RULE-4.96
AF51-2
PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 7, 1996

Mr. Richard J. K. Stratford
Director
Nuclear Energy Affairs
Bureau of Political-Military Affairs
U.S. Department of State
Washington, DC 20520

Dear Mr. Stratford:

SUBJECT: REQUEST FOR EXECUTIVE BRANCH CONCURRENCE OF A FINAL RULE TO AMEND NRC'S PART 110 EXPORT REGULATIONS

The Nuclear Regulatory Commission requests Executive Branch concurrence to publish in the Federal Register the enclosed final rule which amends the Commission's export licensing regulations in 10 CFR Part 110. We would appreciate your clearance by June 13, 1996. If you have questions, please contact Elaine Hemby (telephone:(301) 415-2341; facsimile:(301) 415-2395; internet:eoh@nrc.gov).

Sincerely,

Ronald D Hauber
for Carlton R. Stoiber, Director
Office of International Programs

Enclosure: As stated

A:\rule-3.96 [7590-01-P]

NUCLEAR REGULATORY COMMISSION

10 CFR Part 110

RIN 3150-AF51

Export of Nuclear Equipment and Materials

AGENCY: Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) is amending its regulations pertaining to the export of nuclear equipment and materials. These amendments are necessary to conform the export controls of the United States to the international export control guidelines of the Nuclear Suppliers Group, of which the United States is a member, and to reflect the nuclear nonproliferation policies of the Department of State.

EFFECTIVE DATE: (30 days after publication)

FOR FURTHER INFORMATION CONTACT: Elaine O. Hemby, Office of International Programs, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone (301) 415-2341, e-mail EOH@NRC.GOV.

SUPPLEMENTARY INFORMATION:

The Nuclear Regulatory Commission (NRC) is amending its regulations pertaining to the export of nuclear materials and equipment. Cambodia and Vietnam are removed from the list of embargoed destinations; Afghanistan, Algeria, Burma (Myanmar), Comoros, Guyana, Mauritania, Niger, St. Kitts, United Arab Emirates, Vanuatu, and Yemen Arab Republic are removed from the list of restricted destinations; Brazil, New Zealand, Republic of Korea, South Africa, and Ukraine are added as member countries of the Nuclear Suppliers Group (NSG) eligible to receive radioactive materials under certain general licenses for export; Austria and Finland are added as eligible countries to receive nuclear reactor components under general license for export; plants for the conversion of uranium and especially designed or prepared equipment for uranium conversion are added to the export controls of the NRC; the kinds of uranium conversion equipment and uranium enrichment equipment under NRC export licensing authority are added for clarification; exports of less than one kilogram of source or special nuclear material exported under the U.S.-IAEA Agreement for Cooperation no longer require Executive Branch review before an NRC license is issued; a general license to export source material is corrected; and Appendices B and L to Part 110 are amended.

In § 110.8, which lists the nuclear facilities and equipment under NRC export authority, and in the appendices to Part 110, which describe the especially designed and prepared equipment under NRC export controls, the word "specially" where it appears is changed to "especially" to conform to the NSG guidelines.

Section 110.8 is amended to add uranium conversion plants and especially designed or prepared equipment therefor to the export authority of the NRC to conform to the NSG guidelines. Recently, the United States and other member countries of the NSG agreed to add to the NSG Trigger List (INFCIRC/254/Part 1) uranium conversion plants. This includes conversion of uranium ore concentrates to UO3, conversion of UO3 to UO2, conversion of uranium oxides to UF4 or UF6, conversion of UF4 to UF6, conversion of UF6 to UF4, conversion of UF4 to uranium metal, and conversion of uranium fluorides to uranium oxides. The materials and equipment desginated by the NSG guidelines as "trigger list" items are controlled by the NRC. Conversion of uranium is an essential step of the nuclear fuel cycle for both civil and military programs, including the production of highly enriched uranium and plutonium. In § 110.2, a definition of "conversion facility" is added for clarification.

Exports of uranium conversion plants and equipment are presently controlled by the Department of Commerce (DOC). The addition of uranium conversion plants to the NRC licensing authority will allow the DOC to remove this item from its nuclear referral list. Accordingly, § 110.1(b)(3), which describes nuclear-related commodities that are subject to DOC export controls, is revised to remove the reference to DOC controls on conversion plants.

In § 110.22, the general license provision in paragraph (c) is amended to delete the word "not" where it first appears. This action is necessary to correct an error in a final rule published July 21, 1995 (60 FR 37556), in which the word "not" was added inadvertently. As corrected, § 110.22(c) authorizes the export of uranium or thorium, other than U-230, U-232, Th-227, or Th-228, in individual shipments of one kilogram or less to any country listed in § 110.29, not to exceed 100 kilograms per year to any one country, except for source material in radioactive waste.

In § 110.26, Austria and Finland are added as eligible recipients of nuclear reactor components under the NRC's general license authority for export. These countries are now members of EURATOM. EURATOM has provided the necessary written assurances to the U.S. Government to permit these kinds of exports.

In § 110.28, which lists the embargoed destinations, Cambodia and Vietnam are removed. Because President Clinton lifted the U.S. general trade embargo against Vietnam on February 3, 1995, and the embargo restrictions for Cambodia in 1993, the Executive Branch recently recommended that Cambodia and Vietnam be removed from the embargoed destinations. Both Cambodia and Vietnam are adherents to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Exports to Cambodia and Vietnam now qualify for the NRC general licensing authorizations specified in §§ 110.21 through 110.25.

In § 110.29, Afghanistan, Algeria, Burma (Myanmar), Comoros, Guyana, Mauritania, Niger, St. Kitts, United Arab Emirates, Vanuatu, and Yemen Arab Republic are removed from the restricted destinations. The Executive Branch recently recommended that these countries be removed because they are NPT adherents. Accordingly, exports to these countries now qualify for the NRC general licensing authorizations specified in §§ 110.21 through 110.25.

In § 110.30, Brazil, New Zealand, Republic of Korea, South Africa, and Ukraine are added as members of the NSG. Accordingly, these countries are eligible to receive radioactive materials under NRC general licenses.

