제047호 (1/10)

국제공인시험기관인정서

기 관 명 : 한국원자력연구원

대 표 자 : 정 연 호

법 인 등 록 번 호 : 160122-000307

사업자등록번호 : 314-82-00813

법 인 주 소 : 대전광역시 유성구 대덕대로 1045(덕진동 150)

사 업 장 소 재 지 : 대전광역시 유성구 대덕대로 1045(덕진동 150)

유 효 기 간 : 2011년 6월 28일 ~ 2015년 6월 27일

인정분야 및 범위 : 별 첨

상기 시험기관을 KS Q ISO/IEC 17025:2006 인정요건 및 국가표준기본법 제23조의 규정에 의거하여 국제공인시험기관으로 인정합니다. 또한 ISO-ILAC-IAF 공동성명(2009.1.8)에 언급된 바와 같이 인정된 분야 및 범위에 대한 기술적 능력과 시험기관 품질경영시스템이 적절함을 인정합니다.

2011년 6월 28일

한 국 인 정 기 구 장

"이면사항기재"

1. 1996. 12. 28 : 최초인정
2. 2001. 09. 07 : 추가인정
3. 2002. 05. 30 : 갱신인정
4. 2003. 08. 19 : 추가인정
5. 2005. 05. 09 : 추가인정 및 분류기준개편에 따른 인정서 재교부
6. 2007. 09. 10 : 갱신인정
7. 2008. 01. 08 : 대표자 변경(박창규 → 양명승)
8. 2009. 02. 04 : 일부항목 철회(조사후시험센터 1. 역학시험 1.018 발전, 원자력)
9. 2009. 09. 16 : 추가인정(1.역학시험 1.018 발전, 원자력 3개 규격)
   일부항목 삭제 (2.007 방사성물질 1개 규격, 1.018 발전, 원자력 2개 규격)
   일부항목 휴지 (2.007 방사성물질 2개 규격, 5.001 금속및관련제품 1개 규격, 5.002 비금속 및 관련제품 1개 규격, 5.003 고무와관련제품 1개 규격, 5.004 기타제품 2개 규격)
10. 2010. 04. 16 : 일부인정항목 휴지소멸 및 일부 부서명칭 변경(하나로이용기술개발센터→중성자과학연구부)에 따른 인정서 재교부
11. 2011. 01. 06 : 대표자 변경(양명승 → 정연호)
12. 2011. 06. 28 : 갱신인정(01. 역학시험 01012. 기계요소, 01018. 발전, 원자력 02. 화학시험 02007. 방사성물질, 04. 열 및 온도측정 04001. 온도 및 습도) 일부항목 휴지 (05. 비파괴시험 05002. 비금속 및 관련제품, 05003. 고무와 관련제품, 05004. 기타 제품 3개 규격)

01. 역학시험

01012. 기계요소

규격번호	규격명	시험범위 및 검출한계
교육과학기술부 고시 제2009-37호 : 2009	방사성 물질 등의 포장 및 운반에 관한 규정	
	제26조: 고온시험	온도 : 38 ℃ ± 2 ℃
	제43조: 낙하시험 타격시험 굽힘시험 가열시험	높이 : 9 m Max. 중량 : 1.4 kg Max. 중량 : 1.4 kg Max. 온도 : 800 ℃ ± 50 ℃
	제45조: 살수시험 낙하시험 하중시험 관통시험	살수 : 50 mm/h(강우량) 중량 : 10 000 kg Max. 중량 : 10 000 kg Max. 중량 : 6 kg Max.
	제47조: 낙하시험 파열시험 침수시험 열 시험	높이 : 9 m Max. 높이 : 1 m Max. 압력 : 2 MPa Max. 온도 : 800 ℃ ± 200 ℃
IAEA Safety Standard Series No. TS-R-1:2005	Regulations for the Safe Transport of Radioactive Material	
	Para 705: Impact test Para 706: Percussion test Para 707: Bending test Para 708: Heat test	높이 : 9 m Max. 중량 : 1.4 kg Max. 중량 : 1.4 kg Max. 온도 : 800 ℃ ± 50 ℃
	Para 721: Water spray test Para 722: Free drop test Para 723: Stacking test Para 724: Penetration test	살수 : 50 mm/h(강우량) 중량 : 10 000 kg Max. 중량 : 10 000 kg Max. 중량 : 6 kg Max.
	Para 727: Mechanical test Para 728: Thermal test Para 729: Water immersion test Para 730: Enhanced water immersion test	높이 : 9 m Max. 온도 : 800 ℃ + 200 ℃ 압력 : 150 kPa Max. 압력 : 2 MPa Max.
	Para 664: Environmental test	온도 : 38 ℃ ± 2 ℃
미국 10 CFR Part 71:2005	CKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIAL	
	71.71: Heat test, Cold test Water spray test Drop test Compression test Penetration test	온도 : 38 ℃ ± 2 ℃ 온도 : -40 ℃ ± 2 ℃ 살수 : 50 mm/h(강우량) 높이 : 9 m Max. 중량 : 10 000 kg Max. 중량 : 6 kg Max.
	71.73: Free drop test Puncture test Thermal test Immersion test	높이 : 9 m Max. 높이 : 1 m Max. 온도 : 800 ℃ + 50 ℃ 압력 : 2 MPa Max.
	71.75: Impact test Percussion test Bending test Heat test	높이 : 9 m Max. 중량 : 1.4 kg Max. 중량 : 1.4 kg Max. 온도 : 800 ℃ ± 200 ℃

