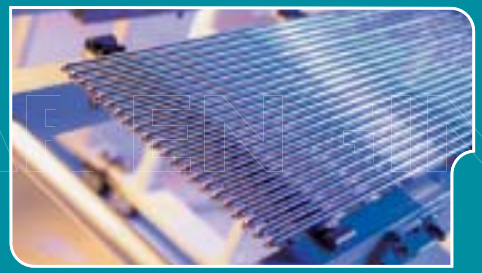
LIST OF REFERENCES



BELGONUCLEAIRE

NUCLEAR ENGINEERING

NUCLEAR ENGINEERING

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Core BR2 Photo: SCK•CEN

1.1. Consultancy

Country	Date	Project and description of Assignment	Client
Belgium	2003	Study of spent fuel performance during intermediate storage and final disposal.	ONDRAF/NIRAS
Belgium	2002-2003	Preliminary fuel pin and assembly design for the MYRRHA ADS.	SCK•CEN
Europe	2001-2003	Co-ordination of MICROMOX projects (irradiation of MOX fuels with various microstructures).	EC
France	2000	Simulation of severe earthquakes on a PWR core, inducing permanent deformations on the grid spacers. Development of fast animation softwares to show the motion.	EDF
France	1999	Fuel large grain size and input of fission gas release.	FRAMATOME
France	1997-1999	Statistical studies on MOX fuel fabrication (BA Assignment).	COGEMA
EC	1997	Low dispersible material study-evaluation of MOX fuel behaviour in case of aircrash (Partners: BNFL, Siemens, Transnucleaire).	EC
France	1997	Feasibility of the in-reactor site determination of Kr-85 activity on irradiated fuel rods strategies and of means for implementing them.	TRACTEBEL/FRAMATOME
EC	1996-1999	Participation in studies about Thorium as a waste management option.	EC
France	1996-1999	Studies of multiple recycling of plutonium and minor actinides in pressurized water reactors.	EDF
France	1995	Helium production and release in MOX fuel.	FRAMATOME
France	1993	Study of recycling plutonium with reprocessed uranium and very old plutonium with natural uranium.	COGEMA
France	1993-1995	Seismic analysis of a PWR core: Effect of assembly heterogeneities. Effect of double beam modelling of the fuel assemblies.	EDF
France	1992	As-fabricated fuel microstructure and impact on in-reactor performance.	EDF

Country	Date	Project and description of Assignment	Client
France	1992	Radio-protection problems induced at the fabrication plant by handling of mixed oxide fuels dopped with minor actinides.	EDF
France	1991-2003	Analysis of fuel performance from selected experiments in the Halden reactor programme.	FRAMATOME
France	1991-1993	Feasibility study of actinides recycling in FBR's and in Light Water Fuels.	EDF
France	1991	Neutronic study of a secondary steam main pipe breakdown of a PWR loaded with 50 % of MOX.	EDF
France	1991	Assessment of irradiation damage level in fuel pin claddings.	EDF
Belgium	1991	Assessing the use of burnable poisons in LWR fuels.	TRACTEBEL
France	1991	Assessing the use of annular pellets in LWR fuels.	EDF
Belgium	1991	Assessment of fuel manufacturing aspects of minor actinides transmutation.	EC
France	1991	Assessment of seismic behaviour of a row sub-assemblies in a LWR-Validation runs.	EDF
France	1991	Two-spectra core studies.	EDF
Korea	1989	Assessment of the PSAR for a new PWR (fuel and core aspects).	KNFC
Korea	1989	Review and checking of fuel assembly design.	KEPCO
France	1988	MONOMOX: Advanced concept for Pu recycling in PWR.	EDF
France	1987	Assessment of in-reactor MOX performance (safety aspects).	ABB/SENA/SIEMENS
France	1987	Evaluation of fast fluences in CNA reactor vessel.	SENA
Belgium	1987	Analysis of thermally induced vibration of fuel elements. Computer modelling and comparison to experiments.	SNR/EFR
Belgium	1987	Seismic analysis of full FBR cores. 3-D modelling of all hexagonal fuel elements Time-History period.	SNR/EFR

Country	Date	Project and description of Assignment	Client
Belgium	1985	Multi-criteria study for the definition of a European strategy regarding fissile material management in LWR's.	EC
Belgium	1979	Analysis of nuclear fuel supply industry in the European Community.	EC

1.2. Computer Codes

Programme	Date	Project and description of Assignment	Client
THGE	from 1980	Programme for the simulation of spectrum-compatible earthquakes.	More than 10 clients (Europe, USA,…)
CLASH	from 1980	Programme for the simulation of seismic behaviour of either FBR or PWR cores - Time-History method.	End-Users: SNR/EFR/MPE/EDF
	from 1980	Nuclear design technology package based on PANTHER and MICROLUX.	6 clients (Europe, Middle East, Africa,…)
COMETHE	from 1980	Computer programme for modelling in-reactor mechanical and thermal behaviour of fuel rods.	More than 54 clients (USA, Europe, Japan)

