Transactions of the Korean Nuclear Society Autumn Meeting
Gyeongju, Korea, October 29-30, 2026

A Comparative Study on Export Control Legal and Regulatory Frameworks in Major Countries

Ju-Ang Jung [a]*, Hojin Hwang [a], Keunhong Min [a], Jinha Choi [a]

[a]*Nuclear Safeguards and Export Control Team, KAERI, 111 Daedeok-daero 989beon-gil, Yuseong-gu, Daejeon, 34057, Korea*

[*]*Corresponding author: jajung@kaeri.re.kr*

Keywords : export control system, regulatory framework, comparative analysis, dual-use items, export licensing

1. Introduction

The Republic of Korea has emerged as a major supplier in the global nuclear market following the Barakah Nuclear Power Plant in the UAE and the Dukovany project in the Czech Republic, and export volumes of nuclear-specific items (NSG Trigger List) and intangible technology transfer (ITT) are expanding rapidly. International export control rests on Article III.2 of the NPT and the guidelines of the Zangger Committee and the NSG (INFCIRC/254 Parts 1 and 2), together with the Wassenaar Arrangement, the MTCR and the Australia Group. These are non-binding arrangements implemented through domestic legislation, so states that have adopted virtually identical control lists still differ in statutory basis, competent authorities, licensing architecture and review criteria, and in nuclear power plant exports such divergences translate directly into compliance burdens.

This study compares the legislation, regulatory governance, control mechanisms and licensing architectures of the United States, the EU and selected Member States, the United Kingdom, Japan and China, assesses the strengths and weaknesses of each regime against a common set of analysis items, and derives policy implications for Korea's strategic-item and nuclear export control system.

2. Analysis Items and Method

Six analysis items are applied, selected because they are the points at which national implementation of the common NSG and Wassenaar lists actually diverges: (i) legal basis and statutory hierarchy; (ii) governance, that is, the competent authorities and the division of responsibility between the nuclear-specific and dual-use regimes; (iii) control list structure; (iv) licensing architecture (license types, validity and scope); (v) ITT and catch-all controls; and (vi) management of parties of concern. Items (i)-(iii) are compared in Table I and items (iv)-(vi) in Table II [1, 2, 5, 7, 8, 9, 11].

For each item, the regimes are assessed against three evaluation criteria: (a) control coverage, that is, how completely non-proliferation-relevant transfers are captured; (b) predictability for exporters, that is, the transparency of the criteria and the administrative burden per transaction; and (c) institutional coherence, that is, the consistency of the linkage between the nuclear-specific and the dual-use channels. The strengths and weaknesses reported in Section 5 are the result of applying these criteria.

3. Legal and Institutional Frameworks of Major Countries

3.1 United States

The United States operates a multi-agency system founded on the Atomic Energy Act of 1954 (§57b, §123, §127-§129), the NNPA of 1978, the ECRA of 2018 and the AECA, implemented through 10 CFR Part 810 (DOE), 10 CFR Part 110 (NRC), the EAR and the ITAR [1, 2]. Intangible technology and assistance are administered by DOE/NNSA, while tangible materials and facilities are overseen by the NRC; Part 810 fixes this boundary by excluding exports licensed by the NRC, the Department of State or the Department of Commerce (§810.2(c)(1)). Within a single project, shipments therefore follow the NRC channel and technology transfers the DOE pathway [1]. Executive Order 14299 and Sec. 8366 of the FY2026 NDAA direct the streamlining of Part 810 authorizations and Part 110 licensing for reactor exports without altering this inter-agency boundary [3, 4].

3.2 EU, Major Member States and the United Kingdom

The EU applies Regulation (EU) 2021/821 uniformly but delegates licensing to Member State authorities. The Commission amends Annex I and operates the Dual-Use Coordination Group without issuing licenses itself, divergence being managed through Article 14 consultation and the "no-undercut" principle of Article 16 [5]. Germany's BAFA integrates licensing, classification and enforcement under the AWG and AWV; France separates the SBDU (dual-use) from the DGA and CIEEMG (military), with CEA and ASNR providing technical input on nuclear items; Italy's UAMA operates a consolidated window. Following BREXIT, the United Kingdom maintains its own Strategic Export Control List under the Export Control Act 2002 and the Export Control Order 2008, administered by the Export Control Joint Unit (DBT, FCDO, MOD), with NSG Trigger List items jointly reviewed by the DESNZ Nuclear Proliferation Unit [7].