01012. 기계요소

규격번호	규격명	시험범위 및 검출한계
교육과학기술부 고시 제2009-37호: 2009	방사성 동위원소 등의 생산에 관한 기준	
	제4조 1항 2호 : 온도시험 외부압력시험 충격시험 관통시험	온도: -40 °C ~ 800 °C 압력: 25 kPa ~ 170 MPa 중량: 20 kg Max. 중량: 1 kg Max.
ANSI N14.5: 1997	Radioactive Materials - Leakage Tests on Packages for Shipment	
	A.5.1 : Gas pressure drop test	해당사항 없음
	A.5.2 : Gas pressure rise test	해당사항 없음
	A.5.4, A.5.5 : Evacuated envelope gas test	해당사항 없음
	A.5.6 : Vacuum bubble test	압력: 15 kPa ~ 25 kPa Max.
	A.5.8 : Tracer gas test - Sniffer technique	해당사항 없음
ISO 12807:1996	Safe transport of radioactive materials - Leakage testing on packages	
	A.3.1 : Gas pressure drop test	해당사항 없음
	A.3.2 : Gas pressure rise test	해당사항 없음
	A.3.4, A.3.5 : Evacuated envelope test	해당사항 없음
	A.4.1.4.2 : Vacuum bubble test	압력: 15 kPa ~ 25 kPa Max.
	A.4.3 : Tracer gas test(sniffer technique)	해당사항 없음
ISO 9978:1992	Radiation protection - Sealed radioactive sources - Leak test methods	
	6.2.1 : Vacuum bubble test	해당사항 없음
	6.2.4 : Liquid nitrogen bubble test	해당사항 없음
ISO 2919:1999	Radiation protection - Sealed radioactive sources - General requirements and classification	
	7.2 : Temperature test	온도: -40 °C ~ 800 °C
	7.3 : External pressure test	압력: 25 kPa ~ 170 MPa
	7.4 : Impact test	중량 : 20 kg Max.
	7.6 : Puncture test	중량 : 1 kg Max.

01012. 기계요소

규격번호	규격명	시험범위 및 검출한계
ISO 3999:2004	Radiation protection - Apparatus for industrial gamma radiography - Specification for performance, design and tests	
	6.4.6, 6.6.1 : Shock-resistance test	해당사항 없음
	6.6.1, 6.7.2 : Crushing and bending tests	해당사항 없음
	6.5, 6.6.3, 6.7.4 : Tensile test	하중 : 1 000 N

선진핵연료기술개발부

01. 역학시험

01018. 발전, 원자력

규격번호	규격명	시험범위 및 검출한계
MDR-PT-07001	핵연료집합체 굽힘시험 지침	횡 방향 : 40 mm Max. 축 방향 : 40 kN Max.
MDR-XGN-08032	핵연료집합체 진동시험 지침	가진력 : 90 N Max. 변위 : 30 mm Max. 동적범위 : 60 Hz Max.
MDR-XGN-08033	핵연료집합체 충격시험 지침	횡 방향 : 40 mm Max. 축 방향 : 40 mm Max.

원자력화학연구부

02. 화학시험

02007. 방사성물질

규격번호	규격명	시험범위 또는 검출한계
ARL/TR040:1981	Radium-226 in environmental samples by the use of liquid scintillation counting	> 1 pCi/L
ASTM C 697-04	Plutonium Isotopic Analysis by Mass Spectrometry	> 0.1 ng/g