1.3. Fuel Assessment International Programmes

Programme	Date	Project and description of Assignment	Client
MALIBU	2002-2005	High-burnup source term of BWR, PWR, UO2 and MOX spent fuel.	10 participants from 6 countries
TOP-GUN	2000-2003	Extension of GERONIMO for BWR 9x9 MOX rods up to 80 GWd/tM.	8 participants from 4 countries
REBUS	1999-2004	Direct evaluation of burnup credit by critical measurements between fresh and irradiated bundles.	6 participants from 5 countries
VIPOX	1999-2001	Void effect for MOX fuel core confirmation simulation in the VENUS critical facility.	Under negotiation
GERONIMO	1997-2004	BWR-MOX rods and segments behaviour up to 70 GWd/tM (9x9 recent MIMAS design).	8 participants from 4 countries
NOK-308	1997-1999	Investigation of high burnup 58 GW/tM MOX PWR fuel segments with ramp testing.	6 participants from 5 countries
VIPEX-P	1996-1998	VENUS critical experiments on 17x17 MOX assembly mock-up.	6 participants from 4 countries
NOK-M109	1995-1999	Statistical study of fission gas release and PCMI on MOX PWR irradiated fuel rods.	5 participants from 5 countries
ARIANE	1994-2001	Radio-chemical source term evaluation of BWR, PWR, UO2 and MOX spent fuel.	15 participants from 7 countries
FIGARO	1994-1996	Study of fission gas release of irradiated MOX fuel using instrumented fuel segments ramped in Halden reactor.	9 participants from 4 countries
VIPO	1993-1994	VENUS critical experiments on void effects for highly-enriched MOX fuel.	10 participants from 7 countries
ZODIAC	1991-1994	Experimental assessment of basic properties of Zircalloy to validate fuel rod cladding creep and stress relaxation models.	8 participants from 7 countries
VIP-BWR	1989-1991	VENUS critical experiments on plutonium recycling in BWR's.	10 participants from 2 countries
VIP-PWR	1989-1991	VENUS critical facility experiments on plutonium recycling in PWR's.	4 participants from 3 countries
CALLISTO	1989-1990	Nuclear design & test in a pressurized water loop allowing irradiation of fuel rods in BR 2 reactor; irradiation of 27 fuel rods (UO2 & MOX) under PWR conditions, followed by extensive PIE and ramp tests.	Japan, United Kingdom, Belgium
HBC	1987-1991	High-Burnup Chemistry of UO2 fuel from PWR and BWR reactors.	23 participants from 9 countries

Programme	Date	Project and description of Assignment	Client
PRIMO	1987-1989	PWR MOX fuel behaviour up to high burnup in steady-state and ramp conditions.	16 participants from 5 countries
DOMO	1986-1993	BWR MOX fuel behaviour up to high burnup in steady-state and ramp conditions.	10 participants from 4 countries
GAP	1984-1988	Experimental determination of 10 % Gadolinium radial distribution versus burnup.	10 participants from 5 countries
GAIN	1983-1990	Thermomechanical behaviour up to high burnup of various designs of PWR Gadolinium fuel.	20 participants from 6 countries
TRIBULATION	1980-1989	Influence of power transients on subsequent behaviour of UO2 fuel of various PWR designs up to high burnup.	19 participants from 7 countries

1.4. Fuel Design: PWR Fuel

Country	Date	Project and description of Assignment	Client
Japan	1993	Design and fabrication of MOX pellets for R & D programmes (in collaboration with CEA-France).	NFI
Japan	1991	Feasibility study on PWR MOX fuel fabrication.	MHI/NFI
Japan	1991	Study on PWR MOX fuel manufacturing.	MHI
Belgium	1990	Fuel rod design analysis - Fuel assembly nuclear design (subcontract from Fragema for the licensing of MOX fuel in Belgian PWR).	EBES
France	1990	Optimization of the end-of-life cycle for the CNA reactor.	SENA
Switzerland	1987	Design of MOX fuel assemblies.	NOK
Belgium	1986	Analysis of an operating incident by computer code simulation.	EBES
France	1983	Criticality study for extension of the storage racks for fresh fuel assemblies.	SENA
France	1980	Monitoring of coolant primary water to detect cladding failure.	SENA
Belgium	1980	Design and fabrication (with Framatome) of dismountable Zircalloy clad UO2 demonstration assemblies.	EBES

Country	Date	Project and description of Assignment	Client
France	1977	Neutronic design of reactor core.	SENA
Belgium	1966	Neutronic design of BR3 PWR.	SCK•CEN
France	1966	Studies on recycling of Plutonium.	SENA
Belgium	1965- up to now	Demonstration programme on in-reactor performance of MOX fuel fabricated by BN (see also fuel fabrication for design activities associated with supply).	BN

1.5. Fuel Design: BWR Fuel

Country	Date	Project and description of Assignment	Client
Japan	1991	Studies on BWR MOX fuel fabrication.	TOSHIBA
Japan	1991	Demonstration test on MOX fuel bundle transport.	TOSHIBA
Sweden	1987	Design assistance with MOX fuel reload (see also fuel fabrication for design activities associated with supply).	ABB ATOM