Section 110.41 is amended to reflect the Executive Branch conclusion that exports of less ~~than~~ one kilogram or less of source or special nuclear material exported under the U.S.-IAEA Agreement for Cooperation do not require the review of the Executive Branch. check w/ Robin

In Appendix B to Part 110, paragraph (c) of the footnote to section 1 is revised to change the level of control for filamentary materials suitable for gas centrifuge rotating components from "12.3×10^6" and "0.3×10^6" to "3.18×10^6m" and "7.62×10^4m". This action is necessary to correct an error made when the values were converted from English units to metric units. At present, items which have a wide variety of non-nuclear applications are subject to these controls.

New appendices to Part 110 are added to clarify the uranium enrichment equipment and uranium conversion equipment under NRC export licensing authority to reflect the guidelines of the NSG. The appendices are illustrative only and not inclusive. Corresponding changes are made to § 110.8.

In Appendix L, which lists the byproduct materials under NRC licensing controls, ~~byproduct material~~ the entry "tungsten 185 (w 85)" is corrected to read "tungsten 185 (W 185)."

The NRC has determined that this regulatory action is not significant. This rule is necessary to conform the export controls of the United States to the international export control guidelines of the NSG, of which the United States is a member, and to reflect the Department of State's nuclear non-proliferation policies.

Because these amendments involve a foreign affairs function of the United States, the notice and comment provisions of the Administrative Procedure Act do not apply (5 U.S.C. 553(a)(1)). Solicitation of public comments would delay United States conformance with its international obligations and therefore would not be in the public interest.

Environmental Impact: Categorical Exclusion

The NRC has determined that this final rule is the type of action described in categorical exclusion 10 CFR 51.22(c)(1) and (c)(2). Therefore, neither an environmental impact statement nor an environmental assessment has been prepared for this final rule.

Paperwork Reduction Act Statement

This final rule does not contain a new or amended information collection requirement subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing requirements in §§ 110.26, 110.31, 110.32, 110.53 and the use of Form NRC 7 were approved by the Office of Management and Budget, approval numbers 3150-0036 and 3150-0027.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Small Business Regulatory Enforcement Fairness Act

In accordance with the Small Business Regulatory Enforcement Fairness Act of 1996, the NRC has determined that this action is not a major rule and has verified this determination with the Office of Information and Regulatory Affairs of OMB. The rule is necessary to conform the nuclear nonproliferation policies of the United States with international export guidelines.

Regulatory Analysis

The final rule eliminating the requirement for a specific license in some circumstances should have a positive economic effect on U.S. export business. U.S. exporters can ship nuclear equipment and materials under the NRC general license authority to additional foreign markets without the expense of license application fees, the paperwork burden, time delays, and uncertainties in delivery. For the first time, Cambodia and Vietnam are eligible to receive certain NRC nuclear materials under general license. Austria and Finland are now eligible to receive nuclear reactor equipment under NRC general license. In addition, Brazil, New Zealand, Republic of Korea, South Africa, Ukraine, Afghanistan, Algeria, Burma (Myanmar), Comoros, Guyana, Mauritania, Niger, St. Kitts, United Arab Emirates, Vanuatu, and Yemen Arab Republic can now receive certain nuclear materials under NRC general licenses.

In transferring export authority of uranium conversion plants and equipment from the DOC to NRC export authority, the Commission was aware of a potential detrimental impact on exporters because of the license fee imposed by NRC for each license application submitted. However, according to DOC export licensing data, the DOC issued only one export license for conversion equipment in the past five years, at a value of $317,000. In view of this information, the NRC continues to believe that the economic impact of the rule on U.S. companies is not significant.

There are no alternatives for achieving the stated objective. This rule conforms NRC's export controls to the international export guidelines of the NSG. Thus, the regulation is required to satisfy international obligations of the United States. The foregoing discussion constitutes the regulatory analysis for this final rule.

Backfit Analysis

The NRC has determined that a backfit analysis is not required for this final rule because these amendments do not include any provisions that would require backfits as defined in 10 CFR 50.109(a)(1).

List of Subject Index Terms

Administrative practice and procedure, Classified information, Criminal penalties, Export, Import, Intergovernmental relations, Nuclear materials, Nuclear power plants and reactors, Reporting and recordkeeping requirements, Scientific equipment.

For the reasons set out in the preamble and under the authority of the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and 5 U.S.C. 552 and 553, the NRC is adopting the following amendments to 10 CFR Part 110.

PART 110 - EXPORT AND IMPORT OF NUCLEAR EQUIPMENT AND MATERIAL

1. The authority citation for Part 110 continues to read as follows:

AUTHORITY: Secs. 51, 53, 54, 57, 63, 64, 65, 81, 82, 103, 104, 109, 111, 126, 127, 128, 129, 161, 181, 182, 183, 187, 189, 68 Stat. 929, 930, 931, 932, 933, 936, 937, 948, 953, 954, 955, 956, as amended (42 U.S.C. 2071, 2073, 2074, 2077, 2092-2095, 2111, 2112, 2133, 2134, 2139, 2139a, 2141, 2154-2158, 2201, 2231-2233, 2237, 2239); sec. 201, 88 Stat. 1242, as amended (42 U.S.C. 5841); sec. 5, Pub. L. 101-575, 104 Stat. 2835 (42 U.S.C. 2243).

Sections 110.1(b)(2) and 110.1(b)(3) also issued under Pub. L. 96-92, 93 Stat. 710 (22 U.S.C. 2403). Section 110.11 also issued under sec. 122, 68 Stat. 939 (42 U.S.C. 2152) and secs. 54c and 57d, 88 Stat. 473, 475 (42 U.S.C. 2074). Section 110.27 also issued under sec. 309(a), Pub. L. 99-440. Section 110.50(b)(3) also issued under sec. 123, 92 Stat. 142 (42 U.S.C. 2153). Section 110.51 also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234). Section 110.52 also issued under sec. 186, 68 Stat. 955 (42 U.S.C. 2236). Sections 110.80-110.113 also issued under 5 U.S.C. 552, 554. Sections 110.130-110.135 also issued under 5 U.S.C. 553. Sections 110.2 and 110.42(a)(9) also issued under sec. 903, Pub. L. 102-496 (42 U.S.C. 2151 et seq.).