02007. 방사성물질

규격번호	규격명	시험범위 또는 검출한계
ASTM C 761-04	Determination of Metallic Impurities by ICP-AES	(0.1～100) μg/g
ASTM C 1108-06	Plutonium by Controlled-Potential Coulometry	(5～10) mg/g
ASTM C 1205-02	Radiochemical Determination of Americium-241 in Soil by Alpha Spectrometry	> 0.005 Bq/g
ASTM C 1267-06	Uranium by Iron(II) Reduction in Phosphoric Acid Followed by Chromium(VI) Titration in the Presence of Vanadium	(20～50) mg/g
ASTM C 1284-05	Electrodeposition of the Actinides for Alpha Spectrometry	> 0.005 Bq/g
ASTM C 1287-03	Determination of Impurities in Nuclear Grade Uranium Compounds by Inductively Coupled Plasma Mass Spectrometry	> 100 μg/g
ASTM C 1387-03	Determination of Technetium-99 in Soil	> 1 Bq/g
ASTM C 1402-04	High-Resolution Gamma-Ray Spectrometry of Soil Samples	> 0.1 Bq/g
ASTM C 1413-05	Isotopic Analysis of Hydrolyzed Uranium Hexafluoride and Uranyl Nitrate Solutions by Thermal Ionization Mass Spectrometry	U-235(0.1% ～5%)
ASTM C 1457-05	Determination of Total Hydrogen Content of Uranium Oxide Powders and Pellets by Carrier Gas Extraction	(0.05～200) μg/g
ASTM C 1474-06	Analysis of Isotopic Composition of Uranium in Nuclear-Grade Fuel Material by Quadrupole Inductively Coupled Plasma-Mass Spectrometry	> 0.1 μg/g
ASTM C 1507-06	Radiochemical Determination of Strontium-90 in Soil	> 0.004 Bq/g
ASTM D 1125-05	Electrical Conductivity and Resistivity of Water	(10～200000) μS/cm
ASTM D 1293-05	pH of Water	(0～14) pH
ASTM D 3082-03	Boron in Water	(0.1～1) μg/mL
ASTM D 3648-03	Measurement of Radioactivity	> 0.2 Bq/g

02007. 방사성물질

규격번호	규격명	시험범위 또는 검출한계
ASTM D 3649-06	High-Resolution Gamma-Ray Spectrometry of Water	(0.4～40) Bq
ASTM D 3865-02	Plutonium in Water	> 0.01 Bq/L
ASTM D 4922-01	Determination of Radioactive Iron in Water	> 7.4E-3 Bq/mL
ASTM D 5072-98	Radon in Drinking Water	> 0.4 Bq/mL
ASTM D 5174-02	Trace Uranium in Water by Pulsed-Laser Phosphorimetry	> 0.05 μg/mL
ASTM D 5673-05	Elements in Water by Inductively Coupled Plasma-Mass Spectrometry	(0.02～5.0) μg/L
ASTM E 203-01	Water Using Volumetric Karl Fischer Titration	0.1%～100%
ASTM E 217-85	Uranium by Controlled-Potential Coulometry	> 0.05 μg
ASTM E 321-005	Atom Percent Fission in Uranium and Plutonium Fuel(Neodymium-148 Method)	0%～50% of Pu
DP-MS-77-77:1978	Light Water Reactor fuel Reprocessing; Dissolution Studies of Voloxidized Fuel	> 1 Bq
DP-MS-78-7:1978	Radiochemical Determination of Carbon-14 in Radioactive Wastes	> 1 Bq
EPA 900.0:1999	Gross alpha and gross beta radioactivity in drinking water	> 3 pCi/L
EPA 901.1:1999	Gamma emitting radionuclides in drinking water	(10～20) pCi/L
EPA 903.1:1999	Radium-226 in drinking water: Radon emanation technique	> 5 pCi/L
EPA 905.0:1999	Radioactive strontium in drinking water	> 2 pCi/L
EPA 906.0:1999	Tritium in drinking water	> 1 pCi/L
EPA p.9(EMSL-CI): 1976	Radiochemical determination of Iodine in radioactive wastes	> 0.03 Bq
ET FEW01:2003	Determination of Iron-55 in water	> 0.5 Bq
ET NIW01:2003	Determination of Ni-63/59 in water	> 0.5 Bq
HASL-300 A-01-R: 1997	Gross alpha activity in radioactive wastes	> 5 pCi/L
HASL-300 Fe-01-RC: 1997	Iron in aqueous samples-Dual DPM mode liquid scintillation analysis	> 0.5 Bq
HASL-300 G-02:1997	Radiochemical determination of Cm-242 and Cm-244 in radioactive wastes	> 0.1 Bq
HASL-300 Pu-02-RC: 1997	Plutonium in radioactive wastes	> 0.1 Bq
HASL-300 Sr-03-RC: 1997	Strontium-90 in environmental matrices	> 2 pCi/L
HASL-300 Tc-01-RC: 1997	Technetium in water	> 0.01 Bq
HASL E-Cs-01-02: 1998	Radiochemical determination of Cesium-137	> 0.01 Bq