1.6. Fuel Design: FBR Fuel

Country	Date	Project and description of Assignment	Client
Germany	1986	Design (with Interatom) of SNR Mk II core.	SBK
Germany	1976-1988	Design (with Interatom) and manufacture (with RBU-ALKEM) of various irradiation assemblies, as back up to SNR Mk II core R & D, design and manufacture programme (see also fuel fabrication for design activities associated with supply).	SBK

2. FUEL FABRICATION

MOX Fuel Photo: Belgonucleaire

Country	Date	Project and description of Assignment	Client
Switzerland	2000	Supply of MOX fuel for 15x15 fuel assemblies for use in the Gösgen reactor.	SIEMENS
Belgium	1999-2000	Supply of MOX fuel for PWR 17x17 900 MWe fuel assemblies for use in Doel 3 and Tihange 2.	COMMOX
Germany	1999-2000	Supply of MOX fuel for 16x16 fuel assemblies for use in Unterweser.	CMX/SIEMENS
Germany	1999-2000	Supply of MOX fuel for BWR 10x10 fuel assemblies for use in Gundremmingen.	COGEMA
Germany	1999	Supply of MOX fuel for17x17 fuel assemblies.	COGEMA
Switzerland	1998-1999	Supply of MOX fuel for PWR 14x14 fuel assemblies for use in Beznau.	COGEMA + COMMOX
Japan	1998-1999	Supply of MOX fuel for 8x8 fuel assemblies for use in Japan.	TOSHIBA
Belgium	1998-1999	Supply of MOX fuel for 17x17 900 MWe fuel assemblies for use in Doel and Tihange.	FRAGEMA
Switzerland	1998	Supply for 15x15 fuel assemblies for use in the Gösgen reactor.	SIEMENS
Germany	1998	Supply of MOX fuel for 16x16 fuel assemblies for use in Brokdorf.	COGEMA
Germany	1997-1998	Supply of MOX fuel for 16x16 fuel assemblies for use in Brokdorf.	COGEMA
Japan	1997	Supply of MOX fuel for BWR 8x8 fuel assemblies for use in Japan.	TOSHIBA
Germany	1997	Supply of MOX fuel for BWR 9x9 fuel assemblies for use in Gundremmingen.	SIEMENS
Switzerland	1996-1997	Supply of MOX fuel for 15x15 fuel assemblies for use in the Gösgen reactor neutronic design of reactor core.	SIEMENS
Belgium	1996-1997	Supply of MOX fuel for PWR 17x17 900 MWe fuel assemblies for use in Belgian reactors.	FRAGEMA

Country	Date	Project and description of Assignment	Client
Germany	1996	Supply of MOX fuel for 16x16 fuel assemblies for use in Brokdorf.	COGEMA
Germany	1995-1996	Supply of MOX fuel for 16x16 fuel assemblies for use in Phillipsburg.	COGEMA
Germany	1995	Supply of MOX fuel for BWR 9x9 fuel assemblies for use in Gundremmingen.	SIEMENS
Belgium	1995	Supply of MOX fuel for 17x17 900 MWe fuel assemblies for use in Belgian reactors.	FRAGEMA
Japan	1995	Qualification of the BN Dessel fabrication plant for the delivery of 8x8 BWR fuel test assemblies for use in Japan.	TOSHIBA
Germany	1995	Supply of MOX fuel for 16x16 fuel assemblies for use in Brokdorf.	COGEMA
Belgium	1994	Supply of MOX 17x17 fuel assemblies for use in Doel 3 and Tihange 2 900 MWe PWR's.	FRAGEMA
Japan	1994	Qualification programme of the BN-Dessel plant for BWR fuel for Japan.	TOSHIBA/HITACHI
Germany	1994	Supply of MOX fuel for 16x16 fuel assemblies for use in Brokdorf.	FRAGEMA
Germany	1993	Supply of MOX fuel for 16x16 fuel assemblies for use in Grafenrheinfeld.	SIEMENS
Germany	1993	Supply of MOX fuel for 16x16 fuel assemblies for use in Phillipsburg.	FRAGEMA
Germany	1992	Supply of MOX fuel for 16x16 fuel assemblies for use in Unterweser.	SIEMENS
Germany	1991	Subcontract from FGA- supply of MOX fuel assemblies (16x16) for Phillipsburg Unit 2, from 1992 through 1995.	KKP
Germany	1990	Subcontract from Siemens/KWU - supply of MOX fuel rods in 3 campaigns from 1991 through 1994.	GERMAN UTILITIES
France	1989	Subcontract from FGA-supply of MOX fuel rods for 17x17 fuel assemblies from 1989 through 1994.	EDF
Switzerland	1988-1992	Supply of MOX fuel for 14x14 fuel assemblies for use in BEZNAU 1.	NOK
France	1987-1994	Supply of MOX fuel for 17x17 fuel assemblies for use in EDF 900 MWe PWR'S.	FRAGEMA