3.3 Japan and China

Japan centralizes classification and licensing in METI under Article 48 of the Foreign Exchange and Foreign Trade Act, supported by CISTEC, a private body established in 1989 in the aftermath of the 1987 Toshiba-Kongsberg case. China administers the Export Control Law (2020), the Regulations on Export Control of Dual-Use Items (Order No. 792, effective 1 December 2024) and a unified control list; Article 50 repealed four earlier regulations, including those on nuclear dual-use items. Because the Regulations on Nuclear Export Control (Order No. 230) remain in force, China retains a dual-track framework in which nuclear-specific items are reviewed first by the CAEA and then by SASTIND or MOFCOM, with export eligibility confined to State Council-designated state-owned enterprises [8]. Table I summarizes these frameworks.

Table I. Legal basis, competent authorities and control list structures in major countries

Country	Legal Basis	Competent Authority	Control List Structure
U.S.	AEA 1954, NNPA 1978, ECRA 2018, AECA; 10 CFR 810/110, EAR, ITAR	DOE/NNSA (intangible technology); NRC (materials, equipment); BIS; DDTC	CCL (NP1/NP2), USML; Part 110 Apps. A-K, O; Part 810 §810.2(b)
EU	Regulation (EU) 2021/821, Member State national law	Commission (list, coordination); Member States: BAFA, SBDU, UAMA	Annex I Cat. 0-9 (Cat. 0 = nuclear); Annex IV (intra-EU transfer)
U.K.	Export Control Act 2002; Export Control Order 2008	ECJU (DBT, FCDO, MOD); DESNZ NPU (nuclear-specific)	SECL: Military List; Dual-Use List (Cat. 0-9); Radioactive Source List
Japan	FEFTA §48; Export Trade Control Order; Foreign Exchange Order	METI (single window); CISTEC (private support body)	Export Trade Control Order, Appended Table 1 (items 1-15)
China	Export Control Law (2020); Dual-Use Reg. (Order 792, 2024); Nuclear Reg. (Order 230)	MOFCOM (dual-use); CAEA to SASTIND / MOFCOM (nuclear-specific items)	Unified list: five-character code (3rd digit '2' = non-proliferation); separate nuclear list
Korea	Foreign Trade Act (Arts. 19-19-7); Nuclear Safety Act; Public Notice on Strategic Items (2025-37)	MOTIE (KOSTI); NSSC (KINAC); DAPA (military items)	Annex 2 Parts 1-9 (dual-use); Part 10 (nuclear-specific); Annex 3 (military)

4. Control Mechanisms and Export Licensing Systems

4.1 Control List Structure and ITT Controls

Control lists follow two patterns. EU Annex I, the UK Dual-Use List and Korea's Annex 2 concentrate nuclear items in a dedicated category, whereas China's 2024 unified list applies a five-character code whose third digit denotes the reason for control ('2' for non-proliferation), dispersing nuclear items across industry categories [5, 8, 9]. ITT controls diverge most sharply. Part 810 covers both "technology" and "assistance", the latter including training, working knowledge and consulting (§810.3); access by a foreign national requires nationality, residence, education, employment and visa data together with a signed compliance certification (§810.11(b)) [1]. Japan tightened its deemed-export rules in 2022, and the EU treats e-mail, cloud storage, remote access and oral transmission as exports (Art. 2(2) of Regulation 2021/821) [5]. Korea's Foreign Trade Act defines "technology" as a strategic item subject to export licensing (Art. 19) [11], but the Public Notice on Trade of Strategic Items neither defines "assistance" separately nor prescribes per-person screening of foreign nationals granted access to Trigger List technology [9].

4.2 Catch-all Controls

All jurisdictions apply catch-all controls, but the triggers differ: EAR §744.2 and §744.5 in the United States, and Articles 4 and 5 of Regulation 2021/821 in the EU [2, 5]. Japan's amendment effective 9 October 2025 added objective end-use and end-user requirements for conventional weapons to specified items destined for general countries, where previously only the inform requirement applied, and expanded the Foreign End User List to 835 entities including conventional-weapons concerns [12, 13]. In Korea, the situational license (Art. 19-3 of the Foreign Trade Act; Arts. 50-54 of the Public Notice) is triggered where the exporter knows the end-use or has grounds for suspicion among those enumerated in the statute; separately, transactions with parties of concern designated under Art. 94-2 require a situational license irrespective of the exporter's knowledge [9, 11].

4.3 Licensing Architecture

Individual and global licenses coexist everywhere, but the design of the global license determines the administrative burden. Part 810 grants general authorization for Appendix A destinations, subject to reporting within 30 days and written confirmation of a retransfer pre-approval undertaking, thus waiving prior licensing while preserving visibility of the transfer history [1]. The EU offers individual and global licenses valid for up to two years, large-project authorizations for up to four, and EU001-EU008 [5]; the UK OIEL runs for five years [7]; Japanese bulk licenses and Chinese general licenses run for three years against a one-year single license; and Korea adds a nuclear power plant technology export license covering an entire project [9].

