuclear source of SMR at the Temelin Site”. Austria is participating in the transboundary EIA. The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology commissioned the Federal Environment Agency to prepare an expert opinion on the submitted documents. The Provinces of Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Tirol and Vorarlberg support this statement.

The Environment Agency commissioned ENCO to elaborate an Expert Statement concerning the EIA Scoping Document.

The documentation for the "scoping" part of the procedure is currently being assessed. Within the framework of this part of the procedure, it is being discussed what content the project applicant will have to present in the environmental report and in what detail.

The objective of Austria's participation in the EIA procedure is to minimise or prevent possible significant adverse effects of the project on Austria. The expert opinion on the scoping part of the procedure sets out the requirements for the environmental report.

The Czech Republic’s energy planning includes the commitment for decarbonisation of electricity production by 2045. Additionally to renewables, the Czech Republic decided to maintain a high fraction of nuclear in its energy mix. The existing nuclear plants are to be supplemented with (and gradually replaced by) two new large units at the Dukovany, one SMR unit at the Temelin site and later with an additional two large units at Temelin.

The SMR at the Temelin site is the first one in a series of SMRs that the Czech Republic is considering for coal plants replacement for various sites around the country. Temelin SMR will also serve to gain experience in construction and in operation of SMRs. Constructing an SMR at an existing nuclear site is expected to ease the process of licensing, preparation and construction, which is very important for the deployment of a reactor that is a First of a kind (FOAK), or at least a FOAK in a country. Eventual construction of Temelin SMR may be expected to start around the end of the decade.

The project proponent CEZ a.s. has initiated activities for the project preparation, primarily related with the environmental impact assessment, as required as per the legal framework in the Czech Republic. In this respect, the “Notification of a new nuclear source of SMR at Temelin” was prepared to delineate evaluations that are required per Section 7 of the Czech Republic’s Environmental Act. The Notification is not to provide detailed information or assessments on expected environmental effects of the project. Those will be elaborated in the “full” environmental impact assessment report.

The future Temelin SMR is to be co-located next to the original Temelin NPP, though it does not overlap with any of the existing installations. The Temelin SMR will share some of the basic infrastructure with the existing Temelin units, most importantly the water management connections. Otherwise, the SMR project will include all necessary buildings and technological systems needed to generate power and transmit it off site.

The Notification document presents and delineates the main characteristics of 4 SMR models that are considered for the Temelin site. Those include Rolls Royce SMR, GE's BWRX, EDF's NUWARD and WEC's AP300. Although not mentioned in the Notification, CEZ took an equity stake in the RR SMR, which makes it very likely that the RR SMR will be selected for the Temelin site. The Notification makes it clear that any SMR model needs to fulfil all the legal and regulatory requirements in the Czech Republic. It is noted that SUJB's safety regulations are modern, in line with the IAEA standards and WENRA objectives for new reactors.

The RR SMR is likely the most "traditional" design of all SMRs considered. Furthermore, RR SMR is undergoing the Generic Design Assessment (GDA) by the ONR (UK nuclear regulator), of which the Phase 2 (of 3) is already completed. As the detailed design is still developing, the safety analysis report and the probabilistic safety analysis are not yet completed. This has a profound impact on the implementation of the EIA. It would not be possible to develop a full scope EIA that would assess the radiological impact near the site and far (i.e. transboundary for Austria) until at least the SAR to include DEC A and B, and a full scope Level 2 PSA are completed. If this is not the case, this might lead to a situation where the assessments are neither realistic nor properly determine the impact on the environment and population. It is therefore recommended that the development of a full EIA, in particular related to environmental impact of radiological releases, is postponed until the detailed design of the SMR is completed.

In terms of alternatives that are required to be considered in the scoping EIA, the Notification document describes different alternatives, though only at a high level. An analysis of a "zero option", i.e. that the SMR is not constructed at all in the EIA might be a prudent addition.

The Temelin nuclear site was originally designed for 4 large NPPs, including all auxiliary buildings that are needed for the operation of NPP units. At present, in addition to two large units, the spent nuclear fuel storage and a fresh nuclear fuel storage, are in operation at Temelin site. It is recommended that the EIA report addresses possible interactions among multiple units, including assessment of external impacts affecting all the units at the site (as well as the SNF interim store). As external hazards are likely the most important safety challenge affecting all units at the site, it is suggested that those are thoroughly assessed. Furthermore, the impact on other units, if one of the units is affected by an accident with radioactive release, is to be addressed.

The Notification document clearly states that the SMR at the Temelin site shall and will meet the safety requirements in the Czech Republic. However, with the SMR models still being under development, what kind of safety level would be achieved, whether there would be some challenges or even cliff edge effects,

cannot be certain at this stage. This is particularly relevant for the so-called DEC -B conditions, which are to be reflected in the EIA report to assure the credibility of an off-site and transboundary impact from severe incidents. Consequently, the EIA report shall provide a list of all internal and external hazards that have been analysed (including their combination) with an indication of the results obtained.

From the perspective of a neighbouring country, where Austrian territory is only about 50 km distance from the Temelin site, the most relevant part of the EIA report is the transboundary impact. The Notification document clearly indicated that the EIA report will be undertaking analyses of enveloping design basis accidents scenarios and of the design extension condition scenarios, to determine the impact onto the population and environment in neighbouring countries. While the Notification documents suggest that even in a case of core damage at a SMR, the release would happen through “microleaks”, it is suggested that, regardless of rather low probability, a DEC B sequence with an early containment failure is assessed in the EIA report for the transboundary impact. In relation with this, it is recommended that the EIA report describes in detail the sequences selected, including the basis for the source terms used in the dispersion models.

As with any nuclear plant, generation of radioactive waste and spent nuclear fuel has a special impact on the environment. It is therefore recommended that the EIS discusses generation, processing/treatment, on site storage and off site disposal for radioactive waste and spent fuel generated by the SMR at Temelin.

Austria, being the closest neighbouring country, has a keen interest in the safety of nuclear plants in the Czech Republic, that could in extreme circumstances have impact on the environment and the population in Austria. In accordance with the EU Directives and the Espoo Convention, Austria participates in the EIA process for Temelin SMR. This report is an important element for this participation, as it establishes the expectations as to the areas and specific topics to be addressed in the full EIA report for the SMR at Temelin site.

ZUSAMMENFASSUNG

Die Tschechische Republik hat Österreich über die Umweltverträglichkeitsprüfung (UVP) zum Projekt "Neubau SMR Temelin" gemäß dem Übereinkommen über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (Espoo Konvention) und Art. 7 UVP-RL notifiziert. Österreich nimmt an diesem Verfahren teil. Im Auftrag des Bundesministeriums für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie sowie unter Mitfinanzierung der Bundesländer Burgenland, Kärnten, Niederösterreich, Oberösterreich, Salzburg, Tirol sowie Vorarlberg wurde vom Umweltbundesamt die Erstellung einer Fachstellungnahme zu den übermittelten Dokumenten koordiniert.

Das Umweltbundesamt hat ENCO mit der Erstellung dieser Fachstellungnahme zu dem vorliegenden Scoping-Dokument beauftragt.

Die Unterlagen für den Scoping-Teil des Verfahrens werden derzeit geprüft. Im Rahmen dieses Teils des Verfahrens wird erörtert, welche Inhalte der Projektwerber im Umweltbericht darzustellen hat und in welchem Umfang sie behandelt werden müssen.

Ziel der österreichischen Beteiligung am UVP-Verfahren ist es, mögliche signifikante nachteilige Auswirkungen des Projekts auf Österreich zu minimieren oder zu verhindern. In der Fachstellungnahme zum Scoping-Teil des Verfahrens werden die Anforderungen an den Umweltbericht dargelegt.

Die Energieplanung der Tschechischen Republik beinhaltet die Verpflichtung zur Dekarbonisierung der Stromerzeugung bis 2045. Zusätzlich zu den erneuerbaren Energien hat die Tschechische Republik beschlossen, einen hohen Anteil an Kernenergie in ihrem Energiemix beizubehalten. Die bestehenden Kernkraftwerke sollen durch zwei neue große Blöcke in Dukovany, einen SMR-Block am Standort Temelin und später durch zwei weitere große Blöcke in Temelin ergänzt (und schrittweise ersetzt) werden.