Programme	Date	Project and description of Assignment	Client
Switzerland	1987	Licensing of the MOX rods manufactured by BN and the supplied fuel assemblies.	NOK
Switzerland	1987	Supply of MOX fuel assemblies for BEZNAU unit 1 from 1988 to 1992.	NOK
Japan	1987	Supply of MOX segmented fuel rods for irradiation in Dodewaard BWR (BWR MOX international Programme-DOMO).	TOSHIBA/HITACHI
France	1983	Design (with Interatom) and manufacture (with Alkem) of 4 complete SNR Mk II sub-assemblies loaded into the Phenix reactor.	SBK
Germany	1982	Supply of complete KNK II-2 prototype assembly.	KfK
France	1976	Supply of complete core for critical experiment (RACINE) for FBR studies in MASURCA.	CNEN
Germany	1974-1985	Design (with Interatom) and manufacture (with RBU-Alkem) of the SNR Mk la core.	SBK

3. FUEL FABRICATION FACILITIES

Doel Nuclear Power Plant Photo: Electrabel

Country	Date	Project and description of Assignment	Client
Japan	2004	Assessment of an RMG 12*4 for MOX pellet grinding.	NFI
United Kingdom	2001-...	Technology transfer and technical support to the operator of the SMP MOX fuel fabrication plant (capacity 100 tons/y) for the startup of the pellet and rod production.	BNFL
Japan	2001-...	Transfer of the MIMAS process (MOX fuel fabrication process) to the owner/operator of the J-MOX fabrication plant (capacity: 100 tons/y), in co-operation with Cogema.	JNFL
USA	2001	Feasibility study of the fabrication - in the Dessel plant - of the Lead Test MOX Assemblies for the US weapon-grade plutonium disposition programme.	COGEMA INC.
Russia	2001	Training of process engineers.	MINATOM
France	2001	Feasibility study of the defabrication of SUPERPHENIX FBR assemblies and recycling into fresh PWR MOX fuel, in the Dessel MOX fuel plant.	EDF
Belgium	2000-...	Intellectual property management (patent filing …) for the Dessel MOX fuel plant.	BN
Belgium	2000-...	Continuous improvement of powder, pellet and rod production and quality management systems of the Dessel MOX fuel fabrication plant (P0).	BN
USA	1999-...	Participation in the design and licensing of the "MFFF" MOX Fuel Fabrication Plant (capacity: 80 tons/y) for the disposition of weapon-grade plutonium, within the DCS team.	DUKE/COGEMA/S&W (US DOE)
Japan	1999	Transfer of operating experience with rotary pelletizing presses.	NFI
Switzerland	1997	Consultancy for TIG rod welding.	EIR
Belgium	1995-1999	Complete assignment of the Dessel MOX fuel fabrication plant (P0) refurbishment (buildings, ventilation, process equipment, handling systems, safety and radiation protection, quality management).	BN

Country	Date	Project and description of Assignment	Client
France	1993	Consultancy for the implementation of the MIMAS process (MOX fuel fabrication process) at the Cadarache MOX fuel fabrication plant.	COGEMA
France	1993	Training of MELOX process/quality engineers for the production of MIMAS MOX fuel.	MELOX
Belgium	1992-1994	Conceptual and basic design, licensing of the new P1 Dessel MOX fuel fabrication plant (capacity: 40-60 tons/y).	BN
France	1992	Participation in the safety report of the MELOX fuel fabrication plant.	COGEMA
France	1991	Supply of the pellet grinding and visual inspection systems for the MELOX fuel fabrication plant (in association with GAME).	COGEMA
France	1991	Supply of the powder granulation and pelletizing systems for the MELOX fuel fabrication plant (in association with SICN).	COGEMA
France	1991	Supply of the rod scanning systems for the MELOX fuel fabrication plant.	COGEMA
Japan	1991	Technology transfer for resistance rod welding.	PNC
France	1987-1992	Participation in the engineering and construction of the MELOX fuel fabrication plant (capacity 100 tons/y), within the team USSI/SGN (COGEMA subsidiary), for the implementation of the MIMAS process and other MOX fuel fabrication process.	COGEMA
France	1987-1992	Technology transfer and technical support to the owner and operator of the MELOX MOX fuel fabrication plant (capacity 100 tons/y) for the implementation of the MIMAS process and other MOX fuel fabrication process.	COGEMA
Belgium	1985-1995	Continuous improvement of powder, pellet and rod production and quality management systems of the Dessel MOX fuel fabrication plant.	BN
Belgium	1982-1985	Complete assignment of the Dessel MOX fuel fabrication plant (P0) upgrade for LWR fuel (capacity: 35 tons/y).	BN
Belgium	1978-1980	Complete assignment of the Dessel assembly workshop for LWR and FBR fuel.	BN
Belgium	1968	Complete assignment of the Dessel MOX fuel fabrication plant (P0) for LWR and FBR fuel (capacity: 15 tons/y).	BN