4.4 Management of Parties of Concern

China's two-tier regime is distinctive: a Watch List (Article 26) captures end-users whose end-use cannot be verified, while a Control List (Articles 28-30) covers confirmed violations. Watch-listed parties may not be supplied under general licenses, and individual applications require a risk assessment report and a compliance undertaking [8]. Korea operates a single tier: parties of concern designated under Art. 94-2 of the Public Notice trigger a mandatory situational license, and Annex 24 lists Russia and Belarus as destination-based restrictions. [9]. Table II compares these controls.

Table II. License types, management of parties of concern and ITT controls in major countries

Country	License Types and Validity	Management of Parties of Concern	ITT and Catch-all Controls
U.S.	General / specific authorization (Part 810); license (Part 110); exception / individual (EAR)	Entity List, denial orders, OFAC sanctions lists	Technology + assistance; per-person screening; EAR §744.2, §744.5 catch-all
EU	Individual and global (2 yrs; large projects 4 yrs); national general; EU001-EU008	EU restrictive measures lists; Art. 16 no-undercut	E-mail, cloud, remote access, oral transfer; Art. 4 (WMD), Art. 5
U.K.	SIEL; OIEL (typically 5 yrs); OGEL, GEA; brokering and technical assistance licenses	Sanctions lists; refusal and revocation history (HMRC)	Electronic-transfer SIEL screened; Trigger List: no open license
Japan	Individual license; general bulk / special general bulk / specific bulk (3 yrs)	METI Foreign End User List (835 entities, Oct. 2025)	Deemed export tightened (2022); conventional-weapons catch-all (Oct. 2025)
China	Single license (1 yr); general license (3 yrs); registration / filing	Watch List (unverifiable) to Control List: two-tier regime	Art. 49 extraterritoriality (de minimis, FDP rule); Law Art. 12(3)
Korea	Individual license (1 yr); user / item bulk license (3 yrs); NPP technology license (project-wide)	Parties of concern (Art. 94-2); Annex 24 Russia and Belarus; UNSC arms embargo states ('Na-2')	Self-classification (CP grade); situational license: know / suspect / designated party

5. Comparative Assessment: Strengths and Weaknesses

Applying the three criteria of Section 2 to Tables I and II yields the following assessment. No regime dominates on all three criteria. The U.S. system offers the widest control coverage - "assistance" and per-person screening under Part 810 close the ITT gap that purely list-based regimes leave open - but its four-agency structure yields the lowest institutional coherence, since applicants must determine for themselves which of three channels applies [1, 2]. The EU has achieved list harmonization and a long project authorization (four years), yet because 27 authorities license independently, predictability varies by Member State notwithstanding the Article 16 no-undercut rule; the Commission's own implementation report identifies uneven national general licenses and divergent catch-all practice as persistent gaps [5, 6]. The United Kingdom scores highest on coherence: a joint unit (ECJU) with a nuclear-specialist reviewer (DESNZ NPU) provides a single point of entry and a five-year OIEL, at the cost of excluding Trigger List items from any open license [7]. Japan's single window and CISTEC support maximize predictability, but coverage of nuclear-specific end-use has historically rested on the list rather than on a dedicated nuclear review body, and the 2025 reform indicates that catch-all coverage for conventional weapons had lagged behind peers [12, 13]. China combines a modern, reason-coded unified list with a graduated two-tier regime for parties of concern, yet offers the lowest predictability to foreign counterparties, since nuclear-specific exports are confined to designated state-owned enterprises and Article 49 extends jurisdiction extraterritorially [8]. Korea's baseline provides a project-wide NPP technology license and a three-year bulk license, but lacks a defined concept of "assistance", an intermediate watch list, and a single window spanning both MOTIE/KOSTI and NSSC/KINAC [9, 11].

6. Policy Implications for Korea

Five implications follow from the weaknesses of the Korean baseline identified in Section 5; each pairs a Korean gap with the foreign design element best suited to addressing it.

(1) ITT scope. An "assistance" concept covering training, working knowledge and consulting, modelled on 10 CFR §810.3, should be introduced into the Public Notice for Annex 2 Part 10 (nuclear-specific) technology, together with controls on foreign nationals granted access to Trigger List technology analogous to §810.11(b) [1, 9]. This would close the largest regulatory gap in NPP projects, where on-site training and design consulting constitute the bulk of technology flows.