Der SMR am Standort Temelin ist der erste einer Reihe von SMRs, die die Tschechische Republik als Ersatz für Kohlekraftwerke an verschiedenen Standorten im ganzen Land in Betracht zieht. Der SMR in Temelin dient auch dazu, Erfahrungen im Bau und Betrieb von SMRs zu sammeln. Der Bau eines SMR an einem bestehenden Atomstandort soll den Genehmigungs-, Vorbereitungs- und Bauprozess erleichtern, was für den Einsatz eines Reaktors, der der erste seiner Art (FOAK) oder zumindest ein FOAK in einem Land ist, sehr wichtig ist. Der endgültige Bau des SMR in Temelin dürfte voraussichtlich gegen Ende des Jahrzehnts beginnen.

Der Projektträger CEZ a.s. hat Aktivitäten zur Projektvorbereitung eingeleitet, die in erster Linie mit der Umweltverträglichkeitsprüfung zusammenhängen, wie es der Rechtsrahmen in der Tschechischen Republik vorschreibt. In diesem Zusammenhang wurde die „Notification of a new nuclear source of SMR at Temelin" vorbereitet, um die Bewertungen darzulegen, die gemäß Abschnitt 7 des tschechischen Umweltgesetzes erforderlich sind. Die Meldung soll keine detail-

lierten Informationen oder Bewertungen zu den erwarteten Umweltauswirkungen des Projekts enthalten. Diese werden in der „vollständigen" Umweltverträglichkeitsprüfung ausführlicher behandelt.

Der zukünftige SMR in Temelin soll neben dem ursprünglichen Kernkraftwerk Temelin errichtet werden, überschneidet sich jedoch nicht mit den bestehenden Anlagen. Der SMR in Temelin wird einen Teil der grundlegenden Infrastruktur mit den bestehenden Temelin-Anlagen teilen, vor allem die Wasserversorgungsanschlüsse. Ansonsten wird das SMR-Projekt alle notwendigen Gebäude und technologischen Systeme umfassen, die zur Stromerzeugung und -übertragung außerhalb des Standorts erforderlich sind.

Das Notification document präsentiert und beschreibt die Hauptmerkmale von 4 SMR-Modellen, die für den Standort Temelin in Betracht gezogen werden. Dazu gehören Rolls Royce SMR, GEs BWRX, EDFs NUWARD und WECs AP300. Obwohl es nicht spezifisch erwähnt wird, hat CEZ eine Beteiligung am RR SMR erworben, was es sehr wahrscheinlich macht, dass der RR SMR für den Standort Temelin ausgewählt wird. Das Notification document macht deutlich, dass jedes SMR-Modell alle gesetzlichen und behördlichen Anforderungen in der Tschechischen Republik erfüllen muss. Es wird darauf hingewiesen, dass die Sicherheitsvorschriften von SUJB modern sind und den IAEA-Standards und den WENRA-Zielen für neue Reaktoren entsprechen.

Der RR-SMR ist wahrscheinlich das „traditionellste" Design aller betrachteten SMRs. Darüber hinaus durchläuft der RR-SMR gerade das Generic Design Assessment (GDA) durch die ONR (britische Atomaufsichtsbehörde), von dem Phase 2 (von 3) bereits abgeschlossen ist. Da sich das detaillierte Design noch in der Entwicklung befindet, sind der Sicherheitsanalysebericht und die probabilistische Sicherheitsanalyse noch nicht abgeschlossen. Dies hat erhebliche Auswirkungen auf die Umsetzung der UVP. Es wäre nicht möglich, eine umfassende UVP zu entwickeln, die die radiologischen Auswirkungen in der Nähe des Standorts und weiter entfernt (d. h. grenzüberschreitend für Österreich) bewertet, bis zumindest der SAR, der DEC A und B umfasst, und eine umfassende PSA der Stufe 2 abgeschlossen sind. Wenn dies nicht der Fall ist, würde dies zu einer Situation führen, in der die Bewertungen weder realistisch sind noch die Auswirkungen auf die Umwelt und die Bevölkerung richtig bestimmen. Es wird daher empfohlen, die Entwicklung einer umfassenden UVP, insbesondere in Bezug auf die Umweltauswirkungen radiologischer Freisetzungen, zu verschieben, bis das detaillierte Design des SMR abgeschlossen ist.

Was die Alternativen betrifft, die in der UVP berücksichtigt werden müssen, werden im Dokument verschiedene Alternativen beschrieben, allerdings nur auf einer groben Ebene. Eine Analyse einer „Zero Option", d. h., dass der SMR überhaupt nicht gebaut wird, könnte eine sinnvolle Ergänzung sein.

Der Atomstandort Temelin war ursprünglich für 4 große Reaktoren ausgelegt, einschließlich aller Nebengebäude, die für den Betrieb der Kernkraftwerkseinheiten erforderlich sind. Derzeit sind am Standort Temelin neben zwei großen Einheiten auch das Lager für abgebrannte Brennelemente und ein Lager für fri-

sche Brennelemente in Betrieb. Es wird empfohlen, dass der UVP-Bericht mögliche Wechselwirkungen zwischen mehreren Einheiten behandelt, einschließlich der Bewertung externer Auswirkungen, die alle Einheiten am Standort betreffen (sowie das Zwischenlager für abgebrannte Brennelemente). Da die externen Gefahren wahrscheinlich die wichtigste Herausforderung für alle Einheiten am Standort darstellen, müssen diese gründlich bewertet werden. Darüber hinaus wird vorgeschlagen, die Bedingungen für andere Einheiten zu berücksichtigen, falls eine der Einheiten von einem Unfall mit Freisetzung radioaktiver Substanzen betroffen ist.

Im Notification document heißt es eindeutig, dass der SMR am Standort Temelin die Sicherheitsanforderungen der Tschechischen Republik erfüllen soll und wird. Da sich die SMR-Modelle jedoch noch in der Entwicklung befinden, lässt sich derzeit noch nicht mit Sicherheit sagen, welches Sicherheitsniveau erreicht werden würde, ob es zu Herausforderungen oder sogar zu Cliff-Edge-Effekten kommen würde. Dies ist insbesondere für die sogenannten DEC-B-Bedingungen relevant, die in der Umweltverträglichkeitsprüfung berücksichtigt werden müssen, um die Glaubwürdigkeit der Auswirkungen schwerer Unfälle auf andere Standorte und über Grenzen hinweg sicherzustellen. Daher muss die Umweltverträglichkeitsprüfung eine Liste aller internen und externen Gefahren enthalten, die analysiert wurden (einschließlich ihrer Kombination) und die erzielten Ergebnisse angeben.

Aus der Perspektive eines Nachbarlandes - österreichisches Gebiet ist nur rund 50 km vom Standort Temelin entfernt - ist der relevanteste Teil der UVP die grenzüberschreitende Auswirkung. Im Notification document wurde klar darauf hingewiesen, dass im Rahmen der UVP-Analysen von Szenarien umfassender Auslegungsstörfälle und Szenarien mit Auslegungserweiterungen vorgenommen werden, um die Auswirkungen auf die Bevölkerung und die Umwelt in den Nachbarländern zu ermitteln. Während angedeutet wird, dass selbst im Falle einer Beschädigung des Reaktorkerns in einem SMR die Freisetzung durch „Mikrolecks“ erfolgen würde, wird vorgeschlagen, dass ungeachtet der eher geringen Wahrscheinlichkeit, in der UVP hinsichtlich der grenzüberschreitenden Auswirkung eine DEC-B-Sequenz mit einem frühen Containmentversagen bewertet wird. In diesem Zusammenhang wird empfohlen, dass im UVP-Bericht die ausgewählten Sequenzen detailliert beschrieben werden, einschließlich der Grundlage für die in den Dispersionsmodellen verwendeten Quellterme.

Wie bei jedem Kernkraftwerk hat die Erzeugung radioaktiver Abfälle und abgebrannter Brennelemente besondere Auswirkungen auf die Umwelt. Es wird daher empfohlen, dass die Umweltverträglichkeitsprüfung die Erzeugung, Verarbeitung/Behandlung, Lagerung vor Ort und Entsorgung der radioaktiven Abfälle und abgebrannten Brennelemente aus der Kernkraftwerksanlage in Temelin erörtert.

Österreich ist das nächste Nachbarland und hat ein großes Interesse an der Sicherheit der Kernkraftwerke in der Tschechischen Republik, die in extremen Fällen Auswirkungen auf die Umwelt und die Bevölkerung in Österreich haben könnten. In Übereinstimmung mit den EU-Richtlinien und der Espoo-Konvention beteiligt sich Österreich am UVP-Prozess für den Temelin SMR. Dieser Bericht ist

ein wichtiges Element dieser Beteiligung, da er die Erwartungen hinsichtlich der Bereiche und spezifischen Themen festlegt, die im vollständigen UVP-Bericht für den SMR am Standort Temelin behandelt werden sollen.