4. RADIOACTIVE WASTE ENGINEERING

Building 136 Photo: Belgoprocess

Country	Date	Project and description of Assignment	Client
France	2003	Comparison of spent fuel (dry and wet) storage systems on the basis of Belgian facilities (Doel and Tihange) (partners: Transnubel, Tractebel).	EDF
Belgium	2003-2004	Feasibility studies for volume reduction of conditioned solid alpha waste.	BN DESSEL
Belgium	2003-2004	Feasibility studies related to alternative scenario of engineering barrier system architecture for disposal of category B and C waste in Boom clay (partner: Tractebel).	ONDRAF/NIRAS
Italy	2002	Due diligence for the decommissioning of the fuel fabrication plant of Casaccia.	ENEA
Belgium	2002-2004	Detailed design and construction follow up of an installation for sorting and cementation of alpha waste (Belgoprocess Building B110).	ONDRAF/NIRAS
Belgium	2001-2002	Audit related to the economical and technical feasibility of a pyrolysis / calcinator to treat the burnable alpha-waste issued from Belgian producers.	ONDRAF/NIRAS
Belgium	2001	Consultancy for design specification related to a pyrolysis / calcinator installation.	ONDRAF/NIRAS
Belgium	2000-2001	Detailed design and construction follow-up of special equipment related to the handling of BR3 spent fuel assemblies.	ONDRAF/NIRAS
Belgium	1999-2001	Detailed design and construction follow-up of an interim-storage facility for conditioned alpha and radium packages.	ONDRAF/NIRAS
Belgium	1998-2002	Consulting related to the dry-storage of BR3 fuel assemblies.	ONDRAF/NIRAS
Belgium	1998-2001	Co-ordination of "safety reports" for new buildings devoted to radwaste treatment on the Belgoprocess site (Dessel / Mol).	ONDRAF/NIRAS/BP

Country	Date	Project and description of Assignment	Client
Phare countries	1998-1999	General overview of existing and future requirements for decommissioning nuclear facilities in the Slovak and Czech Republics, Hungary and Slovenia (BA assignment in association with SCK•CEN, BP and STUDSVIK).	EC DG I
Hungary	1998-1999	Quality assurance and quality control procedures for safe management and disposal of L/ILW (BA assignment in association with MAGNOX).	EC DG I
Belgium	1998-2002	Complete A/E assignment for an installation of alpha-waste sorting and cementation (Belgoprocess - Building 110).	ONDRAF/NIRAS
Belgium	1998-1999	Feasibility study for Belgian spent-fuel disposal (open cycle).	TRACTEBEL/SYNATOM
Romania	1997-1999	Technical basis and methodological approach for waste criteria (BA assignment in association with AEA technology).	EG DG I
Phare Countries	1997-1998	Regional methodologies for the storage in Phare countries of low- and medium level activities radwaste (BA assignment in association with AEA Technology).	EC DG I
Russia	1997-1998	Civil plutonium storage design concept for MAYAK, Russia (EFCC assignment).	EFCC/EC
Belgium	1997-…	Assistance to characterisation of radwaste conditioned by Belgoprocess.	BELGOPROCESS
Belgium	1997-1999	Assistance for the redaction of the SAFIR II Report (Safety Assessment and Feasibility Interim Report).	ONDRAF/NIRAS
Belgium	1996-2002	Concept, detailed study and construction follow-up for an on-site treatment and conditioning of high- and medium-waste stored in the radwaste disposal facilities of Belgoprocess Site 2 (HRA).	TRACTEBEL
Russia	1996-1997	Improvement of the Sergei Posad radwaste storage and conditioning (BA assignment in association with SGN and AEA Technology).	EC DG I
Ukraine	1996-1997	Elaboration of a regional storage for irradiated fuel of Ukrainian NPPs of the VVER type (EFCC assignment).	EC DG I
Belgium	1996-1998	Preliminary study for Belgian spent-fuel conditioning plant (open cycle).	TRACTEBEL/SYNATOM

Country	Date	Project and description of Assignment	Client
Belgium	1995	Verification of the design of spent-fuel racks for Tihange NPP (earthquake, criticality, cooling, accidental drops).	MPE
France	1994	Extraction of MOX rods from irradiated spent fuel element for selective reprocessing (underwater electro-erosion and handling).	SENA
Belgium	1994	Criticality study of the long-term geological depository of spent fuel.	ONDRAF/NIRAS
Belgium	1993	Extraction of sample plates of the irradiated vessel of the BR2 reactor by electro-erosion.	SCK•CEN
Belgium	1993	Development and supply of a Thermopress to treat nuclear synthetic waste.	TECNUBEL
Belgium	1993	Conceptual study for a disposal facility for low-level radioactive waste (Belgoprocess - Building B151).	ONDRAF/NIRAS
The Netherlands	1993	Consultancy for the design of the Dutch storage facility for conditioned radwaste (HABOG Project).	COVRA
Russia	1993	Technical assistance for the assessment of the bituminization installation.	TRACTEBEL
Belgium	1993	Technical assistance for the site erection of the incinerator unit of CILVA.	STUDSVIK/ENVIKRAFT
Belgium	1993	Specification of the secondary waste issued from the vitrification of HAWC by the PAMELA facility.	ONDRAF/NIRAS
Belgium	1993	Study of the radiation fields into the geological evacuation system (gallery inside clay) for HLW and spent fuel.	ONDRAF/NIRAS
Belgium	1992	Technical assistance for the detailed design of the supercompaction unit of CILVA.	ENI
Belgium	1991	Assessment of fuel manufacturing problems with the recycling of minor actinides in power reactors.	EC
Slovakia	1991	Safety assessment on a low-level radwaste disposal facility at Mochovce.	SEP
Taiwan	1991	Supply of an automated radwaste tracking system.	RWA