2. In § 110.1, paragraph (b)(3) is revised to read as follows:

§ 110.1 Purpose and Scope.

(b) * * *

(3) Persons who export nuclear referral list commodities subject to the licensing authority of the Department of Commerce pursuant to 15 CFR Part 799, such as bulk zirconium, rotor and bellows equipment, maraging steel, nuclear reactor related equipment, including process control systems and simulators; and

* * * * *

3. In § 110.2, a definition for <u>Conversion facility</u> is added in alphabetical order to read as follows:

§ 110.2 Definitions.

*   *   *   *   *

<u>Conversion facility</u> means any facility for the transformation from one uranium chemical species to another, including: conversion of uranium ore concentrates to UO3, conversion of UO3 to UO2, conversion of uranium oxides to UF4 or UF6, conversion of UF4 to UF6, conversion of UF6 to UF4, conversion of UF4 to uranium metal, and conversion of uranium fluorides to uranium oxides.

*   *   *   *   *

4. In § 110.8, paragraphs (f) and (g) are redesignated as paragraphs (g) and (h); paragraphs (a), (b), (c), (d), (e) and (g) are revised; and a new paragraph (f) is added to read as follows:

(a) Nuclear reactors and especially designed or prepared equipment and components for nuclear reactors. (See appendix A to this part.)

(b) Plants for the separation of isotopes of uranium (source material or special nuclear material) including gas centrifuge plants, gaseous diffusion plants, aerodynamic enrichment plants, chemical exchange or ion exchange enrichment plants, laser based enrichment plants, plasma separation enrichment plants, electromagnetic enrichment plants, and especially designed or prepared equipment, other than analytical instruments, for the separation of isotopes of uranium. (See appendices to this part for lists of: gas centrifuge equipment-Appendix B; gaseous diffusion equipment-Appendix C; aerodynamic enrichment equipment-Appendix D; chemical exchange or ion exchange enrichment equipment-Appendix E; laser based enrichment equipment-Appendix F; plasma separation enrichment equipment-Appendix G; and electromagnetic enrichment equipment-Appendix H.)

(c) Plants for the separation of the isotopes of lithium and especially designed or prepared assemblies and components for these plants.

(d) Plants for the reprocessing of irradiated nuclear reactor fuel elements and especially designed or prepared assemblies and components for these plants. (See Appendix I to this part.)

(e) Plants for the fabrication of nuclear reactor fuel elements and especially designed or prepared assemblies and components for these plants.

(f) Plants for the conversion of uranium and especially designed or prepared assemblies and components for these plants. (See Appendix J to this part.)

(g) Plants for the production, separation, or purification of heavy water, deuterium, and deuterium compounds and especially designed or prepared assemblies and components for these plants. (See Appendix K to this part.)

* * * * *

§ 110.22 [Amended]

5. In § 110.22(c), remove the word "not" where it appears between "country" and "listed."

§ 110.23 [Amended]

6. In § 110.23, paragraph (a)(1), "Appendix F" is changed to "Appendix L."

§ 110.26 [Amended]

7. In § 110.26, paragraph (a)(2) is amended by adding "Austria" and "Finland" in alphabetical order.

§ 110.28 [Amended]

8. Section 110.28 is amended by removing "Cambodia" and "Vietnam."

§ 110.29 [Amended]

9. Section 110.29 is amended by removing "Afghanistan," "Algeria," "Burma (Myanmar)," "Comoros," "Guyana," "Mauritania," "Niger," "St. Kitts," "United Arab Emirates," "Vanuatu," and "Yemen Arab Republic."

§ 110.30 [Amended]

10. Section 110.30 is amended by adding "Brazil," "New Zealand," "Republic of Korea," "South Africa," and "Ukraine" in alphabetical order.

11. In § 110.41, paragraph (a)(4) is amended to read as follows:

(a) * * *

(4) More than one kilogram of source or special nuclear material to be exported under the US-IAEA Agreement for Cooperation.

* * * * *

12. In § 110.44, paragraph (b)(2), "Appendix G" is changed to "Appendix M."

Appendix A to Part 110 [Amended]

13. In Appendix A to Part 110, paragraph (9), remove the word "specially" and add in its place the word "especially."

Appendix B to Part 110 [Amended]

14. In Appendix B to Part 110, paragraph (c) of the "Footnote" to section 1 is revised by changing the numerical values from "12.3×10^6" and "0.3×10^6" to "3.18×10^6m" and "7.62×10^4m".

Appendices D, E, F, and G to Part 110 [Redesignated]

15. Appendix D to Part 110 is redesignated Appendix I to Part 110 and Appendices E through G to Part 110 are redesignated as Appendices K through M to Part 110.

16. A new Appendix D to Part 110 is added to read as follows:

Appendix D to Part 110 - Illustrative List of Aerodynamic Enrichment Plant Equipment and Components Under NRC Export Licensing Authority.

Note--In aerodynamic enrichment processes, a mixture of gaseous UF6 and light gas (hydrogen or helium) is compressed and then passed through separating elements wherein isotopic separation is accomplished by the generation of high centrifugal forces over a curved-wall geometry. Two processes of this type have been successfully developed: the separation nozzle process and the vortex tube process. For both processes the main components of a separation stage included cylindrical vessels housing the special separation elements (nozzles or vortex tubes), gas compressors and heat exchangers to remove the heat of compression. An aerodynamic plant requires a number of these stages, so that quantities can provide an important indication of end use. Because aerodynamic processes use UF6, all equipment, pipeline and instrumentation surfaces (that come in contact with the gas) must be made of materials that remain stable in contact with UF6. All surfaces which come into contact with the process gas are made of or protected by UF6-resistant materials; including copper, stainless steel, aluminum, aluminum alloys, nickel or alloys containing 60% or more nickel and UF6-resistant fully fluorinated hydrocarbon polymers.