SHRNUTÍ

Česká republika oznámila Rakousku postup posuzování vlivů na životní prostředí (EIA) podle Úmluvy z Espoo a směrnice EU EIA pro „Nový jader-ný zdroj SMR v lokalitě Temelín“. Rakousko se účastní přeshraničního řízení posouzení vlivu na životní prostředí (EIA). Spolkové ministerstvo pro klima, životní prostředí, energetiku, mobilitu, inovace a technologie pověřilo Spolkovou agenturu pro životní prostředí vypracováním odborného stanoviska k předloženým dokumentům. Spolkové země Burgenland, Korutany, Dolní Rakousy, Horní Rakousy, Salcbursko, Tyrolsko a Vorarlbersko toto podporují.

Agentura pro životní prostředí pověřila ENCO vypracováním odborného stanoviska týkajícího se rozsahu předložených dokumentů (Scoping Document).

V současné době se posuzuje rozsah dokumentace předložené pro přeshraniční řízení. V rámci této části řízení se projednává, jaký obsah musí žadatel projektu ve studii vlivu na životním prostředí a obyvatelstvo (EIA) uvést a v jakém rozsahu.

Cílem účasti Rakouska v procesu přeshraničního řízení je minimalizovat možné významné nepříznivé dopady projektu na Rakousko nebo jim zabránit. Odborný posudek k části řízení o stanovení rozsahu posoudí náležitosti studie vlivu na životní prostředí.

Energetické plánování v České republice zahrnuje závazek dekarbonizace výroby elektřiny do roku 2045. Kromě obnovitelných zdrojů se Česká republika rozhodla zachovat ve svém energetickém mixu vysoký podíl jádra. Stávající jaderné elektrárny mají být doplněny (a postupně nahrazeny) dvěma novými velkými bloky v Dukovanech, jedním blokem malého modulárního reaktoru (SMR) v lokalitě Temelín a později dalšími dvěma velkými bloky v Temelíně.

Uvažovaný nový reaktor v lokalitě Temelín je první z projektové řady malých modulárních reaktorů, o kterých Česká republika uvažuje za výměnu uhelných elektráren pro různé lokality po celé zemi. SMR v Temelíně také poslouží k získání zkušeností z výstavby a provozu SMR. Očekává se, že výstavba SMR na stávající lokalitě usnadní proces licencování, přípravy a výstavby, což je velmi důležité pro nasazení reaktoru, který je v dané zemi prvním reaktorem tohoto druhu (FOAK). Zahájení případné výstavby SMR v lokalitě Temelín lze očekávat koncem této dekády.

Předkladatel projektu ČEZ a.s. zahájil činnosti v přípravě projektu, především související s posuzováním vlivů na životní prostředí (EIA), jak to vyžaduje právní úprava v České republice. V této souvislosti bylo připraveno „Oznámení nového jaderného zdroje SMR v Temelíně“ (dále jen Oznámení), které stanovuje rozsah a obsah studie posouzení vlivu na životní prostředí podle § 7 Zákona o životním prostředí České republiky. Účelem Oznámení není poskytovat podrobné informace nebo posouzení očekávaných vlivů projektu na životní prostředí. Ty budou rozpracovány v „úplné studii“ posouzení vlivů na životní prostředí EIA později.

Umístění budoucího SMR v lokalitě Temelín má být vedle stávajících dvou bloků v jaderné elektrárně Temelín, ale nebude se překrývat s žádným ze stávajících zařízení. SMR sice bude sdílet část základní infrastruktury se stávajícími bloky v Temelíně, především vodohospodářské přípojky, ale bude mít vlastní všechny stavby a technologické systémy potřebné k výrobě elektřiny a jejímu přenosu do rozvodné sítě.

V Oznámení se uvádí a vymezují hlavní charakteristiky čtyř modelů SMR, které jsou uvažovány pro lokalitu Temelín. Patří mezi ně Rolls Royce SMR (RR SMR), BWRX od GE, NUWARD od EDF a AP300 od WEC. Ačkoli to není v Oznámení uvedeno, ČEZ převzal majetkový podíl v RR JMK, což velmi pravděpodobně znamená, že RR SMR bude vybrán pro lokalitu Temelín. Oznámení vysvětluje, že jakýkoli model SMR musí splňovat všechny právní požadavky a požadavky Státního úřadu pro jadernou bezpečnost (SÚJB) v České republice. Je třeba poznamenat, že požadavky SÚJB jsou moderní, v souladu s normami MAAE a s bezpečnostními cíli WENRA pro nové reaktory.

RR SMR pravděpodobně patří k „nejtradičnějšímu" projektu ze všech uvažovaných SMR. Kromě toho RR SMR právě prochází generickým hodnocením návrhu (GDA) ze strany ONR (jaderný dozor ve Velké Británii), jehož 2. fáze (ze 3) je již dokončena. Vzhledem k tomu, že se podrobný projektový návrh stále vyvíjí, bezpečnostní analýzy a pravděpodobnostní hodnocení bezpečnosti (PSA) ještě nejsou plně dokončeny. To může mít velký dopad na posouzení dopadu na životní prostředí, kdy není možné v plném rozsahu vypracovat toto posouzení, zejména posouzení radiačních vlivů na lokalitě a dále mimo lokalitu (tj. přeshraniční vliv na Rakousko), dokud nebude dokončena alespoň bezpečnostní zpráva (BZ) zahrnující rozšířené projektové podmínky bez vážného poškození jaderného paliva (DEC - A) a celý rozsah PSA úrovně 2. Pokud tomu tak není, může vést k situaci, kdy posouzení vlivu není realistické, a neurčuje správně dopad na životní prostředí a obyvatelstvo. Proto se doporučuje, aby vypracování úplného posouzení vlivů na životní prostředí, zejména v souvislosti s dopady radiačních úniků na životní prostředí, bylo odloženo do doby, než bude dokončen podrobný projekt SMR.

Pokud jde o alternativy, které je třeba vzít v úvahu v rámci studie EIA, Oznámení popisuje čtyři různé projekty SMR, i když jen pouze na vysoké úrovni. V této souvislosti se rozumným řešením zdá být tzv. „nulová varianta", tedy že SMR není v studii EIA vůbec uvažován.

Lokalita Temelín byla původně projektovaná pro čtyři velké reaktory, včetně všech pomocných staveb, které jsou potřebné pro provoz bloků jaderné elektrárny. V současné době je na lokalitě Temelín, kromě dvou velkých bloků v provozu, také sklad vyhořelého jaderného paliva a sklad čerstvého jaderného paliva. Doporučuje se, aby se studie EIA také zabývala možnými více blokovými, včetně posouzení vnějších vlivů ovlivňujících všechny reaktory v lokalitě (a také meziskladu vyhořelého jaderného paliva (VJP)). Vzhledem k tomu, že vnější ohrožení jsou pravděpodobně nejdůležitějším faktorem ovlivňujícím všechny bloky v lokalitě, je potřebné, aby byly důkladně posouzeny. Dále se navrhuje posoudit stav ostatních bloků, pokud by jeden z bloků byl postižen havárií s únikem radioaktivních látek.

V Oznámení se jasně uvádí, že SMR na lokalitě Temelín bude splňovat bezpečnostní požadavky platné v České republice. Vzhledem k tomu, že projekty SMR jsou stále ve vývoji, nelze v této fázi zjistit, jaké úrovně bezpečnosti bude dosaženo, zda se mohou vyskytnout problémy nebo dokonce cliff-edge efekty. To je zvláště důležité pro posouzení rozšířených projektových podmínek s vážným poškozením jaderného paliva (těžká havárie) (DEC -B), které se mají posoudit v rámci EIA tak, aby byla zajištěna důvěryhodnost posouzení vlivu přeshraničního dopadu závažné havárie. Následně studie EIA poskytne seznam všech vnitřních a vnějších ohrožení, která jsou analyzována (včetně jejich kombinací) s uvedením výsledků těchto analýz.

Z pohledu sousední země, kde je rakouské území od lokality Temelín vzdáleno asi jen 50 km, je přeshraniční dopad nejdůležitější částí v EIA. Oznámení jasně uvádí, že studie EIA bude provádět analýzy zahrnující scénáře projektových havárií a scénáře rozšířených projektových podmínek tak, aby se určil dopad na životní prostředí a obyvatelstvo v sousedních zemích. I když Oznámení naznačuje, že i v případě poškození aktivní zóny SMR by k došlo k úniku prostřednictvím „mikroúniků“, navrhuje se, aby byly v EIA pro přeshraniční dopad posouzeny sekvence rozšířených projektových podmínek s vážným poškozením jaderného paliva (DEC B) s časným selháním kontejnmentu, a to bez ohledu na jejich poměrně nízkou pravděpodobnost. V souvislosti s tím se doporučuje, aby EIA podrobně popsala a zdůvodnila vybrané sekvence, včetně zdrojových členů, použitých v modelech rozptylu.