02007. 방사성물질

규격번호	규격명	시험범위 또는 검출한계
ISO 7097-1:2004	Determination of uranium in reactor fuel solutions and in uranium product solutions - Iron(II) sulfate reduction/potassium dichromate oxidation titrimetric method	> 15 mg
ISO 8299:2005	Determination of the isotopic and elemental uranium and plutonium concentrations of nuclear materials in nitric acid solutions by thermal-ionization mass spectrometry	U-235(0.1%～5%)
ISO 9696:1992	Measurement of gross alpha activity in non-saline water - Thick solution method	> 1 μg/g
ISO 9697:1992	Measurement of gross beta activity in non-saline water	> 5 pCi/L
ISO 9698:1989	Determination of tritium activity concentration - Liquid scintillation counting method	> 1 pCi/L
ISO 10703:1997	Determination of the activity concentration of radionuclides by high resolution gamma-ray spectrometry	> 0.01 Bq
ISO 12183:2005	Controlled-potential coulometric assay of plutonium	(5～10) mg/g
ISO 16796:2004	Determination of Gd_2O_3 content in gadolinium fuel blends and gadolinium fuel pellets by atomic emission spectrometry using an inductively coupled plasma source(ICP-AES)	(1～10) mg/g
ISO 21238:2007	The scaling factor method to determine the radioactivity of low and intermediate level radioactive waste packages generated at nuclear power plant	> 1 Bq
KS M 0011:2008	수용액의 pH 측정방법	(0～14) pH
KS I 9696:2007	수질-염분이 없는 물의 알파방사능 측정방법 (진한 용액법)	> 1 μg/g
KS I 9697:2007	수질-염분이 없는 물의 베타방사능 측정방법	> 5 pCi/L
KS I ISO 9698:2008	삼중수소 방사능 농도 측정법(액체섬광계측법)	> 0.01 Bq
KS I ISO 10703:2008	고분해능 감마선 분광법에 의한 방사선 핵종의 방사능 농도 측정방법	> 0.01 Bq
LANL ER-120:1992	Radiochemical determination of Am-241 in radioactive wastes	> 0.1 Bq
PNL ALO-472:1991	Radiochemical determination of Nb-93m and Nb-94 in radioactive wastes	> 0.5 Bq

환경방사능평가팀

02. 화학시험

02007. 방사성물질

규격번호	규격명	시험범위 또는 검출한계
Japan Science Technology Agency Manual Series Vol. 1:1979	Test method for gross beta	Gross alpha: > 0.1 Bq/L
EMSL-LV-0539-17:1999	Radiochemical analytical procedures for analysis of environmental samples	High: 5×10^{5} counts/min
ESSAP-AP 1:2001	Gross alpha and beta for various matrices	Gross alpha: > 0.1 Bq/L
HASL-300 U-04-RC:1997	Uranium in biological and environmental material	LLD $6.7x10^{-4}$ Bq/400 min for ^{238}U $6.7x10^{-4}$ Bq/400 min for ^{235}U $3.2x10^{-3}$ Bq/400 min for ^{234}U
HASL-300 Pu-02-RC:1997	Plutonium in soil samples	LLD 1 mBq/400 min
HASL-300 Pu-10-RC:1997	Plutonium in water	LLD 0.60 mBq/400 min
HASL-300 Pu-11-RC:1997	Plutonium purification - ion exchange technique	LLD 1 mBq/400 min
ARL/TR040:1981	An analytical method for radium-226 in environmental samples by the use of liquid scintillation counting	> 0.005 Bq
ASTM D 5072-98	Standard Test Method for Radon in Drinking Water	> 0.04 Bq/L
HASL-300 Sr-02-RC:1997	Strontium-90	LLD 0.007 Bq/400 min
HASL-300 Sr-03-RC:1997	Strontium-90 in environmental matrices	LLD 0.007 Bq/400 min
HASL-300 Sr-05-RC:2001	Strontium-90 in environmental water samples	LLD 0.007 Bq/400 min
HASL-300 Tc-01-RC:1997	Technetium-99 in water and vegetation	LLD 6.7 mBq/1000 sec
HASL-300 ^{3}H-02-RC:1997	Tritium in water - alkaline electroysis	LLD 8 mBq/100 min
HASL-300 ^{3}H-04-RC:1997	Tritium in Water - liquid scintillation counting	LLD 0.007 Bq/400 min

02007. 방사성물질

규격번호	규격명	시험범위 또는 검출한계
GAU/RC/2022:2005	Analysis of total tritium and total C-14 in solid samples	Tritium : 0.0984 Bq/g ~ 237,000 Bq/g C-14 : 0.0299 Bq/g ~ 1,500 Bq/g
GAU/RC/2023:2005	Determination of Fe-55 and Ni-63 in effluents, smears and other low-Fe samples	0.5 Bq/g ~ 2000 Bq/g
HASL-300 Ga-01-R:1997	Gamma radioassay in environmental samples	Count rates< 2000 counts/sec
IEC 61452:1995	Measurement of Gamma-Ray Emission Rates of Radionuclides-Calibration and Use of Germanium Spec.	0.002 Bq ~ 10^6 Bq
ANSI N42.12:1999	American National Standard for Calibration and Use of Germanium Spectrometers for Measurement of Gamma-Ray Emission Rates of Radionuclides	0.002 Bq ~ 10^6 Bq
IEC 61562:2001	Radiation Protection Instrumentation - Portable Equipment for Measuring Specific Activity of Beta-Emitting Radionuclides in Foodstuffs	Maximum low bound: 100 Bq/kg Minimum upper bound: 10^6 Bq/kg
ASTM C 1402-98:1998	Standard Guide for High-Resolution Gamma-Ray Spectrometry of Soil Samples	0.1 Bq ~ 10^4 Bq
ISO 10703:1997	Determination of the activity concentration of radionuclides by high resolution gamma-ray spectrometry	1 Bq ~ 10^4 Bq