The following items either come into direct contact with the UF6 process gas or directly control the flow within the cascade:

(1) Separation nozzles and assemblies thereof.

Especially designed or prepared nozzles that consist of slit-shaped, curved channels having a radius of curvature less than 1 mm (typically 0.1 to 0.05 mm). The nozzles are resistant to UF6 corrosion and have a knife-edge within the nozzle that separates the gas flowing through the nozzle into two fractions.

(2) Vortex tubes and assemblies thereof.

Especially designed or prepared vortex tubes that are cylindrical or tapered, made of or protected by materials resistant to UF6 corrosion, have a diameter of between 0.5 cm and 4 cm, a length to diameter ratio of 20:1 or less and with one or more tangential inlets. The tubes may be equipped with nozzle-type appendages at either or both ends.

The feed gas enters the vortex tube tangentially at one end or through swirl vanes or at numerous tangential positions along the periphery of the tube.

(3) Compressors and gas blowers.

Especially designed or prepared axial, centrifugal or positive displacement compressors or gas blowers made of or protected by materials resistant to UF6 corrosion and with a suction volume capacity of 2 m^3/min or more of UF6/carrier gas (hydrogen or helium) mixture.

These compressors and gas blowers typically have a pressure ratio between 1.2:1 and 6:1.

(4) Rotary shaft seals.

Especially designed or prepared seals, with seal feed and seal exhaust connections, for sealing the shaft connecting the compressor rotor or the gas blower rotor with the driver motor to ensure a reliable seal against out-leakage of process gas or in-leakage of air or seal gas into the inner chamber of the compressor or gas blower which is filled with a UF6/carrier gas mixture.

(5) Heat exchangers for gas cooling.

Especially designed or prepared heat exchangers, made of or protected by materials resistant to UF6 corrosion.

(6) Separation element housings.

Especially designed or prepared separation element housings, made of or protected by materials resistant to UF6 corrosion, for containing vortex tubes or separation nozzles.

These housings may be cylindrical vessels greater than 300 mm in diameter and greater than 900 mm in length, or may be rectangular vessels of comparable dimensions, and may be designed for horizonal or vertical installation.

(7) Feed systems/product and tails withdrawal systems.

Especially designed or prepared process systems or equipment for enrichment plants made of or protected by materials resistant to UF6 corrosion, including:

(i) Feed autoclaves, ovens, or systems used for passing UF6 to the enrichment process;

(ii) Desublimers (or cold traps) used to remove UF6 from the enrichment process for subsequent transfer upon heating;

(iii) Solidification or liquefaction stations used to remove UF6 from the enrichment process by compressing and converting UF6 to a liquid or solid form; and

(iv) 'Product' or 'tails' stations used for transferring UF6 into containers.

(8) Header piping systems.

Especially designed or prepared header piping systems, made of or protected by materials resistant to UF6 corrosion, for handling UF6 within the aerodynamic cascades.

The piping network is normally of the 'double' header design with each stage or group of stages connected to each of the headers.

(9) Vacuum systems and pumps.

Especially designed or prepared vacuum systems having a suction capacity of 5 m^3/min or more, consisting of vacuum manifolds, vacuum headers and vacuum pumps, and designed for service in UF6-bearing atmospheres.

Especially designed or prepared vacuum pumps for service in UF6-bearing atmospheres and made of or protected by materials resistant to UF6 corrosion. These pumps may use fluorocarbon seals and special working fluids.

(10) Special shut-off and control valves.

Especially designed or prepared manual or automated shut-off and control bellows valves made of or protected by materials resistant to UF6 corrosion with a diameter of 40 to 1500 mm for installation in main and auxiliary systems of aerodynamic enrichment plants.

(11) UF6 mass spectrometers/ion sources.

Especially designed or prepared magnetic or quadrupole mass spectrometers capable of taking 'on-line' samples of feed, 'product' or 'tails', from UF6 gas streams and having all of the following characteristics:

(i) Unit resolution for mass greater than 320;

(ii) Ion sources constructed of or lined with nichrome or monel or nickel plated;

(iii) Electron bombardment ionization sources; and

(iv) Collector system suitable for isotopic analysis.

(12) UF6/carrier gas separation systems.

Especially designed or prepared process systems for separating UF6 from carrier gas (hydrogen or helium).

These systems are designed to reduce the UF6 content in the carrier gas to 1 ppm or less and may incorporate equipment such as:

(i) Cryogenic heat exchangers and cryoseparators capable of temperatures of -120°C or less;

(ii) Cryogenic refrigeration units capable of temperatures of -120°C or less;

(iii) Separation nozzle or vortex tube units for the separation of UF6 from carrier gas; or

(iv) UF6 cold traps capable of temperatures of -20°C or less.

17. A new Appendix E to Part 110 is added to read as follows:

Appendix E to Part 110--Illustrative List of Chemical Exchange or Ion Exchange Enrichment Plant Equipment and Components Under NRC Export Licensing Authority.

Note--The slight difference in mass between the isotopes of uranium causes small changes in chemical reaction equilibria that can be used as a basis for separation of the isotopes. Two processes have been successfully developed: liquid-liquid chemical exchange and solid-liquid ion exchange.

A. In the liquid-liquid chemical exchange process, immiscible liquid phases (aqueous and organic) are countercurrently contacted to give the cascading effect of thousands of separation stages. The aqueous phase consists of uranium chloride in hydrochloric acid solution; the organic phase consists of an extractant containing uranium chloride in an organic solvent. The contactors employed in the separation cascade can be liquid-liquid exchange columns (such as pulsed columns with sieve plates) or liquid centrifugal contactors. Chemical conversions (oxidation and reduction) are required at both ends of the separation cascade in order to provide for the reflux requirements at each end. A major design concern is to avoid contamination of the process streams with certain metal ions. Plastic, plastic-lined (including use of fluorocarbon polymers) and/or glass-lined columns and piping are therefore used.

(1) Liquid-liquid exchange columns.