Jako v každé jaderné elektrárně, produkce radioaktivních odpadů a vyhořelého jaderného paliva má specifický dopad na životní prostředí. Proto se doporučuje, aby studie EIA posoudila vznik, zpracování/úpravu, skladování na lokalitě a ukládání radioaktivního odpadu a vyhořelého paliva z SMR v Temelíně.

Rakousko, jako nejbližší sousední země, má velký zájem na bezpečnosti jaderné elektrárny v České republice, která by v extrémních případech mohla mít v Rakousku dopad na životní prostředí a obyvatelstvo. Rakousko se v souladu se směrnicemi Evropské unie (EU) a Úmluvy Espoo účastní procesu EIA pro SMR Temelín. Tato zpráva je důležitým prvkem pro jeho účast, protože stanovuje očekávání, pokud jde o oblasti a konkrétní témata, kterými se bude zabývat úplná studie EIA pro SMR v lokalitě Temelín.

1 INTRODUCTION AND OVERVIEW

The Czech Republic has notified Austria about the Environment Impact Assessment (EIA) procedure under the Espoo Convention and the EU EIA Directive for the project “New Nuclear source of SMR at the Temelin Site”. Austria is participating in the transboundary EIA. The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology commissioned the Federal Environment Agency to prepare an expert opinion on the submitted documents. The Provinces of Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Tirol and Vorarlberg support this statement.

The Environment Agency commissioned ENCO to elaborate an Expert Statement concerning the Scoping Document.

The documentation for the "scoping" part of the procedure is currently being assessed. Within the framework of this part of the procedure, it is being discussed what content the project applicant will have to present in the environmental report and in what detail.

The objective of Austria's participation in the EIA procedure is to minimise or prevent possible significant adverse effects of the project on Austria. The expert opinion on the scoping part of the procedure sets out the requirements for the environmental report.

The overarching aim for the national Energy policy of the Czech Republic for the next decades is maximising the decarbonisation of the electricity production, with a total removal of fossil fuels set for 2045. Unlike some other EU Member States, the Czech Republic decided to maintain a high fraction of nuclear in its energy mix. The existing nuclear plants, 4 units at the Dukovany site and 2 units at the Temelin site, are planned to be supplemented with (and gradually replaced by) 2 large units at the Dukovany site and later with an additional 2 large units at the Temelin site over the next decades.

The commitment to nuclear goes also beyond large, utility- scale nuclear reactors. With the advent of small modular reactors (SMR), that are expected to have a significantly shorter construction time and, due to their size, can be deployed at sites that were previously not considered suitable for large nuclear plants, the Czech Republic is considering those for various sites around the country. SMRs are also planned as on-site replacements at the locations of retiring thermal (coal fired) plants, with about 8 sites being considered.

In order to assess the constructability to enable future deployment at other sites, but also to gain experience in the operation of SMRs, a construction of a SMR at the existing nuclear operating site at Temelin is proposed. Establishing a new plant at an existing nuclear site is expected to ease the process of licensing, preparation and construction of the unit. This is of particular importance for the deployment of a reactor that is a First of a kind (FOAK), or at least a FOAK in a country.

The plans for the project for the construction of a SMR at the Temelin NPP site reflects the Policy Statement of the Government of the Czech Republic of January 2022, as updated in March 2023, and the Plan for Small and Medium Reactors in the Czech Republic - utilisation and economic development (MPO, May 2023), that were approved by Government Resolution No. 808 of 1 November 2023. The project fully complies with the objectives of the update of the State Energy Policy (ASEK), with the National Action Plan for the Development of Nuclear Power in the Czech Republic (NAP NP) and the update of the National Energy and Climate Plan of the Czech Republic (VPEK).

Although the project "SMR at Temelin site" is still in an early planning stage, with eventual construction expected to start around the end of the decade, the project proponent ("the Developer") CEZ a.s. is already initiating the activities, particularly related with the environmental impact assessment, which is required as per the legal framework in the Czech Republic. Within this, the initial "Notification of the Project" was prepared in accordance with Section 6 and Annex No. 3 to Act No. 100/2001 Coll., on the Environmental Impact Assessment, as amended (hereinafter referred to as the "Act"). The Notification serves as the basic document for delineating the assessments to be performed that are required per Section 7 of the Act. The Notification document also aims at specifying information that is suitable to be included in the project's environmental impact documentation. The Notification document was released in November 2024, and is available for public comments. Austria, as a neighbouring country, participates in this process.

The aim of the Notification document is to collect present basic information on the project, including various environmental impacts stemming from the construction and operation of the facility. As per the environmental regulations in the Czech Republic, nuclear facilities are considered "Category 1" projects, meaning that those are always subject to a full environmental assessment. In this respect, the Notification is the initial step in the process, which is sometimes termed as the "Scoping EIA".

The aim of the Notification is not to provide detailed information or assessments on expected environmental effects of the project, rather to provide basic information that would then be further elaborated in the "full" environmental impact assessment. The EIA report would then be, in accordance with the Espoo Convention and the EIA Directive, made publicly available to the population that might be impacted by the project implementation, which in cases of nuclear projects encompasses countries that might be potentially affected. Austria, having its closest border just 50 km from the Temelin site, will be participating in the process on the full EIA.

The detailed EIA will be the subject of further follow-up discussions as part of the public commenting process. Those will be compiled according to Section 8 of the Environmental Act of the Czech Republic.

The project itself is the construction of one SMR reactor to be co-located with the existing Temelin NPPs, where 2 WWER 1000 units are in operation since the early 2000s. The original plan for the Temelin nuclear site had foreseen that it

would encompass 4 units, but only 2 were completed. At present, plans are being discussed to additionally construct Temelin units 3 and 4 at some point in the foreseeable future (2030ties). The Temelin site also houses an interim spent fuel storage facility, which is in the process of being extended, to allow for the storage of all spent fuel generated during the operation of units 1 and 2.

The future Temelin SMR is to be co-located next to the original Temelin NPP site, though it does not overlap with any of the existing (or future planned, i.e. units 3 & 4) installations. The South Bohemian region issued a Decision No. 216/2024/ZK-34 to delineate the site, to enable the implementation of the ”new nuclear source” i.e. SMR. The Temelin SMR will share some of the basic infrastructure with the existing Temelin NPP site, most importantly the water management connection(s).

It needs to be mentioned that the Temelin site is well characterised, though specific geologic studies for the foundations of the SMR are certainly still due. Furthermore, the vicinity of the site appears, as per the map on the Page 13 of the Notification document, to have enough space for the temporary construction areas. Locating a new SMR at the site of an existing (operating) nuclear plant has an additional advantage in the availability of staff with specific nuclear knowledge as well as general acceptance of the nuclear plant by the local population. Other structures, switchyard(s), connection to the national grid and high voltage lines to enable evacuation of the power generated are all in place.

As per the Notification documents, the “new nuclear source is to encompass “one power unit, consisting of one or two reactors”, including all necessary buildings and technological systems needed to generate power and transmit it off site. The Notification document states that the supplier has not been selected yet. It further establishes that the “selection of a supplier is not part of the EIA process”.

The Notification documents establishes that any SMR to be selected needs to fulfil the legal and regulatory requirements for new nuclear plants in the Czech Republic, which reflect the newest IAEA as well as WENRA requirements, including WENRA RL and WENRA Safety objectives for new reactors. The Notification document establishes that the requirement for the future Temelin SMR is that it shall be a light water reactor (LWR), which means either pressurised (PWR) or boiling water (BWR). This is an obvious statement, as it is not reasonable to expect that any SMR using other technologies, like gas or molten salt, might be ready for licensing by the planned project’s commencement date of 2029.

Considering further requirement that Temelin SMR shall reach a “utility” power level of up to 500 MWe, the Notification document summarises main characteristics of 4 different SRM models:

1. Rolls Royce (RR) SMR (a 470/498 MWe design under development in the UK)
2. BWRX (a 300 MWe design that is undergoing the licensing review in Canada)
3. NUWARD (a 2x170 MWe at the stage of conceptual design by EDF - abandoned in the meantime, to be replaced by a 400 MWe unit)

4. Westinghouse AP300 (300 MWe conceptual design of a reduced version of the WEC's AP1000/600)

While those 4 models are among the forerunners in the development of SMRs internationally (there are several others, but those would have been less attractive for the utility-level new nuclear generation and/or are of no interest due to political and security reasons), at least 2 of those are in an early design stage with questionable chances of being available for a planned project initiation in 2029, as defined in the Notification document. Moreover, apart from the BWRX, the SMR designs considered are not yet close to developing the licensing level Safety analysis report, which is the precondition for the licensing review by the Czech regulator, SUJB.