재순환공정실증연구부

04. 열 및 온도측정

04001. 온도 및 습도

규격번호	규격명	시험범위 또는 검출한계
ASTM E 228-06	Standard Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer	> 10^{-6} m

경수로핵연료개발부

04. 열 및 온도 측정

04001. 온도 및 습도

규격번호	규격명	시험범위 또는 검출한계
ASTM E 1461-07	Standard Test Method for Thermal Diffusivity by the Flash Method	측정 최소 온도 : 150℃ 측정 최대 온도: 1200℃ 열확산도 검출한계 :0.001mm2/s 측정용 시편 최대 지름 :12.5mm 측정용 시편 최소 지름 : 6mm 측정용 시편 최대 두께 : 4mm 측정용 시편 최소 두께: 0.5mm

중성자과학연구부

02. 화학시험

02007. 방사성물질

규격번호	규격명	시험범위 또는 검출한계
IAEA-TECDOC-564:1990	Neutron activation analysis(Operation)	고체시료 함량 분석
IAEA-TECDOC-1218:2001	Neutron activation analysis(QA/QC)	Na~U (1 μg/kg ~ 95 %)

끝.

No. 047 (1/9)

CERTIFICATE OF ACCREDITATION

Name of Laboratory : Korea Atomic Energy Research Institute

Representative : Jung, Youn-Ho

Address of Headquarters : 1045, Daedeok-daero(150, Deokjin-dong), Yuseong-gu, Daejeon, Korea

Address of Laboratory : 1045, Daedeok-daero(150, Deokjin-dong), Yuseong-gu, Daejeon, Korea

Duration : June 28, 2011 ~ June 27, 2015

Scope of Accreditation
(Scope of Accreditation is described in the accompanying Annex)

This testing laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025 : 2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated 8 January 2009).

June 28, 2011

Huh. Kyung

Administrator,
Korea Laboratory Accreditation Scheme(KOLAS)

No. 047(2/9)

<Fuel Cycle System Engineering Technology Development Division>

01. Mechanical Test

01012. Mechanical component

Test Method	Standard Designation	Test range or detection limit
KOREA MEST Notice 2009-37 :2009	Regulation for the safe transport of radioactive material	
	A.26 Heat test	Temp. : 38 ℃ ± 2 ℃
	A.43 Impact test Percussion test Bending test Heat test	Height : 9 m Max. Weight : 1.4 kg Max. Weight : 1.4 kg Max. Temp. : 800 ℃ ± 50 ℃
	A.45 Water spray test Drop test Stacking test Penetration test	Spray : 50 mm/h Weight : 10 000 kg Max. Weight : 10 000 kg Max. Weight : 6 kg Max.
	A.47 Drop test Puncture test Water immersion test Thermal test	Height : 9 m Max. Height : 1 m Max. Pressure : 2 MPa Max. Temp. : 800 ℃ ± 200 ℃
IAEA Safety Standard Series No. TS-R-1:2005	Regulations for the Safe Transport of Radioactive Material	
	Para 705: Impact test Para 706: Percussion test Para 707: Bending test Para 708: Heat test	Height : 9 m Max. Weight : 1.4 kg Max. Weight : 1.4 kg Max. Temp. : 800 ℃ ± 50 ℃
	Para 721: Water spray test Para 722: Free drop test Para 723: Stacking test Para 724: Penetration test	Spray : 50 mm/h Weight : 10 000 kg Max. Weight : 10 000 kg Max. Weight : 6 kg Max.
	Para 727: Mechanical test Para 728: Thermal test Para 729: Water immersion test Para 730: Enhanced water immersion test	Height : 9 m Max. Temp : 800 ℃ ± 200 ℃ Pressure : 150 kPa Max. Pressure : 2 MPa Max.
	Para 664: Environmental test	Temp. : 38 ℃ ± 2 ℃
US 10 CFR Part 71:2005	PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIAL	
	71.71: Heat test Cold test Water spray test Drop test Compression test Penetration test	Temp. : 38 ℃ ± 2 ℃ Temp. : -40 ℃ ± 2 ℃ Spray : 50 mm/h Height : 9 m Max. Weight : 10 000 kg Max. Weight : 6 kg Max.
	71.73: Free drop test Puncture test Thermal test Immersion test	Height : 9 m Max. Height : 1 m Max. Temp. : 800 ℃ ± 50 ℃ Pressure : 2 MPa Max.
	71.75: Impact test Percussion test Bending test Heat test	Height : 9 m Max. Weight : 1.4 kg Max. Weight : 1.4 kg Max. Temp. : 800 ℃ ± 200 ℃