Countercurrent liquid-liquid exchange columns having mechanical power input (i.e., pulsed columns with sieve plates, reciprocating plate columns, and columns with internal turbine mixers), especially designed or prepared for uranium enrichment using the chemical exchange process. For corrosion resistance to concentrated hydrochloric acid solutions, these columns and their internals are made of or protected by suitable plastic materials (such as fluorocarbon polymers) or glass. The stage residence time of the columns is designed to be short (30 seconds or less).

(2) Liquid-liquid centrifugal contactors.

Especially designed or prepared for uranium enrichment using the chemical exchange process. These contactors use rotation to achieve dispersion of the organic and aqueous streams and then centrifugal force to separate the phases. For corrosion resistance to concentrated hydrochloric acid solutions, the contactors are made of or are lined with suitable plastic materials (such as fluorocarbon polymers) or are lined with glass. The stage residence time of the centrifugal contactors is designed to be short (30 seconds or less).

(3) Uranium reduction systems and equipment.

(i) Especially designed or prepared electrochemical reduction cells to reduce uranium from one valence state to another for uranium enrichment using the chemical exchange process. The cell materials in contact with process solutions must be corrosion resistant to concentrated hydrochloric acid solutions.

The cell cathodic compartment must be designed to prevent re-oxidation of uranium to its higher valence state. To keep the uranium in the cathodic compartment, the cell may have an impervious diaphragm membrane constructed of special cation exchange material. The cathode consists of a suitable solid conductor such as graphite.

These systems consist of solvent extraction equipment for stripping the U+4 from the organic stream into an aqueous solution, evaporation and/or other equipment to accomplish solution pH adjustment and control, and pumps or other transfer devices for feeding to the electrochemical reduction cells. A major design concern is to avoid contamination of the aqueous stream with certain metal ions. For those parts in contact with the process stream, the system is constructed of equipment made of or protected by materials such as glass, fluorocarbon polymers, polyphenyl sulfate, polyether sulfone, and resin-impregnated graphite.

(ii) Especially designed or prepared systems at the product end of the cascade for taking the U+4 out of the organic stream, adjusting the acid concentration and feeding to the electrochemical reduction cells.

These systems consist of solvent extraction equipment for stripping the U+4 from the organic stream into an aqueous solution, evaporation and/or other equipment to accomplish solution pH adjustment and control, and pumps or other transfer devices for feeding to the electrochemical reduction cells. A major design concern is to avoid contamination of the aqueous stream with certain metal ions. For those parts in contact with the process stream, the system is constructed of equipment made of or protected by materials such as glass, fluorocarbon polymers, polyphenyl sulfate, polyether sulfone, and resin-impregnated graphite.

(4) Feed preparation systems.

Especially designed or prepared systems for producing high-purity uranium chloride feed solutions for chemical exchange uranium isotope separation plants.

These systems consist of dissolution, solvent extraction and/or ion exchange equipment for purification and electrolytic cells for reducing the uranium U+6 or U+4 to U+3. These systems produce uranium chloride solutions having only a few parts per million of metallic impurities such as chromium, iron, vanadium, molybdenum and other bivalent or higher multi-valent cations. Materials of construction for portions of the system processing high-purity

U+3 include glass, fluorocarbon polymers, polyphenyl sulfate or polyether sulfone plastic-lined and resin-impregnated graphite.

(5) Uranium oxidation systems.

Especially designed or prepared systems for oxidation of U+3 to U+4 for return to the uranium isotope separation cascade in the chemical exchange enrichment process.

These systems may incorporate equipment such as:

(i) Equipment for contacting chlorine and oxygen with the aqueous effluent from the isotope separation equipment and extracting the resultant U+4 into the stripped organic stream returning from the product end of the cascade; and

(ii) Equipment that separates water from hydrochloric acid so that the water and the concentrated hydrochloric acid may be reintroduced to the process at the proper locations.

B. In the solid-liquid ion-exchange process, enrichment is accomplished by uranium adsorption/desorption on a special, fast-acting, ion-exchange resin or adsorbent. A solution of uranium in hydrochloric acid and other chemical agents is passed through cylindrical enrichment columns containing packed beds of the adsorbent. For a continuous process, a reflux system is necessary to release the uranium from the adsorbent back in the liquid flow so that 'product' and 'tails' can be collected. This is accomplished with the use of suitable reduction/oxidation chemical agents that are fully regenerated in separate external circuits and that may be partially regenerated within the isotopic separation columns themselves. The presence of hot concentrated hydrochloric acid solutions in the process requires that the equipment be made of or protected by special corrosion-resistant materials.

(1) Fast reacting ion exchange resins/adsorbents.

Especially designed or prepared for uranium enrichment using the ion exchange process, including porous macroreticular resins, and/or pellicular structures in which the active chemical exchange groups are limited to a coating on the surface of an inactive porous support structure, and other composite structures in any suitable form including particles or fibers. These ion exchange resins/adsorbents have diameters of 0.2 mm or less and must be chemically resistant to concentrated hydrochloric acid solutions as well as physically strong enough so as not to degrade in the exchange columns. The resins/adsorbents are especially designed to achieve very fast uranium isotope exchange kinetics (exchange rate half-time of less than 10 seconds) and are capable of operating at a temperature in the range of 100°C to 200°C.

(2) Ion exchange columns.

Cylindrical columns greater than 1000 mm in diameter for containing and supporting packed beds of ion exchange resin/adsorbent, especially designed or prepared for uranium enrichment using the ion exchange process. These columns are made of or protected by materials (such as titanium or fluorocarbon plastics) resistant to corrosion by concentrated hydrochloric acid solutions and are capable of operating at a temperature in the range of 100°C to 200°C and pressures above 0.7 MPa (102 psia).

(3) Ion exchange reflux systems.

(i) Especially designed or prepared chemical or electrochemical reduction systems for regeneration of the chemical reducing agent(s) used in ion exchange uranium enrichment cascades.

The ion exchange enrichment process may use, for example, trivalent titanium (Ti^{+3}) as a reducing cation in which case the reduction system would regenerate Ti^{+3} by reducing Ti^{+4}.