The development of the Notification documents was initiated in November 2023 and completed a year later. During that period, CEZ negotiated with the developer of the RR SMR (Rolls Royce Ltd.) its participation in the development of RR SMR. This finally resulted in CEZ taking a 20 % equity in the RR SMR, as announced in late 2024. The announcement particularly indicated that CEZ would be planning the construction of a RR SMR in the Czech Republic. Given that statement, but also considering expected participation of the Czech nuclear industry in the RR SMR, it is reasonable to expect that, regardless of the options presented in the Notification documents, the RR SMR would be the model of choice for construction at the Temelin site.

The RR SMR is, based on the information on the design that is available at present, the most "traditional" design of all SMRs considered in the Notification document (and broader, among all LWR SMRs that are in the development). This has certain advantages, primarily in the fact that the licensing of the RR SMR is expected to be relatively easy, but also that it would offer similarities to existing reactors in operation, maintenance, etc. The RR SMR is also one of 3 remaining SMR types that are subject to an on-going Generic Design Assessment (GDA) by the ONR (UK nuclear regulator). The fact that the RR SMR passed the Stage 2 (out of 3) of ONR's GDA without having any Regulatory Issues (RIs) raised, is positive. Having RIs raised would indicate that there might be some fundamental regulatory concerns regarding the design, i.e. its safety. The ONR review raised two Regulatory Observations (ROs), related with the development of the Safety Analysis Report (SAR, in ONR parlance called "E3S case") and the Probabilistic Safety Analysis, which are essential to proceed with the GDA review. While ONR generally expressed its confidence that the applicant (Rolls Royce Ltd.) would be able to develop the E3S case and the PSA to be able to justify the safety level of the design, it notes that the current level of the development of RR SMR equates to "…majority of Systems, Structures and Components (SSCs) included within the GDA scope have reached sufficient maturity to define the baseline design but further work is needed to complete the list of functional

and non-functional requirements and demonstrate they are met by the design"[1]. Nevertheless, ONR felt that the Step 3 for the RR SMR can be initiated. The current schedule calls for the completion of Step 3 of the GDA in mid-2026.

It is reasonable to assume that the Czech regulator SUJB would initiate its licensing process at the time when the project developer CEZ would submit an application for the licence, or at least signal its intentions to do so, which to the information available, did not yet happen. It is also reasonable to expect that SUJB would be consulting with ONR and likely accepting and adopting some results of the assessments performed within ONR's GDA process into its regulatory review. However, the ONR regulations are – in general – performance-based, while the SUJB regulations are prescriptive. This fact, plus specific requirements that might exist in the Czech Republic but do not exist in the UK and vice versa, would effectively require that most of the elements of the licensing review for the RR SMR would need to be implemented by SUJB. This will take a significant amount of time.

The regulatory processes, as well as the need to develop the design to the level of constructability, plus the fact that, if not First of a kind (FOAK), the RR SMR in the Czech Republic will certainly be the „in-country FOAK", give raise to some scepticism whether the project initiation date of 2029 and the operation commencement date of 2034 are achievable.

The Notification document justifies that the EIA process has been initiated before the supplier or the SMR model is known[2] by the fact that "it is the environmental parameters of a facility that are decisive and not a specific type of facility or specific manufacturer or their trademarks"[3]. While it is obvious that the "environmental parameters of a facility" are relevant for environmental impact, rather than the "specific type of facility or manufacturer", in the case of the 4 models preselected for Temelin SMR, all designs are still under development.

This has a profound impact on the implementation of the EIA. The SMR model to be selected for the construction at the Temelin site would obviously need to comply with SUJB's standards and requirements on safety. In terms of the off-site release, SUJB does have clearly defined limits for the effluents (during normal operation) as well as targets in terms of severity and frequency of severe accidents and resulting radiological releases. In the view of this reviewer, it is not possible to develop a full EIA that would assess the radiological impact near the site and far (i.e. transboundary) until at least the SAR to include DEC A and B, and a full scope Level 2 PSA are completed. For those documents to be developed to a reasonable level of detail that would enable using the results in a comprehensive dispersion analysis as required in the EIA, the detailed design of a SMR needs to be completed first. Furthermore, even though LWR SMRs would

[1] Generic Design Assessment of the Rolls-Royce SMR – Step 2 summary, ONRW-2019369590-8980 July 2024, pg 6

[22] Clearly the model/supplier was not known at the time the development of the notification documents has been initiated. While it is only reasonable to expect the choice being RR SMR, a formal announcement in this respect has still to be made

[3] NOTIFICATION OF THE PROJECT Section B.I.6, pg. 22

be taking over general reactor technologies and (some) SSC solutions from existing large PWRs, the actual details including the operation of SMRs, are still (and will remain so until some operating experience from real SMR is accumulated) an unknown factor, adding to the uncertainty of the analysis.

It is therefore not really clear what the intention of the project developer CEZ is, in terms of initiating a full EIA report earlier than when the design is ready and the associated safety and probabilistic analysis is completed and reviewed. Without these documents, there is no way to establish any realistic "environmental parameters" that are a necessary input for a complete EIA.

The Notification document does not indicate as to when the EIA will be initiated (likely, it must be completed before a site permit would be applied for). Developing an EIA with "environmental parameters" that are prepared for a SMR which is in the design development stage would be nothing more than a "number game", which would not be expected to pass the scrutiny which an EIA would be subject to under the Espoo Convention and the EIA Directive.

Recommendation

It is therefore recommended that the development of a full EIA, in particular in the areas of environmental impact of radiological releases, is postponed until the time that the detailed design of the SMR that is to be selected for the Temelin site is completed, and the main safety documents (SAR and PSA) are developed and reviewed/accepted by the Czech regulator SUJB. Only such an approach would allow for a reasonable estimation of the potential impact from the Temelin SMR on the environment and population of Austria.

While the EIA might be developed based on the documentation submitted within the UK ONR's GDA stage 3 (which might still not be as exact as necessary for the EIA), in such a case the EIA report should provide detailed information on the scope and the schedules of relevant licensing processes with SUJB, including expected approval of the:

1. Temelin SMR site (site licence)
2. Design approval
3. Expected issuance of the construction licence

The EIA report shall clearly differentiate the information (mainly plant specific technical data) that are assumptions from those that are the data based on a detailed design that is ready for construction.

In this respect, and in particular if the licensing process is still ongoing with SUJB, the EIA report shall elaborate on the design changes that might occur due to prescriptive regulatory practices in the Czech Republic (as opposed to performance-based in the UK). Furthermore, the EIA report shall describe how the operation of the Temelin SMR would be depicted in the EIA and how the radiological releases (during normal operation and in accident conditions) would be modelled, given that there would be no operating experience with the SMR model selected.

The EIA report should describe how the public interaction in the Czech Republic and in the neighbouring countries would be implemented, given that the design of the SMR would not be completed and the actual safety parameters would not be known at the time of the EIA. In other words, the public has the right to know whether the assumptions taken during the EIA (due to incomplete design) might lead to the result of the radiological impact analysis possibly underestimating the impact or the probability of such events.

2 PROCEDURAL ASPECTS OF THE EIA

The procedural aspects of the EIA are defined in the Espoo and Aarhus Conventions, of which all EU member states are signatories. Furthermore, in the EU, the EU Directive 2011/92/EU is establishing the requirements and the procedural steps. Especially relevant for the nuclear plants, the "Commission Notice regarding application of the Environmental Impact Assessment Directive (Directive 2011/92/EU of the European Parliament and of the Council, as amended by Directive 2014/52/EU) to changes and extension of projects - Annex I.24 and Annex II.13(a)" defines main requirements and principles that are to be fulfilled by the environmental impact assessment.

The document "Notification of the project: new nuclear source of SMR at the Temelin site" is effectively a "scoping EIA", which is recognised as such by the EU Directives. It clearly indicates that the aim is the scoping analysis and not an assessment of impact on the environment, which would then be developed in the full EIA.

As discussed in the introduction, the main problem in this case is that there is too little information regarding the design of a SMR to be constructed at the Temelin site, to enable the EIA to be developed. All the SMRs that are considered (that includes the RR SMR, which will most likely be selected) are not advanced in the design (apart from possibly BWRX), which leaves big uncertainties relating to the safety status, operation, generation of RW and SNF, effluents, etc., all of which are an essential input to the EIA.