01012. Mechanical component

Test Method	Standard Designation	Test range or detection limit
KOREA MEST Notice 2009-37 :2009	Standard for production of radioisotopes, ets.	
	A.4.1.2 Thermal test External pressure test Bending test Heat test	Temp: -40 ℃ ~ 800 ℃ Pressure: 25 kPa ~ 170 MPa Weight: 20 kg Max. Weight: 1 kg Max.
ANSI N14.5: 1997	Radioactive Materials - Leakage Tests on Packages for Shipment	
	A.5.1 : Gas pressure drop test	-
	A.5.2 : Gas pressure rise test	-
	A.5.4, A.5.5 : Evacuated envelope gas test	-
	A.5.6 : Vacuum bubble test	Pressure: 15 kPa ~ 25 kPa Max.
	A.5.8 : Tracer gas test - Sniffer technique	-
ISO 12807:1996	Safe transport of radioactive materials - Leakage testing on packages	
	A.3.1 : Gas pressure drop test	-
	A.3.2 : Gas pressure rise test	-
	A.3.4, A.3.5 : Evacuated envelope test	-
	A.4.1.4.2 : Vacuum bubble test	Pressure: 15 kPa ~ 25 kPa Max.
	A.4.3 : Tracer gas test(sniffer technique)	-
ISO 9978:1992	Radiation protection - Sealed radioactive sources - Leak test methods	
	6.2.1 : Vacuum bubble test	-
	6.2.4 : Liquid nitrogen bubble test	-
ISO 2919:1999	Radiation protection - Sealed radioactive sources - General requirements and classification	
	7.2 : Temperature test	Temp: -40 °C ~ 800 °C
	7.3 : External pressure test	Pressyre: 25 kPa ~ 170 MPa
	7.4 : Impact test	Weight : 20 kg Max.
	7.6 : Puncture test	Weight : 1 kg Max.
ISO 3999:2004	Radiation protection - Apparatus for industrial gamma radiography - Specification for performance, design and tests	
	6.4.6, 6.6.1 : Shock-resistance test	-
	6.6.1, 6.7.2 : Crushing and bending tests	-
	6.5, 6.6.3, 6.7.4 : Tensile test	Load : 1 000 N

<Innovative Nuclear Fuel Division>

01. Mechanical Test

01018. Electric generation, Nuclear

Test Method	Standard Designation	Test range or detection limit
MDR-PT-07001	Fuel assembly bending test	lateral : 40 mm Max. axial : 40 kN Max.
MDR-XGN-08032	Fuel assembly vibration test	excitation force : 90 N Max. amplitude : 30 mm Max. frequency range : 60 Hz Max.
MDR-XGN-08033	Fuel assembly impact test	lateral : 40 mm Max. axial : 40 mm Max.

<Nuclear Chemistry Research Division>

02. Chemical Test

02007. Radioactive Material

Test Method	**Standard Designation**	**Test range or detection limit**
ARL/TR040:1981	Radium-226 in environmental samples by the use of liquid scintillation counting	> 1 pCi/L
ASTM C 697-04	Plutonium Isotopic Analysis by Mass Spectrometry	> 0.1 ng/g
ASTM C 761-04	Determination of Metallic Impurities by ICP-AES	(0.1～100) μg/g
ASTM C 1108-06	Plutonium by Controlled-Potential Coulometry	(5～10) mg/g
ASTM C 1205-02	Radiochemical Determination of Americium-241 in Soil by Alpha Spectrometry	> 0.005 Bq/g
ASTM C 1267-06	Uranium by Iron(II) Reduction in Phosphoric Acid Followed by Chromium(VI) Titration in the Presence of Vanadium	(20～50) mg/g
ASTM C 1284-05	Electrodeposition of the Actinides for Alpha Spectrometry	> 0.005 Bq/g
ASTM C 1287-03	Determination of Impurities in Nuclear Grade Uranium Compounds by Inductively Coupled Plasma Mass Spectrometry	> 100 μg/g
ASTM C 1387-03	Determination of Technetium-99 in Soil	> 1 Bq/g
ASTM C 1402-04	High-Resolution Gamma-Ray Spectrometry of Soil Samples	> 0.1 Bq/g
ASTM C 1413-05	Isotopic Analysis of Hydrolyzed Uranium Hexafluoride and Uranyl Nitrate Solutions by Thermal Ionization Mass Spectrometry	U-235 (0.1% ～5%)
ASTM C 1457-05	Determination of Total Hydrogen Content of Uranium Oxide Powders and Pellets by Carrier Gas Extraction	(0.05～200) μg/g