(ii) Especially designed or prepared chemical or electrochemical oxidation systems for regeneration of the chemical oxidizing agent(s) used in ion exchange uranium enrichment cascades.

The ion exchange enrichment process may use, for example, trivalent iron (Fe^{+3}) as an oxidant in which case the oxidation system would regenerate Fe^{+3} by oxidizing Fe^{+2}.

18. A new Appendix F to Part 110 is added to read as follows:

Appendix F to Part 110 - Illustrative List of Laser-Based Enrichment Plant Equipment and Components Under NRC Export Licensing Authority.

Note--Present systems for enrichment processes using lasers fall into two categories: the process medium is atomic uranium vapor and the process medium is the vapor of a uranium compound. Common nomenclature for these processes include: first category-atomic vapor laser isotope separation (AVLIS or SILVA); second category-molecular laser isotope separation (MLIS or MOLIS) and chemical reaction by isotope selective laser activation (CRISLA). The systems, equipment and components for laser enrichment plants include: (a) devices to feed uranium-metal vapor for selective photo-ionization or devices to feed the vapor of a uranium compound for photo-dissociation or chemical activation; (b) devices to collect enriched and depleted uranium metal as 'product' and 'tails' in the first category, and devices to collect dissociated or reacted compounds as 'product' and unaffected material as 'tails' in the second category; (c) process laser systems to selectively excite the uranium-235 species; and (d) feed preparation and product conversion equipment. The complexity of the spectroscopy of uranium atoms and compounds may require incorporation of a number of available laser technologies.

All surfaces that come into contact with the uranium or UF6 are wholly made of or protected by corrosion-resistant materials. For laser-based enrichment items, the materials resistant to corrosion by the vapor or liquid of uranium metal or uranium alloys include yttria-coated graphite and tantalum; and the materials resistant to corrosion by UF6 include copper, stainless steel, aluminum, aluminum alloys, nickel or alloys containing 60% or more nickel and UF6-resistant fully fluorinated hydrocarbon polymers.

Many of the following items come into direct contact with uranium metal vapor or liquid or with process gas consisting of UF6 or a mixture of UF6 and other gases:

(1) Uranium vaporization systems (AVLIS).

Especially designed or prepared uranium vaporization systems that contain high-power strip or scanning electron beam guns with a delivered power on the target of more than 2.5 kW/cm.

(2) Liquid uranium metal handling systems (AVLIS).

Especially designed or prepared liquid metal handling systems for molten uranium or uranium alloys, consisting of crucibles and cooling equipment for the crucibles.

The crucibles and other system parts that come into contact with molten uranium or uranium alloys are made of or protected by materials of suitable corrosion and heat resistance, such as tantalum, yttria-coated graphite, graphite coated with other rare earth oxides or mixtures thereof.

(3) Uranium metal 'product' and 'tails' collector assemblies (AVLIS).

Especially designed or prepared 'product' and 'tails' collector assemblies for uranium metal in liquid or solid form.

Components for these assemblies are made of or protected by materials resistant to the heat and corrosion of uranium metal vapor or liquid, such as yttria-coated graphite or tantalum, and may include pipes, valves, fittings, 'gutters', feed-throughs, heat exchangers and collector plates for magnetic, electrostatic or other separation methods.

(4) Separator module housings (AVLIS).

Especially designed or prepared cylindrical or rectangular vessels for containing the uranium metal vapor source, the electron beam gun, and the 'product' and 'tails' collectors.

These housings have multiplicity of ports for electrical and water feed-throughs, laser beam windows, vacuum pump connections and instrumentation diagnostics and monitoring with opening and closure provisions to allow refurbishment of internal components.

(5) Supersonic expansion nozzles (MLIS).

Especially designed or prepared supersonic expansion nozzles for cooling mixtures of UF6 and carrier gas to 150 K or less which are corrosion resistant to UF6.

(6) Uranium pentafluoride product collectors (MLIS).

Especially designed or prepared uranium pentafluoride (UF5) solid product collectors consisting of filter, impact, or cyclone-type collectors, or combinations thereof, which are corrosion resistant to the UF5/UF6 environment.

(7) UF6/carrier gas compressors (MLIS).

Especially designed or prepared compressors for UF6/carrier gas mixtures, designed for long term operation in a UF6 environment. Components of these compressors that come into contact with process gas are made of or protected by materials resistant to UF6 corrosion.

(8) Rotary shaft seals (MLIS).

Especially designed or prepared rotary shaft seals, with seal feed and seal exhaust connections, for sealing the shaft connecting the compressor rotor with the driver motor to ensure a reliable seal against out-leakage of process gas or in-leakage of air or seal gas into the inner chamber of the compressor which is filled with a UF6/carrier gas mixture.

(9) Fluorination systems (MLIS).

Especially designed or prepared systems for fluorinating UF5 (solid) to UF6 (gas).

These systems are designed to fluorinate the collected UF5 powder to UF6 for subsequent collection in product containers or for transfer as feed to MLIS units for additional enrichment. In one approach, the fluorination reaction may be accomplished within the isotope separation system to react and recover directly off the 'product' collectors. In another approach, the UF5 powder may be removed/transferred from the 'product' collectors into a suitable reaction vessel (e.g., fluidized-bed reactor, screw reactor or flame tower) for fluorination. In both approaches equipment is used for storage and transfer of fluorine (or other suitable fluorinating agents) and for collection and transfer of UF6.

(10) UF6 mass spectrometers/ion sources (MLIS).

Especially designed or prepared magnetic or quadrupole mass spectrometers capable of taking 'on-line' samples of feed, 'product' or 'tails', from UF6 gas streams and having all of the following characteristics:

(i) Unit resolution for mass greater than 320;

(ii) Ion sources constructed of or lined with nichrome or monel or nickel plated;

(iii) Electron bombardment ionization sources; and

(iv) Collector system suitable for isotopic analysis.

(11) Feed systems/product and tails withdrawal systems (MLIS).