In accordance with the National environmental legislation in the Czech Republic, the Notification document is to provide this basic information on:

- project developer,
- project technical and technological solution and its environmental demands,
- options of the Project solution,
- state of the environment in the affected territory,
- possible Project effects on public health and the environment to support other relevant supplementary data.

In the case of the Temelin SMR, the Notification document formally fulfils the requirements. It identifies CEZ as the developer, provides a (high level) description of the technological solutions, although not quite on its "environmental demands" – simply as those are not really available at this stage, provides the options (see later in this document) and lists possible effects on the population and environment.

As discussed above, given the commitment to expand its nuclear power, and in this process also considering new technologies like SMRs, the selection of the Temelin site is prudent, as it takes into account site availability, infrastructure (particularly the supply of water and drainage, offsite power evacuation and offsite power sources) as well as operating conditions (existing NPP, educated

staff, public acceptance). Moreover, given that Temelin is a licensed nuclear site, it is reasonable to expect that an adjacent site (which still might have some geological differences, but those are not likely to cause immeasurable problems) would be acceptable under the legislative requirements for the location of nuclear power facilities.

The SMR site being adjacent to the existing Temelin NPP site, assures the space the SMR itself as well as space for necessary staging areas for the construction. The location has been assessed to be "optimal" from the environmental point of view. The implementation of the SMR project at Temelin site is not expected to restrict the operation of the existing Temelin units and would have an impact on nuclear safety, radiation protection, assurance and abnormal radiation occurrence management.

In terms of the technology to be utilised for the project, there are two sets of information of relevance. First the requirements are defined as:

- Power unit: number of units: one unit (consisting of one or two nuclear reactors)
- Type: light water reactor (LWR)
- Generation: III+ with a high degree of passive safety elements
- Net electrical power: up to 500 MWe
- Design lifetime: 60 - 80 years

Then, 4 different SMR designs (in two cases, only rather conceptual) that complied with these (very high level) requirements have been presented. While this might be enough for the "Notification" (i.e., scoping of the EIA) document, where basically the requirement is defined as a "nuclear power plant with up to 1500 MW thermal", it does not allow for a detailed analysis as expected in the EIA report.

Other relevant requirements presented in the Notification document are the list of legal and regulatory requirements that would be applicable to the Temelin SMR. Most importantly, that encompasses SUJB safety requirements that are well developed, in line with the (newest) IAEA standards and incorporate WENRA Safety objectives for new reactors.

As discussed in the introduction, establishing only high level requirements and having assurances that a facility would "comply with national standards" does not establish the basis for undertaking the assessment (in particular of radiological impact) within an EIA. Therefore, the statement in the Notification "...the subsequent selection of a supplier cannot be to the detriment of environmental protection" does not quite give an assurance that one or another model might have better or worse impact onto the environment and population, in particular in the transboundary framework.

Recommendation

The Notification document provides overall information on the procedures to be followed in the EIA process. It lists the national legislation of the Czech Republic, which defines the steps in terms of the interactions on the international level to take place once the EIA report is developed. It is believed that those are in line with the requirements of the Conventions and with applicable EU Directives and would allow Austria to receive the documents and assess those to determine possible impact on the environment and population.

In general, the concept for the development of the EIA as described in the Notification document is, from the Austrian perspective, acceptable. Nevertheless, the fact that it appears that the EIA would be developed on a generic level, i.e. before the detailed design and relevant safety justification has been developed and approved by the regulator, might lead to a situation where the assessments are not realistic nor properly determine the impact on the environment and population of Austria. It is therefore recommended that the EIA is developed only when necessary information is available.

3 ALTERNATIVES

The strategic premise for the decarbonisation strategy in the Czech Republic relies on the development of nuclear power with an increasing share in electricity generation. This is planned to be achieved through both construction of large nuclear reactors and SMRs. The effect will be a shift from (and after 2045 disappearance of) the fossil sources in electricity generation. At that time, all of the consumption is expected to be covered by nuclear and renewables.

The analyses have shown that the already-decided construction of the new nuclear plant at the Dukovany site (Dukovany NPP 5 and 6) will not in itself be sufficient to cover future demand, even when considering the increased availability of renewables. A study "Assessment of the Resource Adequacy of the Electricity Network of the Czech Republic by 2040 (MPO, ČEPS, 2023)" determined that up to 3 GWe of new capacity would be needed by 2050. On this basis, the deployment of SMRs to replace retiring coal units is planned. To enable reaching the capacity levels needed by 2050, it is necessary to commission the first SMR in the mid-2030s. Therefore, the Temelin SMR could be considered as the diversification of electricity sources. Nuclear plants are also considered to be a pillar of energy security in the Czech Republic and are crucial for maintaining the stability of the network.

The "Update of the State Energy Policy of the Czech Republic" is proposing maximum usage of the existing Dukovany and Temelin nuclear sites for the construction of further new nuclear units. The WAM3 scenario considers construction of three new big units and one SMR. Therefore, the Notification is not considering multiple locations, capacity or technical solutions, i.e. the decision for one SMR unit at the Temelin site is anchored in the State Energy Policy for the Czech Republic.

Still, the Notification document discusses various options and alternatives as following:

Options for other locations within the Czech Republic: While there are at least 7 other locations where a SMR could replace existing coal generation, the selection of the Temelin site reflects the availability of infrastructure, including regulatory requirements in the Czech Republic. Maintaining the continuity of nuclear generation including availability of staff was also considered. It is therefore assessed (in the Notification) that the Temelin site represents the best technical environmental and social solution for the first SMR plant in the Czech Republic. This is a reasonable assumption.

Options of specific location at the Temelin site: The specific location was decided within the planning for the South Bohemia region, considering spatial, urban, ecological, technical, and infrastructure conditions. The SMR site is adjacent to the existing Temelin NPP site and will not impact the operation of existing units.

Options of generating capacity: An installed electrical power (up to 500 MWe) is said to be selected reflecting "commercially available SMRs". This is not quite

clear as out of the 4 SMR types considered, one is for the time being abandoned (to be replaced with something else), and a second might not become commercially available within the time frame for the expected implementation of the project. Another argument for the generating capacity is said to be "available site size". That argument also does not quite sound right, because the site location figure in the Notification seems to suggest that more land is available than what is being now assigned to the Temelin SMR. Therefore, it seems that the site could house more units, different power level, etc., if wished.

Options of technical solution: The selection of the LWR-type, generation III+ reactor, reflects that LWRs are the most advanced in the development of all SMR models, and the experience with operating LWRs or PRW, in particular in the Czech Republic. That is a reasonable choice.

Option for different sources of electricity generation and/or electrical energy saving: The selection reflects strategic decisions of the Czech Republic (National Energy Policy, National Action Plan for Nuclear Power Development) and considers the development aspects, by maintaining the continuity of nuclear operation at the Temelin site. The Notification document concludes that the Temelin SMR represents part of the nuclear portion of the generation mix. Other resources (including savings) are said not to be affected by the choice of Temelin SMR. While the choice to go nuclear is a sovereign choice for the Czech Republic, it is a bit unusual to conclude that the other resources or savings are not affected by the choice. Within the energy mix, all of the available sources are having (some) impact on the others, thus influencing other sources.

Options for the connection to the infrastructure: The selection of the Temelin site for the first SMR will benefit from all existing infrastructure, from traffic flows, water connection to high voltage grid. That seems to be a prudent choice in this respect.

Zero option: From the discussion in the Notification document, it appears that the zero option (i.e., non-implementation of the project) is considered and is expected to be elaborated in the EIA report. The Notification document indicates that the zero option would imply that there will be no new sources at the Temelin site, and instead a new site would need to be found.

It is not clear whether the zero option in terms of not constructing an SMR and instead deploying e.g. additional renewables or even savings has been considered. While it is expected that discarding an option for a guaranteed dispatchable power source might be a difficult choice for a highly industrialised country, the effects of such a decision cannot be determined if not analysed. Therefore, the analysis of an actual zero option in the EIA might be a prudent addition.

Recommendation

While the concept for different alternatives is described, the Notification document provides only high-level information. In particular, a discussion on the technical parameters, whether the choice of 300 vs 500 MWe would impact the site, etc., would be useful. Furthermore, given that all of the 4 proposed SMR

designs are still on the drawing board and none of those has even been licensed, a discussion on potential challenges during licensing, potential risks associated with a FOAK (or at least a FOAK in a country) situation, and risk stemming from the early operation of a new design would be useful to be considered.

The impact of the SMR at the Temelin site in terms of the generation of radioactive waste and spent nuclear fuel is not really discussed. While there are some general-level ideas of the generation of SNF, there is no conclusive discussion on where the SNF would be stored and even less disposed of. The Notification document indicates that an "interim store might be constructed at the SMR site or the larger Temelin site", which sounds logical, but this facility will have an environmental impact, which is directly caused by the construction of the SMR.