Country	Date	Project and description of Assignment	Client
Belgium	1991	Radwaste inventory computer system.	ONDRAF/NIRAS
Belgium	1990	Assessment of the high-level radwaste canister shielding.	ONDRAF/NIRAS
Belgium	1990-1995	Complete A/E assignment of a storage facility for conditioned intermediate- and high-level radwaste (Belgoprocess - Building 136).	ONDRAF/NIRAS
Belgium	1989-1994	Complete A/E assignment for a centralised LLW Treatment Facility including a super-compactor and an incinerator (Belgoprocess - Cilva).	ONDRAF/NIRAS
Belgium	1989	Basic design for a High-Level Liquid Waste Receiving Station (Belgoprocess Building 49).	ONDRAF/NIRAS
Belgium	1988-1997	Basic and detailed design of high-level liquid waste receiving station (BA assignment).	ONDRAF/NIRAS
Belgium	1988	Evaluation of problems associated with nuclear reactor radwaste in Belgium.	EC
Taiwan	1988	Radwaste monitoring computer system.	RWA
Taiwan	1988	Feasibility study on sea dumping of radwaste.	RWA
Belgium	1988	Evaluation of problems associated with nuclear reactor waste in Europe.	EC
Taiwan	1987-1988	Complete assignment of a supercompactor system for treatment of low-level solid waste from Taiwanese nuclear power plants.	TPC
Belgium	1986-1987	Complete assignment for a mobile decontamination unit (COMI Process).	TECNUBEL
Belgium	1985	Complete assignment; Tihange 3 nuclear power plant (1000 MWe PWR). Solid, liquid and gaseous radwaste processing plant.	INTERCOM
Japan	1985	Licence granted to Japan Gasoline Corporation to supply high-temperature incinerators in Japan.	JGC
Belgium	1983	Economic evaluation of underground disposal.	EC
Taiwan	1982	Study of backlifting the solid waste treatment system.	TPC

Country	Date	Project and description of Assignment	Client
Belgium	1981-1987	Complete assignment Tihange 2 nuclear power plant (900 MWe PWR). Solid, liquid and gaseous radwaste processing plant.	INTERCOM
Belgium	1981&1990	Shielding design and radioprotection studies related to treatment, storage and transport of radwaste.	ONDRAF/NIRAS/ BELGOPROCESS
Belgium	1980	Liquid effluent conditioning studies.	TRANSNUBEL/IRE
Sweden	1978	FORSMARK 1 & 2 BWR - Assignment for a radwaste bituminization plant.	AB BOFORS
Japan	1976-1983	Design, detailed study (BN with JGC) and supply of a radwaste bituminization plant for PNC reprocessing plant.	PNC
Belgium	1976 (1) 1978 (2) 1981 (3)	EUROBITUM (1) and EUROSTORAGE (2) radwaste volume reduction, solidification and storage Complete Assignment. EUROSTORAGE extension (3).	EUROCHEMIC
Belgium	1975	Complete assignment - Tihange 1 nuclear power plant (900 MWe PWR). Solid, liquid and gaseous radwaste processing plant (BN + GAAA).	Association of Belgian Utilities
Belgium	1974-1975	Doel 1 & 2 nuclear power plants (2 x 390 MWe PWR) - Complete assignment for liquid radwaste processing (in association with Degrémont-Sobelco).	Association of Belgian Utilities

5. SPENT FUEL AND HLW CASKS ENGINEERING

A3X Waste Photo: Belgonucleaire

Country	Date	Project and description of Assignment	Client
Russia	2004	Study on transport and storage of ex-weapon plutonium in Russian Federation (partners: Transnubel, Nuclear Cargo Service).	EC
Belgium	2003-2004	Concept design of a supercontainer for disposal of spent fuel and high-level waste.	ONDRAF/NIRAS
Belgium	1999	Thermal and mechanical verification of a CASTOR cask for the storage of BR3 spent fuel.	ONDRAF/NIRAS
Belgium	1997-2004	Feasibility study of a concrete cask for the storage of spent fuel issued from Doel NPP.	TRANSNUBEL
Switzerland	1997-2000	Thermal verifications of spent fuel casks for Swiss Utilities (KKW-Gösgen, EGL-Leibstadt, BKW-Bern).	BELGATOM
Belgium	1996-1997	Study and supply of equipment for transfer and cask loading of spent fuel issued from Tihange NPP.	TRANSNUBEL
Belgium	1993-2000	Study for spent fuel casks. Thermal and mechanical analysis of various storage and transport casks (TN 24D, TN 24XL, TN 81, TN 91, TN 12, TN 17T).	TRANSNUBEL
Belgium	1992	Cask of transport for High-Level Radwaste canisters (radiological protection study).	ONDRAF/NIRAS
Belgium	1992	Cask for transport to underground repository of a package with four irradiated fuel assemblies (radiological protection study).	ONDRAF/NIRAS