(2) License design. For approved NPP projects, the validity of the user / item bulk license (3 yrs) should be aligned with the EU large-project authorization (4 yrs) and the UK OIEL (5 yrs) [5, 7], which maintains regulatory effectiveness without narrowing the scope of control.

(3) Management of parties of concern. Benchmarking China's Watch List (Art. 26 of Order 792), an intermediate "watch list" tier should be added to the Art. 94-2 list: parties whose end-use cannot be verified would be excluded from bulk licenses and required to submit a risk assessment with individual applications, rather than being either fully listed or unlisted [8, 9].

(4) Governance. Following the UK ECJU / DESNZ NPU cooperation model, a joint point of entry should be established between MOTIE/KOSTI and NSSC/KINAC, providing mutual recognition of classification results and a single application route for NPP projects combining Part 10 and Parts 1-9 items [7]. This would remedy the weakness of the dual-agency model without merging the two statutes.

(5) Extraterritoriality. Because U.S. de minimis and FDP rules and China's Art. 49 apply to Korean re-exports, a retransfer consent condition should be incorporated into the NPP technology export license, and compliance guidance on foreign extraterritorial rules should be issued to Korean suppliers [2, 8].

7. Conclusions

This study compared the export control legislation and licensing regimes of the United States, the EU and its major Member States, the United Kingdom, Japan and China using six analysis items and three evaluation criteria, and identified the following differences.

First, governance structures can be typologized as a pluralistic (multi-agency) model in the United States, a decentralized model in the EU, a joint single-window model in the United Kingdom, a single-window model in Japan, and a dual-agency model in China and Korea; of these, the joint single-window model is the most favorable to exporters in terms of institutional coherence.

Second, control lists diverge between an approach that concentrates nuclear-related items within specific categories and an approach that identifies them in a distributed manner through reasons-for-control codes.

Third, the validity period and scope of general (comprehensive) licenses vary considerably across countries, ranging from two to five years, while the United States adopts a distinctive structure that substitutes ex post reporting obligations for any fixed term limit.

Fourth, recent regulatory trends are converging toward the expansion of extraterritorial application and the strengthening of targeted, counterparty-based (end-user-oriented) controls [3, 4, 8, 12, 13].

Fifth, measured against this benchmark, the Korean baseline is weakest in ITT scope, the graduation of parties of concern and inter-agency coherence. The five implications set out in Section 6 - an "assistance" concept with per-person screening, project-aligned license validity with post-transfer reporting, a two-tier list of parties of concern, a joint MOTIE-NSSC point of entry, and a retransfer consent condition - may serve as baseline policy material, and as concrete proposals for improvement, for the forthcoming revision of the Public Notice on Trade of Strategic Items and for compliance guidelines addressed to NPP exporters.

REFERENCES

[1] 10 CFR Part 810, Assistance to Foreign Atomic Energy Activities, eCFR, 2026.

[2] U.S. BIS, Export Administration Regulations, 15 CFR §742.3, §744.2, §744.5, 2026.

[3] Executive Order 14299, Deploying Advanced Nuclear Reactor Technologies for National Security, May 23, 2025.

[4] National Defense Authorization Act for FY2026, Sec. 8366, International Nuclear Energy Act of 2025.

[5] Regulation (EU) 2021/821 of the European Parliament and of the Council, OJ L 206, 11.6.2021.

[6] European Commission, Report on the implementation of Regulation (EU) 2021/821, COM(2025) 19 final, 30 Jan. 2025.

[7] UK Department for Business and Trade, United Kingdom Strategic Export Controls Annual Report 2024.

[8] PRC, Regulations on Export Control of Dual-Use Items (Order No. 792, 2024)

[9] MOTIR, Public Notice on Trade of Strategic Items, No. 2026-101, Aug. 31, 2025 (Arts. 54-56, 94-2; Annexes 2, 24).

[10] IAEA, Guidelines for Nuclear Transfers, INFCIRC/254/Rev.14/Part 1 (2019); Guidelines for Transfers of Nuclear-Related Dual-Use Equipment, Materials, Software and Related Technology, INFCIRC/254/Rev.12/Part 2 (2022).

[11] Republic of Korea, Foreign Trade Act (Act No. 20319, amended Feb. 20, 2024), Arts. 19-19-7.

[12] METI, Review of the End User List Providing Information on Foreign Entities for which Verification of Transaction Status is Required (WMD, Missiles or Conventional Weapons), press release, Sep. 29, 2025 (applied from Oct. 9, 2025).

[13] METI, Amendments to the Export Trade Control Order and Related Ordinances Reviewing Catch-all Controls, promulgated Apr. 9, 2025, effective Oct. 9, 2025.