In terms of radioactive waste, the information is even less clear, as there is no experience as to what kind and which capacity of waste might be generated by a SMR. There are publications that seem to suggest that there will be less waste, and also those that suggest it will be more, given the small reactor size. Whichever of the two might be correct, this is an environmental impact that needs to be considered, in terms of processing of RAW and its storage on the site or offsite as well as final disposal

The consideration of possible alternatives, apart from the site, where the selection seems to be fully logical, as well as the decision-making processes related with choosing one over another alternative as well as their impacts would be useful to be thoroughly addressed in the EIA report.

1. For each of the alternatives, the EIA report shall provide a detailed discussion on a technical basis, the safety and impact, in particular the radiological impact, as well as the basis and criteria that is being used to evaluate the alternatives that are being considered.
2. Alternatives like new large NPPs or non-nuclear electricity sources could also be considered as an option.
3. The EIA report should provide as detailed as possible the technical description of the SMR design selected, with emphasis on the radiological impact (effluents, accidental releases, RAW and SNF, etc.) for it.

4 SIMULTANEOUS OPERATIONS AND INTERACTIONS OF UNITS OF EXISTING TEMELIN UNITS AND THE SMR

The Temelin nuclear site was originally designed for 4 large NPPs, including all auxiliary buildings that are needed for the operation of NPP units. The following facilities are at present operational at the Temelin site

- Two units of the Temelin Nuclear Power Plant (Temelín NPP 1,2),
- Spent nuclear fuel storage (SVJP),
- Fresh nuclear fuel storage as part of the auxiliary building Temelín NPP 1,2 (BAPP),

The Notification envisages the construction of one SMR unit, eventual construction of the 2 more large units (Temelin 3 and 4) and the expansion of the capacity of the spent nuclear fuel storage (SVJP). There are already plans for an expansion of the SVJP to accommodate for all of the Temelin 1 and 2 spent fuel. With new units at the site, more storage will certainly be needed.

While the Notification correctly recognises that there will be multiple nuclear units at the site, it does not quite provide guidance as to how the existence of multiple units would be treated in the EIA.

With multiple nuclear facilities on the site, there are, in particular with post-Fukushima considerations, questions whether the multiple units could jeopardise each other, and what kind of safety impact could be caused from one unit to another, e.g. accidents affecting multiple units that might lead to off-site consequences.

While it is understood that there will be no common systems or service supporting the operation of large Temelin units and SMR (apart from the water supply, which, if used as the ultimate heat sink, might be affecting all units), it is nevertheless of high interest to thoroughly assess mutual impact of the units, in particular related with severe accidents that might lead to off-site releases.

The assessment of severe accidents, initiating events, its propagation and its releases, e.g. due to a simultaneous damage to multiple “features” of the plant including safety systems and structures, needs to be addressed in the EIA report for the Temelin SMR, even though the EIA itself is focused on the SMR. In particular, potential impact of external hazards that might become more severe with the acceleration of global warming needs to be considered. Also important are the external events of human origin, those being e.g. large-scale fires in the vicinity, dangerous goods transports as well as aircraft crashes and terrorist attacks. It is understood that the latter might not be publicly discussed, but general information could be provided.

The plant specific challenges including e.g. the turbine missiles need to be assessed, e.g. as required by the US NRC Regulatory Guide RG 1.115. While it is believed that the Temelin 1 and 2 turbines would, because of their orientation,

not be jeopardising the SMR, from the layout it is not clear whether the reverse is true. Therefore, this challenge needs to be addressed.

The impact of a radiological emergency on site, in the case one unit is experiencing a large release of radioactivity, needs to be assessed. In case of a release of radioactivity, there will be very strict restrictions and general difficulties for the operational and/or maintenance staff to be reaching and working in units not directly affected by an accident. What kinds of measures will be in place to enable a safe shutdown of non-affected units need to be considered in the EIA.

The Notification programme provides little information neither on the planned assessment in relation with external impacts, nor on the interaction for the multiple units at the site. The importance of external hazards cannot be underestimated. Most studies addressing NPPs have shown that in terms of the risk (probability x consequence), the external impact hazards dominates the risk, in particular related with off-site impact. The EIA process is a good opportunity to perform such an assessment.

Recommendation

The EIA report should contain the following information on possible interactions among multiple units, including assessment of external impacts affecting all the units at the site (as well as the SNF interim store):

1. Assessment of the severe weather conditions with consideration of new trends in climate change and the fact that Temelin SMR would be expected to continue its operation through 21st century;
2. An assessment of man-made external events;
3. Assessment of a combination of external events, including consideration of multiple plants on the site;
4. Investigation into interaction among the plants, including effects like turbine missiles;
5. Thorough analysis of the possible events affecting multiple units on the site, with a view on establishing an enveloping radiological release source term.
6. Assessment of the effects on the operation and safe shutdown of other units in a case where one or more units at the site have released radioactivity into the environment, making site access and/or communication difficult or impossible.

5 SAFETY AND SEVERE ACCIDENTS

The Notification document clearly states that the SMR reactor at the Temelin site shall and will meet the safety requirements in the Czech Republic. Those are, as already mentioned, well defined and encompass both the IAEA and WENRA requirements for new reactors. The Temelin SMR design will be subject to the regulatory review in the process of the licensing in the Czech Republic. While SUJB might rely on some assessments undertaken by other regulators, it is nevertheless expected that SUJB will do its own assessment and, upon being certain that the design has an acceptable safety level, will issue the construction license, as appropriate.

It is to be expected that the SMR designer, whichever SMR model is selected, originally offers its standardised design. Nevertheless, it is reasonable to expect that there will be some modifications to:

1. Accommodate for the Temelin site specifics
2. Accommodate for the specific regulatory requirements by SUJB.

It is also possible that the original design solution might not be licensable under the SUJB regulations. In such a case, it would be up to the designer to either change the design feature, which for an SMR would be rather unlikely (if substantial) or SUJB might need to change its requirements. In general, this is not seen as a problem, as SUJB would certainly not allow for safety standards to be reduced, but it might take time and add uncertainty for the project. The description of specific safety principles and requirements, starting with the defence in depth, is well covered in the Notification document.

While discussing safety of SMRs, the Notification document stresses that the safety concept of the SMR technologies presented in the document is built upon “proven and advanced technologies of large nuclear units” while also using “passive solutions and passive safety systems”. This is assessed to help ensure the autonomy of the units and management of emergency conditions even without the intervention of an operator or the need for a power supply.

While this is, in principle, the design objective of every SMR on the market, which naturally include those 4 selected, the extent of using “traditional technology”, use of passive systems, as well as autonomy varies greatly among the models considered. Even in case of the RR SMR that is most likely to be selected for the Temelin SMR, apart from the general design goals, the specifics of how those are to be fulfilled, what combination of active and passive system would be needed for a specific severe accident evolution, and what might be the ultimate prevention concept including cliff edges, is simply not known at this stage. It is likely it will not be known, especially for the SMR to be built in the Czech Republic, for some foreseeable future.

Consequently, while not questioning safety of SMRs in general, too little information and clarity including the outcome of regulatory reviews, is currently available to be able to comprehensively predict the radiological impact to the level as expected in a (modern) EIA for nuclear facilities developed under the EU

Directives. As discussed in chapter 1, it is impossible to model the releases and estimate their probability as the design and the safety assessment has not been completed, and the design solutions are still under development.

This is particularly relevant for the so-called DEC conditions, specifically the DEC B. It is known and recognised that the design goals for SMRs (possibly less so for a large SMR like the RR SMR) is to practically exclude the accidents that would be leading to a large or early release of radioactivity for a full spectrum of internal initiators, internal and external hazards. Nevertheless, before this is proven (and it is indeed questionable how it could be proven), an assessment that will consider that there will be a fraction of a core released (to be determined how much) would need to be undertaken. Such an assessment needs to be reflected in the EIA report to assure the credibility of an off-site and transboundary impact from severe incidents affecting the Temelin SMR.

It is understood that the residual risk of such a severe accident would be coming from either specific not envisaged or sequences not analysed, due to unforeseen interaction, like material challenges or structural issues. The fact that the SMR at Temelin will be a FOAK would only raise the risk of some unforeseen circumstances causing problems.

This is even more so in relation with external events. Again, it is recognised that the SUJB regulation generally requires a broad range of external hazards to be evaluated and the consequences on a nuclear facility estimated. The Notification document lists numerous examples of external hazards that could challenge the safety of the SMR. The Notification document further indicates that all of those would be assessed within the licensing process in the Czech Republic. If it is so, then it would be best that the EIA report provides a list of all internal and external hazards that have been analysed (including their combination) with an indication of the results obtained.