MOX Rod control Photo: Belgonucleaire

6.1. Research and Training Facilities

Country	Date	Project and description of Assignment	Client
Bulgaria	2003-2004	Technical assignment for the development of a technical project of a research reactor of 200kW (reconstruction of the IRT-2000 reactor).	INRNE
Morocco	1995-1996	Consulting assignment for the MAAMORA nuclear research centre.	CNESTEN
Belgium	1994	Feasibility study, detailed study and procurement of equipment to remove irradiated metal samples from the shroud of a reactor vessel.	SCK•CEN
EC	1993	TELEMAN: technical assessment of the research of development in TELEROBOTICS.	EC
Belgium	1989	CALLISTO: Design, construction and commissioning of a pressurized water loop facility for BR2 MTR (in association with SCK•CEN).	MHI-NFI BNFL
Portugal	1988	Consultancy during replacement of pool lining and primary circuit of a research reactor.	MAGUE
Belgium	1987	Re-evaluation of the safety of the nuclear facilities.	SCK•CEN
Portugal	1983	Detailed design and consultancy services during replacement of liner and primary circuit of a 1 MW research reactor.	LNETI
Tunisia	1983	Design and construction of a solar plant using flat-plate collectors and double-axis tracking parabolic troughs (for electricity generation).	EC/MESRS
Spain	1981	Development of SESAM, a simulation software for operator training and optimization of the solar DCS system.	SPPS (+ 9 countries)
Spain	1982	Participation in the SSPS (Small Solar System) in Tabernas (Almeria), construction follow-up of Central Receiver System (CRS, sodium colled) and of Distributed Collectors Systems (DCS, oil cooled). Plant management.	SPPS (+ 9 countries)
South Korea	1980	MTR feasibility study.	KNFDI

Country	Date	Project and description of Assignment	Client
Turkey	1980	Modification of a 1 MW research reactor (TR1) and installation of a 5 MW research reactor (TR2).	TAEC
France	1966	Complete A/E assignment, commissioning and placing in operation of a fast critical mock-up MASURCA, used for cores of up to 6000 liters.	Euratom-CEA Association
France	1965	Fast source reactor HARMONIE (2 kW). Same assignment.	Euratom-CEA Association
Italy	1964 & 1972	Conceptual design, detailed design and cost estimate (in association with SIEMENS) for a pulsed fast reactor SORA.	Euratom

6.2. Hot Cells and Labs

Country	Date	Project and description of Assignment	Client
France	1990	Zircaloy tube testing equipment under transient conditions.	EDF
Italy	1987	Performance laboratory (PERLA)-consultancy in association with CEA.	EC
Belgium	1987	Complete A/E assignment on high-activity hot cells, for the development of reprocessing head-end operations and fission gas release control techniques.	SCK•CEN
Belgium	1987	A/E assignment on laboratory for high-activity applications (fuel pin post-irradiation examinations).	SCK•CEN
Belgium	1975	Detailed design and consultancy on a laboratory for medium activity applications including Alpha-gamma hot cells.	SCK•CEN
Italy	1968	Conceptual and detailed design of a Plutonium research laboratory.	CNEN
Belgium	1967	Detailed design and A/E assignment on alpha-gamma hot cells for irradiated fuel reprocessing in a pilot plant.	SCK•CEN

6.3. Nuclear Plants

Country	Date	Project and description of Assignment	Client
France	1994	Feasibility study and safety assessment of MOX rod extraction from irradiated fuel assemblies.	SENA
Belgium	1994	Critically study of a close-packed water pool storage of spent fuel for the Tihange 3 power station.	TIHANGE
France	1993-1994	Mechanical and thermal calculations of an irradiated fuel container used for dry storage of irradiated fuel.	TRANSNUBEL
Belgium	1993	Critically study of a MOX fuel assembly shipping container.	TRANSNUBEL
France	1990	Complete assignment: reconditioning of control rod extension lugs by spark erosion in a storage pool.	SENA
France	1990	Feasibility study on evacuation and conditioning of passive core elements.	SENA
France	1988	Modernization of the instrumentation and control of the shipping facility.	SENA
France	1987	EFR - conceptual design phase (BN with Interatom, Novatome).	EFRUG
Korea	1987	Nuclear facility safety calculation for FNFC reconversion facility.	KAERI
Belgium	1987	Safety assessment of SCK•CEN's nuclear facilities.	SCK•CEN
Belgium	1987	Evaluation of inherent FBR core safety features.	EC
France	1987	Renewal of a flux measurement system in a PWR core.	SENA
Belgium	1986	Assessment of safety characteristics of Soviet RBMK reactors.	EC
France	1986	Underwater spark-erosion technique applied to fuel assembly opening and fuel rod extraction.	SENA
Germany	1985	SNR-2, the first of an anticipated commercial series of Sodium-cooled FBR - Preliminary studies.	ESK

Country	Date	Project and description of Assignment	Client
France	1983 & 1991	Extraction of source and MOX rods from irradiated fuel assemblies by spark-erosion techniques.	SENA
France	1983 & 1989	Shielding design and radioprotection studies related to auxiliary equipment.	SENA
Taiwan	1982	Review and checking methodology in PWR power plant engineering: source term, environmental impact, shielding and monitoring for licensing of PWR's.	TPC
France	1975 & 1988	Accident transient studies of reactor cores.	SENA
Germany	1972 - 1991	SNR Sodium-cooled FBR - complete assignment (BN, with Interatom and Neratoom).	SBK
Belgium	1966	VULCAIN Programme: Complete assignment on modification of BR3 power plant for operation with a spectral shift Vulcain core (BN with UKAEA).	SCK•CEN