Especially designed or prepared process systems or equipment for enrichment plants made of or protected by materials resistant to corrosion by UF6, including:

(i) Feed autoclaves, ovens, or systems used for passing UF6 to the enrichment process;

(ii) Desublimers (or cold traps) used to remove UF6 from the enrichment process for subsequent transfer upon heating;

(iii) Solidification or liquefaction stations used to remove UF6 from the enrichment process by compressing and converting UF6 to a liquid or solid; and

(iv) 'Product' or 'tails' stations used to transfer UF6 into containers.

(12) UF6/carrier gas separation systems (MLIS).

Especially designed or prepared process systems for separating UF6 from carrier gas. The carrier gas may be nitrogen, argon, or other gas.

These systems may incorporate equipment such as:

(i) Cryogenic heat exchangers or cryoseparators capable of temperatures of -120°C or less;

(ii) Cryogenic refrigeration units capable of temperatures of -120°C or less; or

(iii) UF6 cold traps capable of temperatures of -20°C or less.

(13) Lasers or Laser systems (AVLIS, MLIS and CRISLA).

Especially designed or prepared for the separation of uranium isotopes.

The laser system for the AVLIS process usually consists of two lasers: a copper vapor laser and a dye laser. The laser system for MLIS usually consists of a CO2 or excimer laser and a multi-pass optical cell with revolving mirrors at both ends. Lasers or laser systems for both processes require a spectrum frequency stabilizer for operation over extended periods.

19. A new Appendix G to Part 110 is added to read as follows:

Appendix G to Part 110 -- Illustrative List of Plasma Separation Enrichment Plant Equipment and Components under NRC Export Licensing Authority.

Note--In the plasma separation process, a plasma of uranium ions passes through an electric field tuned to the 235U ion resonance frequency so that they preferentially absorb energy and increase the diameter of their corkscrew-like orbits. Ions with a large-diameter path are trapped to produce a product enriched in 235U. The plasma, made by ionizing uranium vapor, is contained in a vacuum chamber with a high-strength magnetic field produced by a superconducting magnet. The main technological systems of the process include the uranium plasma generation system, the separator module with superconducting magnet, and metal removal systems for the collection of 'product' and 'tails'.

(1) Microwave power sources and antennae.

Especially designed or prepared microwave power sources and antennae for producing or accelerating ions having the following characteristics: greater than 30 GHz frequency and greater than 50 kW mean power output for ion production.

(2) Ion excitation coils.

Especially designed or prepared radio frequency ion excitation coils for frequencies of more than 100 kHz and capable of handling more than 40 kW mean power.

(3) Uranium plasma generation systems.

Especially designed or prepared systems for the generation of uranium plasma, which may contain high power strip or scanning electron beam guns with a delivered power on the target of more than 2.5 kW/cm.

(4) Liquid uranium metal handling systems.

Especially designed or prepared liquid metal handling systems for molten uranium or uranium alloys, consisting of crucible and cooling equipment for the crucibles.

The crucibles and other system parts that come into contact with molten uranium or uranium alloys are made of or protected by corrosion and heat resistance materials, such as tantalum, yttria-coated graphite, graphite coated with other rare earth oxides or mixtures thereof.

(5) Uranium metal 'product' and 'tails' collector assemblies.

Especially designed or prepared 'product' and 'tails' collector assemblies for uranium metal in solid form. These collector assemblies are made of or protected by materials resistant to the heat and corrosion of uranium metal vapor, such as yttria-coated graphite or tantalum.

(6) Separator module housings.

Especially designed or prepared cylindrical vessels for use in plasma separation enrichment plants for containing the uranium plasma source, radio-frequency drive coil and the 'product' and 'tails' collectors.

These housings have a multiplicity of ports for electrical feed-throughs, diffusion pump connections and instrumentation diagnostics and monitoring. They have provisions for opening and closure to allow for refurbishment of internal components and are constructed of a suitable non-magnetic material such as stainless steel.

20. A new Appendix H to Part 110 is added to read as follows:

Appendix H to Part 110--Illustrative List of Electromagnetic Enrichment Plant Equipment and Components Under NRC Export Licensing Authority.

Note--In the electromagnetic process, uranium metal ions produced by ionization of a salt feed material (typically UCL4) are accelerated and passed through a magnetic field that has the effect of causing the ions of different isotopes to follow different paths. The major components of an electromagnetic isotope separator include: a magnetic field for ion-beam diversion/separation of the isotopes, an ion source with its acceleration system, and a collection system for the separated ions. Auxiliary systems for the process include the magnet power supply system, the ion source high-voltage power supply system, the vacuum system, and extensive chemical handling systems for recovery of product and cleaning/recycling of components.

(1) Electromagnetic isotope separators.

Especially designed or prepared for the separation of uranium isotopes, and equipment and components therefor, including:

(i) Ion Sources--especially designed or prepared single or multiple uranium ion sources consisting of a vapor source, ionizer, and beam accelerator, constructed of materials such as graphite, stainless steel, or copper, and capable of providing a total ion beam current of 50 mA or greater;

(ii) Ion collectors--collector plates consisting of two or more slits and pockets especially designed or prepared for collection of enriched and depleted uranium ion beams and constructed of materials such as graphite or stainless steel;

(iii) Vacuum housings--especially designed or prepared vacuum housings for uranium electromagnetic separators, constructed of suitable non-magnetic materials such as stainless steel and designed for operation at pressures of 0.1 Pa or lower.

The housings are specially designed to contain the ion sources, collector plates and water-cooled liners and have provision for diffusion pump connections and opening and closure for removal and reinstallation of these components; and

(iv) Magnet pole pieces--especially designed or prepared magnet pole pieces having a diameter greater than 2 m used to maintain a constant magnetic field within an electromagnetic isotope separator and to transfer the magnetic field between adjoining separators.

(2) High voltage power supplies.

Especially designed or prepared high-voltage power supplies for ion sources, having all of the following characteristics:

(i) Capable of continuous operation;

(ii) Output voltage of 20,000 V or greater;

(iii) Output current of 1 A or greater; and

(iv) Voltage regulation of better than 0.01% over an 8 hour time period.

(3) Magnet power supplies.