The EIA report has to clarify how the hazard combinations were applied and what the results of such are.

6 TRANSBOUNDARY IMPACT

The Notification document specifies that the consequences of the accidents and emergency conditions at the Temelin SMR will be subject to the assessment as envisaged in the legal framework within the Czech Republic. The EIA is expected to "demonstrate the effect on the vicinity and population for representative (envelope) cases of a design basis accident and a major fuel melting accident". The Notification document goes further to explain that two categories of events would be assessed.

One is the design basis accidents, where the EIA assessment will determine the consequences on the environment and the population. In this, the "envelope approach" is to be followed, where an enveloping scenario combining the most critical source term will be combined with specific meteorological conditions to assess the radiological consequences. The Notification document seems to suggest that the consequences determined in that should be more conservative than the results of the Preliminary safety analysis report.

The enveloping approach to the Design basis accident could certainly be used in the EIA, especially for the immediate vicinity of the plant, which is likely where the effects are to be felt. However, as argued in this expert review, without the detailed (design) safety analysis being completed, it is not easy to determine what an "enveloping condition" would be for a reactor that is only being designed.

The second category are the (most) severe Beyond Design Basis Accidents (i.e., DEC-B). The Notification document defines that the "potential source of a leak of radionuclides to the vicinity is the content in fuel". The "content of the fuel" would indeed be the most critical, i.e. enveloping release that could be imagined, though in most cases only a fraction of the radioactive content of the fuel would end up being released. For the source term that is of relevance for the environmental impact, the release from the containment is the most important one. The Notification document seems to suggest that a leak from the containment would be "through microleaks of the containment". The Notification document justifies such approach by the fact that the design acceptance criteria is set in such a way that there will be no need for the evacuation or food restrictions in the surroundings of the site, even in a case of core damage, because the radioactivity would be (mostly) retained in the containment.

However, as the Notification document clearly states, the goal is based on a "virtual" exclusion, rather than an absolute one. This is not different from some large generation III reactor designs, where e.g. any longer term off-site consequences are excluded as a design goal. In practice, severe accidents including early large releases are still considered, in particular in the EIA framework.

For Severe accidents including in particular the DBA B conditions, the actual design solutions and the robustness of a SMR model is relevant. Nevertheless, what is the robustness of the design, strength of the containment, possibilities of bypass, etc. for a full spectrum of possible hazards, is rather uncertain until

the design is completed and appropriately analysed and justified. Therefore, and in particular in a case that the EIA is to be undertaken for the Temelin SMR before it is approved by SUJB, the most critical, enveloping scenario to be considered is a release from the containment that is beyond "microleaks", i.e. either a bypass or a breach of the containment need to be considered.

In terms of assessing the transboundary impact, the Notification document in its section D.III promises an "analysis of radiation effects for the transboundary areas of the nearest adjacent state, for a representative conservative case of DBA and a major accident for extended design conditions". In the case of the latter, the DEC-B with an early failure of the containment should be analysed. That would be sufficient to estimate the doses to the population and the impact on the environment (i.e., deposition on agricultural land, etc.) in Austria.

Recommendation

The EIA report should contain the following information as relevant for the transboundary impact that might affect Austria:

1. An introduction as to how the most critical sequences (envelope) for the DBA and DEC-B cases are selected;
2. Detailed description of DEC-B sequence selected, including an estimate of the source term, considering retention in the fuel, reactor vessel and containment, with the resulting source term being released in the environment;
3. Description of the assumptions taken when modelling DEC-B accident sequences, including duration of a release, levels of release, energy, etc.;
4. Presentation of the dispersion model, including the weather parameters taken, covering a range of weather situations as well as the determination of radiation impacts (deposits, doses to the population, etc.);
5. Discussion on relevant assumptions for the dispersion modelling;
6. Resulting probability distribution of the radiological impact, covering all cases.

7 SPENT FUEL AND RADIOACTIVE WASTE

The Notification document states that the principles for radioactive waste management for the SMR Temelin will be the same as for the "existing nuclear source" (i.e., Temelin 1-2). As a matter of principle, this is correct, though one might expect the difference not just in quantities (which is not only dependant on the power of the reactor, but rather on the operating concept, utilisation, etc.), but also in the composition of waste. The Notification document describes three categories of RAW that are to be generated, gaseous, liquid and solid, with a qualitative description of the treatment of each of the waste streams.

Given that the SMR is in a design development stage, it is obvious that the information/concepts needed for any reasonable modelling of generation and subsequent processing of RAW would not be available. The Notification document provides the quantity of radioactive waste to be generated per year (up to 184 m^3/year) which is said to be the "enveloping" amount of the waste generated before processing. The waste contributing to this value includes treated liquid RAO. The Notification document further states that the "amount of processed and treated radioactive waste will only be specified on the basis of applied processing technology". The technology in turn will be selected depending on the waste acceptance criteria for the repository for the waste in the Czech Republic.

The Notification document suggests that the "amount and type of radioactive waste produced during the operation of Temelin SMR will be specified after the selection of SMR technology". Even if the technology would be selected today (i.e. in the view of this reviewer it will be the RR SMR), that does still not define the amount and the type of radioactive waste, as this does not only depend on the generation (which is presently uncertain due to lack of a detailed design and lack of the concept and experience with operation), but also due to the selection of the processing technologies. Ultimately, none of those might be similar as for the large units at Temelin.

In terms of spent nuclear fuel generation, the Notification document estimates that it will be "up to 12.5t UO_2/year". It is likely that this value comes from the estimate of the maximum power of a SMR, which is defined per conditions set up by CEZ (500 MWe), rather than a real estimate for a specific SMR model. Additionally, depending on the model, a differently designed fuel (regarding dimension and/or composition) would prevent storage in the same structures as for the spent nuclear fuel from the existing large units at Temelin.

Recommendation

The EIA report needs to analyse the impact onto the environment from the processing and storage and later from the disposal of radioactive waste generated by the SMR at the Temelin site. In order to accomplish this, the SMR model to be considered needs to be selected first and then the RWM storage and processing facilities can be designed. This would eventually lead to a prediction of the quantities and types of radioactive waste to be generated during the operation of a SMR. As there is no operational experience, neither with the RR SMR nor

with any other SMR mentioned in the Notification document, the actual generation of radioactive waste cannot be determined with a certainty. However, a best estimate could be made, also whether the existing waste processing as well as storage facilities at Temelin 1 and 2 would be used or new SMR dedicated facilities need to be constructed.

It is further required that the EIA report describes the disposal of RAW, in terms of what is the current status of the plans for facilities to dispose of the RAW from the SMR at Temelin. While it is clear that the disposal facility in the Czech Republic will have its own EIA developed, a section to “close the cycle” in the EIA for the SMR at Temelin is recommended.

The same applies to the spent nuclear fuel. Once the SMR model is selected, the type of fuel to be used will be known. The generation of the spent fuel would depend on the availability factor as well as on the enrichment (in reality, AP 300 would have higher enriched fuel and therefore smaller weight of spent fuel). Additionally, the dimensions of spent fuel would then be known, so the plans for the onsite storage (beyond the SNF pools) could be presented in the EIA report.

A decision on how the SNF storage is planned to be implemented, whether there will be a separate storage facility for the SMR or it will become a part of the central SNF storage at Temelin (for which a separate EIA exists and likely will be performed for further expansion) needs to be discussed in the EIA report.

8 GLOSSAR

Bq	Becquerel
BWR	Boiling Water Reactor
CDF	Core damage frequency
CEZ a.s.	Czech nuclear plants operator and electricity generation company
DBA	Design Basis Accident
DEC-A/B	Design Extension Condition A and B part
E3S	ONR's term for "safety, security and safeguards (and environmental) case" for nuclear reactor safety review
EIA	Environmental impact assessment
EU	European Union
FOAK	First of a kind
GDA	Generic Design assessment
IAEA	International Atomic Energy Agency
LERF	Large early release fraction
LWR	Light water reactor
LILW	Low- and Intermediate Level radioactive Waste
MW	Megawatt
MWe	Megawatt electric
MWth	Megawatt thermal
NPP	Nuclear power plant
ONR	UK Nuclear regulator
PSA	Probabilistic safety assessment
PSR	Periodic safety review
PWR	Pressurized water reactor
RAW	Radioactive Waste
RL	Reference Level
RR	Rolls Royce
SMR	Small modular reactor

SNF ..... Spent Nuclear Fuel

SSC ..... System Structures & Components

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