6.4. Training

Country	Date	Project and description of Assignment	Client
France	1992-2002	Lecture at the university of Limoges on MOX fuel performance.	LIMOGES UNIVERSITY
Taiwan	1987	General introduction to radwaste management and spent nuclear fuel management (30 engineers).	RWA
Austria	1986	Training of candidate safeguard inspectors on MOX utilization (in collaboration with SCK•CEN).	IAEA
Taiwan	1985	Training programme on radwaste system design, review and checking.	TPC
Taiwan	1982	Training programme on the review and checking of the safety analysis report (Chapters 11, 12 and 15) in the field of : source term, environmental impact, shielding and monitoring.	TPC
South Korea	1979	Training in nuclear technology, reactor design and architect-engineering (45 engineers).	KNE

SUBSIDIARIES

MOX Pellets Photo: Belgonucleaire

BELGATOM	Together with Tractebel, Belgonucleaire is a founder of Belgatom (Nuclear engineering and consulting services)
COMMOX	Together with Cogema, Belgonucleaire is a founder of Commox (sales and marketing of LWR mixed oxide fuel and related services)
TRANSNUBEL	Together with Transnucleaire, Belgonucleaire is a founder of Transnubel (a turn-key service for nuclear transport)
TECNUBEL	Together with Fabricom, Belgonucleaire is a shareholder of Tecnubel (maintenance, decontamination and other services in a radioactive environment)

ABBREVIATIONS

A/E	Architect/Engineer
AEA	Atomic Energy Authority
ABB ATOM	Asea Brown Boveri
BA	Belgatom
BN	Belgonucleaire
BP	Belgoprocess
BNFL	British Nuclear Fuel Ltd
BWR	Boiling Water Reactor
CNA	Centrale Nucléaire des Ardennes
CNEN	Comitato Nazionale per l'Energie Nucleare (alto ENEA)
CNESTEN	Centre National de l'Energie, des Sciences et des Techniques Nucléaires (Maroc)
CMX	Commox
COGEMA	Compagnie Générale des matières nucléaires
EBES	Electricité du Bassin de l'Escaut
EC	European Community
EDF	Electricité de France
EFCC	European Fuel Cycle consortium
EFR	European Fast Reactor
EFRUG	European Fast Reactor Users Group
EIR	Eidg. Institut für Reaktorforschung
End-Users	SNR/EFR/MPE
ENI	Electro Naval Industrie
ENEA	Ente per le Nuove Tecnologie, l'Energie e l'Ambiente
ESK	Europäische Schnellbrüter Kernkraftwerke
Euratom-CEA	Commissariat à l'Energie Atomique
FBR	Fast Breeder Reactor
FGA	Fragema
FRA	Framatome
GAAA	Groupement Atomique Alsacienne Atlantique
HLW	High Level Waste
IAEA	International Atomic Energy Agency
INRNE	Institute for Nuclear Research & Nuclear Energy
IRE	Institut des radioéléments
JGC	Japan Gasoline Cy
JNFL	Japan Nuclear Fuel Limited

KAERI	Korea Advanced Energy Research Institute
KEPCO	Korean Electric Power Cy
KfK	Kernforschungszentrum Karlsruhe
KKP	Kernkraftwerke Phillipsburg
KNE	Korea Nuclear Engineering Services, Inc.
KNFC	Korea Nuclear Fuel Company
KNFDI	Korea Nuclear Fuel Development Institute
KNK	Kernkraftwerk Natrium Karlsruhe
KWU	Kraftwerk Union AG
LNETI	Laboratorio Nacional de Engenharia e Technologia Industrial
LWR	Light Water Reactor
LLW	Low Level Waste
MHI	Mitsubishi Heavy Industries
MPE	Mécanique de Précision pour Equipements
NFI	Nuclear Fuel Industries
NOK	Nordostschweizerische Kraftwerke
NPP	Nuclear Power Plant
ONDRAF/NIRAS	Belgian National Radwastes Authorities
PCMI	Pellet Cladding Metal Interaction
PNC	Power Reactor and Nuclear Fuel Development Corporation
PSAR	Preliminary Safety Analysis Report
PWR	Pressurized Water Reactor
RBMK	Reactor Bolshoi Moschnosti Kanalyni (= Channelized Large Power Reactor)
RWA	Radwaste Administration (Taiwan)
SCK•CEN	Studiecentrum voor Kernenergie • Centre d'Etude de l'Energie nucléaire
SBK	Schnell-Brüter Kernkraftwerke
SENA	Société d'Electricité Nucléaire des Ardennes
SEP	Slovenské Energetické Podniky
SNR	Schneller Natrium Reaktor
SMP	Sellafield MOX Plant
SPPS	Services de Programmation de la Politique Scientifique
TAEC	Turkish Atomic Energy Commission
TIG	Tungsten Inert Gaz
TPC	Taiwan Power Company
USSI	Société de construction d'usines de séparation isotopique

NOTES

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