02007. Radioactive Material

Test Method	Standard Designation	Test range or detection limit
ASTM C 1474-06	Analysis of Isotopic Composition of Uranium in Nuclear-Grade Fuel Material by Quadrupole Inductively Coupled Plasma-Mass Spectrometry	> 0.1 μg/g
ASTM C 1507-06	Radiochemical Determination of Strontium-90 in Soil	> 0.004 Bq/g
ASTM D 1125-05	Electrical Conductivity and Resistivity of Water	(10~200000) μS/cm
ASTM D 1293-05	pH of Water	(0~14) pH
ASTM D 3082-03	Boron in Water	(0.1~1) μg/mL
ASTM D 3648-03	Measurement of Radioactivity	> 0.2 Bq/g
ASTM D 3649-06	High-Resolution Gamma-Ray Spectrometry of Water	(0.4~40) Bq
ASTM D 3865-02	Plutonium in Water	> 0.01 Bq/L
ASTM D 4922-01	Determination of Radioactive Iron in Water	> 7.4E-3 Bq/mL
ASTM D 5072-98	Radon in Drinking Water	> 0.4 Bq/mL
ASTM D 5174-02	Trace Uranium in Water by Pulsed-Laser Phosphorimetry	> 0.05 μg/mL
ASTM D 5673-05	Elements in Water by Inductively Coupled Plasma-Mass Spectrometry	(0.02~5.0) μg/L
ASTM E 203-01	Water Using Volumetric Karl Fischer Titration	0.1%~100%
ASTM E 217-85	Uranium by Controlled-Potential Coulometry	> 0.05 μg
ASTM E 321-005	Atom Percent Fission in Uranium and Plutonium Fuel(Neodymium-148 Method)	0%~50% of Pu
ET FEW01:2003	Determination of Iron-55 in water	> 0.5 Bq
ET NIW01:2003	Determination of Ni-63/59 in water	> 0.5 Bq
HASL-300 A-01-R: 1997	Gross alpha activity in radioactive wastes	> 5 pCi/L
HASL-300 Fe-01-RC: 1997	Iron in aqueous samples - Dual-DPM mode liquid scintillation analysis	> 0.5 Bq
DP-MS-77-77:1978	Light Water Reactor fuel Reprocessing; Dissolution Studies of Voloxidized Fuel	> 1 Bq
DP-MS-78-7:1978	Radiochemical Determination of Carbon-14 in Radioactive Wastes	> 1 Bq
EPA 900.0:1999	Gross alpha and gross beta radioactivity in drinking water	> 3 pCi/L
EPA 901.1:1999	Gamma emitting radionuclides in drinking water	(10~20) pCi/L
EPA 903.1:1999	Radium-226 in drinking water: Radon emanation technique	> 5 pCi/L
EPA 905.0:1999	Radioactive strontium in drinking water	> 2 pCi/L
EPA 906.0:1999	Tritium in drinking water	> 1 pCi/L

02007. Radioactive Material

Test Method	Standard Designation	Test range or detection limit
EPAp.9(EMSL-CI): 1976	Radiochemical determination of Iodine in radioactive wastes	> 0.03 Bq
HASL-300 G-02:1997	Radiochemical determination of Cm-242 and Cm-244 in radioactive wastes	> 0.1 Bq
HASL-300 ^{3}H-04-RC: 1997	Tritium in water - liquid scintillation counting	> 1 pCi/L
HASL-300 Pu-02-RC: 1997	Plutonium in radioactive wastes	> 0.1 Bq
HASL-300 Sr-03-RC: 1997	Strontium-90 in environmental matrices	> 2 pCi/L
HASL-300 Tc-01-RC: 1997	Technetium in water	> 0.01 Bq
HASL E-Cs-01-02: 1998	Radiochemical determination of Cesium-137	> 0.01 Bq
ISO 7097-1:2004	Determination of uranium in reactor fuel solutions and in uranium product solutions - Iron(II) sulfate reduction/potassium dichromate oxidation titrimetric method	> 15 mg
ISO 8299:2005	Determination of the isotopic and elemental uranium and plutonium concentrations of nuclear materials in nitric acid solutions by thermal-ionization mass spectrometry	U-235(0.1%~5%)
ISO 9696:1992	Measurement of gross alpha activity in non-saline water - Thick solution method	> 1 μg/g
ISO 9697:1992	Measurement of gross beta activity in non-saline water	> 5 pCi/L
ISO 9698:1989	Determination of tritium activity concentration - Liquid scintillation counting method	> 1 pCi/L
ISO 10703:1997	Determination of the activity concentration of radionuclides by high resolution gamma-ray spectrometry	> 0.01 Bq
ISO 12183:2005	Controlled-potential coulometric assay of plutonium	(5~10) mg/g
ISO 16796:2004	Determination of Gd_2O_3 content in gadolinium fuel blends and gadolinium fuel pellets by atomic emission spectrometry using an inductively coupled plasma source(ICP-AES)	(1~10) mg/g
ISO 21238:2007	The scaling factor method to determine the radioactivity of low and intermediate level radioactive waste packages generated at nuclear power plant	> 1 Bq
KS M 0011:2003	Method for determination of pH in aqueous solution	(0~14) pH

02007. Radioactive Material

Test Method	Standard Designation	Test range or detection limit
KS I 9696:2007	Measurement of gross alpha activity in non-saline water-thick solution method	> 1 μg/g
KS I 9697:2007	Measurement of gross beta activity in non-saline water	> 5 pCi/L
KS I ISO 9698:2008	Determination of tritium activity concentration-liquid scintillation counting method	> 0.01 Bq
KS I ISO 10703:2008	Determination of the activity concentration of radionuclides by high resolution gamma-ray spectrometry	> 0.01 Bq
LANL ER-120:1992	Radiochemical determination of Am-241 in radioactive wastes	> 0.1 Bq
PNL ALO-472:1991	Radiochemical determination of Nb-93m and Nb-94 in radioactive wastes	> 0.5 Bq