Especially designed or prepared high-power, direct current magnet power supplies having all of the following characteristics:

(i) Capable of continuously producing a current output of 500 A or greater at a voltage of 100 V or greater; and

(ii) A current or voltage regulation better than 0.01% over an 8 hour time period.

21. A new Appendix J to Part 110 is added to read as follows:

Appendix J to Part 110-- Illustrative List of Uranium Conversion Plant Equipment under NRC Export Licensing Authority.

Note--Uranium conversion plants and systems may perform one or more transformations from one uranium chemical species to another, including: conversion of uranium ore concentrates to UO3, conversion of UO3 to UO2, conversion of uranium oxides to UF4 or UF6, conversion of UF4 to UF6, conversion of UF6 to UF4, conversion of UF4 to uranium metal, and conversion of uranium fluorides to uranium oxides. Many key equipment items for uranium conversion plants are common to several segments of the chemical process industry, including furnaces, rotary kilns, fluidized bed reactors, flame tower reactors, liquid centrifuges, distillation columns and liquid-liquid extraction columns. However, few of the items are available "off-the-shelf"; most would be prepared according to customer requirements and specifications.

Some require special design and construction considerations to address the corrosive properties of the chemicals handled (HF, F2, CLF3, and uranium fluorides). In all of the uranium conversion processes, equipment which individually is not especially designed or prepared for uranium conversion can be assembled into systems which are especially designed or prepared for uranium conversion.

(1) Especially designed or prepared systems for the conversion of uranium ore concentrates to UO3.

Conversion of uranium ore concentrates to UO3 can be performed by first dissolving the ore in nitric acid and extracting purified uranyl nitrate using a solvent such as tributyl phosphate. Next, the uranyl nitrate is converted to UO3 either by concentration and denitration or by neutralization with gaseous ammonia to product ammonium diuranate with subsequent filtering, drying, and calcining.

(2) Especially designed or prepared systems for the conversion of UO3 to UF6.

Conversion of UO3 to UF6 can be performed directly by fluorination. The process requires a source of fluorine gas or chlorine trifluoride.

(3) Especially Designed or Prepared Systems for the conversion of UO3 to UO2.

Conversion of UO3 to UO2 can be performed through reduction of UO3 with cracked ammonia gas or hydrogen.

(4) Especially Designed or Prepared Systems for the conversion of UO2 to UF4.

Conversion of UO2 to UF4 can be performed by reacting UO2 with hydrogen fluoride gas (HF) at 300-500°C.

(5) Especially Designed or Prepared Systems for the conversion of UF4 to UF6.

Conversion of UF4 to UF6 is performed by exothermic reaction with fluorine in a tower reactor. UF6 is condensed from the hot effluent gases by passing the effluent stream through a cold trap cooled to -10°C. The process requires a source of fluorine gas.

(6) Especially Designed or Prepared Systems for the conversion of UF4 to U metal.

Conversion of UF4 to U metal is performed by reduction with magnesium (large batches) or calcium (small batches). The reaction is carried out at temperatures above the melting point of uranium (1130°C).

(7) Especially designed or prepared systems for the conversion of UF6 to uranium oxides.

Conversion of UF6 to UO2 can be performed by one of three processes. In the first, UF6 is reduced and hydrolyzed to UO2 using hydrogen and steam. In the second, UF6 is hydrolyzed by solution in water, ammonia is added to precipitate ammonium diuranate, and the diuranate is reduced to UO2 with hydrogen at 820°C. In the third process, gaseous UF6, CO2, and NH3 are combined in water, precipitating ammonium uranyl carbonate. The ammonium uranyl carbonate is combined with steam and hydrogen at 500-600°C to yield UO2. UF6 to UO2 conversion is often performed as the first stage of a fuel fabrication plant.

(8) Especially Designed or Prepared Systems for the conversion of UF6 to UF4.

Conversion of UF6 to UF4 is performed by reduction with hydrogen.

Appendix L to Part 110 [Amended]

22. In Appendix L to Part 110, remove the words "Tungsten 185 (W 85)" and add in its place the words "Tungsten 185 (W 185)."

Dated in Rockville, MD this ____ day of ________, 1996.

For the Nuclear Regulatory Commission.

James M. Taylor,
Executive Director for Operations.

Questions from NRC
for Department of Energy
6/6/96
AF51-2
PDR

Item 1. Appendix B to Part 110. (Gas Centrifuge Enrichment)

Paragraphs (a) through (d) of Sec 1.2 Static Components describe: (a) Magnetic Suspensiion Bearings; (b) Bearings/ Dampers; (c) Molecular Pumps; and (d) Motor Stators; however the NSG Guidelines also describe (e) Centrifuge housing/recipients and (f) Scoops. Should these be added?

Item 2. Appendix B to Part 110. (Gas Centrifuge Enrichment)

In sec 2. Especially designed or prepared auxiliary systems, equipment and components for gas centrifuge enrichment plants, para two of the **"Note--"** reads: "... (operating at about -70°C) where they are condensed prior to onward transfer.." Is temperature correct? Also, in par 2(a)(2) "The desublimers ... being chilled to -70°C and heated to 70°C." Are these correct?

Item 3. Appendix D to Part 110. (Reprocessing Plant Equipment)

Please review paras (1) through (7) because the language is not the same as the NSG guidelines.

Item 4. Cross-references to DOC regs.

NRC agrees that providing references in NRC regs to DOC-licensed items would be useful to exporters and regulators, and would appreciate any DOE guidance of how to do this.

In addition to cross references for lasers, super-conducting magnets, and crucibles, NRC thinks cross references to other DOC-licensed items should be considered, such as: "rotor fabrication and assembly equipment," "frequency changers," "mass spectrometers," "valves," "vacuum pumps," equipment in sec 4 Heavy Water Production Plant Related Equipment (other than Trigger List Items)?

For your information, please note that in the current § 110.8 (list of nuclear facilities/equipment under NRC export authority) para (g) reads, "Other nuclear-related commodities are under the export licensing authority of the Department of Commerce. (See 15 CFR part 799)."

A:\Review