<Environmental Radioactivity Assessment Team>

02. Chemical Test

02007. Radioactive Material

Test Method	Standard Designation	Test range or detection limit
Japan Science Technology Agency Manual Series Vol. 1:1979	Test method for gross beta	Gross alpha: > 0.1 Bq/L
EMSL-LV-0539-17:1999	Radiochemical analytical procedures for analysis of environmental samples	High: 5×10^{5} counts/min
ESSAP-AP 1:2001	Gross alpha and beta for various matrices	Gross alpha: > 0.1 Bq/L
HASL-300 U-04-RC:1997	Uranium in biological and environmental material	LLD $6.7x10^{-4}$ Bq/400 min for ^{238}U $6.7x10^{-4}$ Bq/400 min for ^{235}U $3.2x10^{-3}$ Bq/400 min for ^{234}U
HASL-300 Pu-02-RC:1997	Plutonium in soil samples	LLD 1 mBq/400 min
HASL-300 Pu-10-RC:1997	Plutonium in water	LLD 0.60 mBq/400 min
HASL-300 Pu-11-RC:1997	Plutonium purification - ion exchange technique	LLD 1 mBq/400 min

02007. Radioactive Material

Test Method	Standard Designation	Test range or detection limit
ARL/TR040:1981	An analytical method for radium-226 in environmental samples by the use of liquid scintillation counting	> 0.005 Bq
ASTM D 5072-98	Standard Test Method for Radon in Drinking Water	> 0.04 Bq/L
HASL-300 Sr-02-RC:1997	Strontium-90	LLD 0.007 Bq/400 min
HASL-300 Sr-03-RC:1997	Strontium-90 in environmental matrices	LLD 0.007 Bq/400 min
HASL-300 Sr-05-RC:2001	Strontium-90 in environmental water samples	LLD 0.007 Bq/400 min
HASL-300 Tc-01-RC:1997	Technetium-99 in water and vegetation	LLD 6.7 mBq/1000 sec
HASL-300 ^{3}H-02-RC:1997	Tritium in water - alkaline electroysis	LLD 8 mBq/100 min
HASL-300 ^{3}H-04-RC:1997	Tritium in Water - liquid scintillation counting	LLD 0.007 Bq/400 min
GAU/RC/2022:2005	Analysis of total tritium and total C-14 in solid samples	Tritium : 0.0984 Bq/g ~ 237,000 Bq/g C-14 : 0.0299 Bq/g ~ 1,500 Bq/g
GAU/RC/2023:2005	Determination of Fe-55 and Ni-63 in effluents, smears and other low-Fe samples	0.5 Bq/g ~ 2000 Bq/g
HASL-300 Ga-01-R:1997	Gamma radioassay in environmental samples	Count rates< 2000 counts/sec
IEC 61452:1995	Measurement of Gamma-Ray Emission Rates of Radionuclides-Calibration and Use of Germanium Spec.	0.002 Bq ~ 10^{6} Bq
ANSI N42.12:1999	American National Standard for Calibration and Use of Germanium Spectrometers for Measurement of Gamma-Ray Emission Rates of Radionuclides	0.002 Bq ~ 10^{6} Bq
IEC 61562:2001	Radiation Protection Instrumentation - Portable Equipment for Measuring Specific Activity of Beta-Emitting Radionuclides in Foodstuffs	Maximum low bound: 100 Bq/kg Minimum upper bound: 10^{6} Bq/kg
ASTM C 1402-98:1998	Standard Guide for High-Resolution Gamma-Ray Spectrometry of Soil Samples	0.1 Bq ~ 10^{4} Bq
ISO 10703:1997	Determination of the activity concentration of radionuclides by high resolution gamma-ray spectrometry	1 Bq ~ 10^{4} Bq

<Recycling Process Demonstration Research Division>

04. Heat & Temperature Measurement

04001. Temperature & Humidity

Test Method	Standard Designation	Test range or detection limit
ASTM E 228-06	Standard Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer	> 10^{-6} m

<Innovative Nuclear Fuel Division>

04. Heat & Temperature Measurement

04001. Temperature & Humidity

Test Method	Standard Designation	Test range or detection limit
ASTM E 1461-07	Standard Test Method for Thermal Diffusivity by the Flash Method	Measurement temperature range Min. : 150℃, max. : 1200℃ Resolution : 0.001mm^2/s Sample dimension Max. diameter :12.5mm Min. diameter : 6mm Max. thickness : 4mm Min. thickness : 0.5mm

<Neutron Science Division>

02. Chemical Test

02007. Radioactive Material

Test Method	Standard Designation	Test range or detection limit
IAEA-TECDOC-564:1990	Neutron activation analysis(Operation)	Solid Sample Content Analysis
IAEA-TECDOC-1218:2001	Neutron activation analysis(QA/QC)	Na_{11}~U_{92} (1 μg/kg ~ 95 %)

End.