



CATALOG

FRENCH TRITIUM OFFER 2023

Nuclear Valley has launched the Club 3H in spring 2023: the club associates the expertise of its members around Tritium, to propose a "French Waste" offer on the various markets in France and Europe.

To date, the first members of the 3H Club - steering committee are the following companies in the nuclear industry :

Curium

Management of critical environmental (chemical, radiological, biological) risks

DG Skid

Process engineering, pressure vessels, piping systems, automation, and process equipment

ECM Technologies

Key player in the market of equipment for the heat treatment and transformation of materials

EGIS

Consulting, engineering, construction supervision and operation of large infrastructure projects

Innow Consulting

Measurement and analysis for the nuclear material and waste characterization

Jacomex

Design and manufacture of glove boxes and gas purifiers

KEP Technologies

Solutions to meet radioactivity measurement challenges, whilst respecting all constraints of the nuclear field

Bouygues Construction Expertises Nucléaire (BCEN), **Ekium** (SNEF Group), **Gonzales Groupe**, **Veolia Nuclear Solutions** (VNS) have already joined the initiative and are strengthening a coherent offer of expertise in order to address the most ambitious projects.

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Preface - by the General Delegate of the Nuclear CSF, Mr. Hervé Maillart and the Director General of Nuclear Valley, Mr. Jean-François Debost.



Nuclear Valley is the competitiveness cluster for civil nuclear power and defence.

Among its missions, supporting the economic development of companies and their internationalization is a priority, and innovation is prioritized as an accelerator of their competitiveness. The genesis of the 3H Club lies in the international mission organized by Gifen, with the CSFN and Nuclear Valley in Romania at the end of November 2022, and in connection with the Cernavoda H3 reduction project: extracting tritium from heavy water and storing it in a safe form in a dedicated facility.



The purpose is to reduce emissions into the environment and to reuse heavy water indefinitely, without it becoming radioactive waste.

The skills needed for the design and construction of such a H3 treatment plant co-exist in France among our expert companies, and are materialised in this industrial alliance, making possible to meet the challenges and opportunities of Tritium.

All wish of success at the 3H Club!



Tritium is a radioactive isotope of hydrogen that disintegrates into the stable helium 3, with a 12.33 years half-life.

THE MAIN TRITIUM SOURCES

Tritium is produced naturally by cosmic ray actions and is also a by-product of the nuclear industry (military nuclear tests, thermonuclear arms manufacturing, NPP and nuclear fuel re-treatment release) . It exists in its gaseous form, but can also be found in oxidized form (tritiated water or water vapor) or organic form (bound to carbon). The action of cosmic rays (neutrons) on certain elements in the air (nitrogen 14) leads to a natural production of atmospheric tritium of between 0.15 to 0.20 kg per year. It is also produced in the earth's crust, but in very small quantities [1].

Most nuclear reactor technologies produce tritium. Some generate such small quantities that it is neither worth recovering nor dangerous to be released into the environment.

This is true for direct releases in gaseous or liquid form, or through fuel processing plants. On the other hand, tritium is produced in large quantities in pressurized heavy water reactors (PHWRs), the majority of which are of the CANDU type (for CANadian Deuterium natural Uranium) [3]. It is mainly in the form of tritiated water (HTO) and can be extracted for industrial use.

This process is applied in Tritium Removal Facility (TRF) in two stages: catalytic extraction in vapor phase, then cryogenic distillation for an approximate production of a few hundred grams per year and per facility [2] [3] [4].

It allows to store tritium and to manage it per radiological decrease or to consider a reuse in industrial applications.

The release of Tritium is expected to increase with the implementation of new reactors and the development of experimental nuclear fusion reactors.

ENVIRONMENTAL PROTECTION AND RISK MANAGEMENT

Compared to other radionuclides, tritium is released in the environment by nuclear sectors due to its mobility. The tritium limit of discharge in the environment is calculated by radiological impact studies that consider the receiving environment and its low radiotoxicity.

Measurement of tritium in its different forms is key in the process of risk assessment (radioprotection, exposure, modelization,...).

Detritiation facilities and storage are solutions to limit the release of tritium into the environment.

All tritium-related operations and activities must follow local and international directives and regulations.

THE MAIN USES

The thermonuclear fusion reaction between deuterium and tritium is the basis of the nuclear deterrence arsenal of some countries [5]. But this reaction will also be exploited in nuclear fusion reactors.

This is in particular the purpose of the research undertaken on an international scale with the ITER project.

Tritium needs are significant in this sector, with an estimated 25 kg for the ITER experimental device. For the next step, the DEMO reactor, which should bring fusion to the threshold of industrial operation, tritium requirements will be of the order of 300 g per day to produce 800 MW of electricity [6].

More peripheral applications use tritium's properties to make phosphorescent materials glow for light signaling, or use it as a radiochemical product or as a tracer for research or oil and gas exploitation.

TRITIUM

Challenges and opportunities

TRITIUM ACCOUNTING AND INVENTORIES, TRITIUM WASTE MANAGEMENT

The monitoring needs in the context of radioactive material and waste disposal are detailed in this document's introduction. But the challenges faced by tritiated material and waste characterization are numerous.

On the one hand, its storage and disposal are made difficult because of its tendency to outgas. Tritium from military installations is notably the source of tritiated waste that poses problems, more because of tritium's mobility than because of its radioactive toxicity [5].

On the other hand, the concentration of tritium is very variable within the same component. Destructive measurements by sampling are therefore not very representative.

Apart from liquid scintillation dedicated to low concentrations, conventional nuclear measurement techniques are not fully adapted to tritium measurement and only chemical analysis techniques meet this need [7]. However, they remain sampling-based techniques, with the above-mentioned problems of representativeness.

TRITIUM QUANTIFICATION FOR COMMERCIAL EXCHANGE

Since tritium is produced worldwide in very small quantities (as a reminder, a CANDU reactor produces a few hundred grams of tritium per year), and since its extraction process is complex and therefore expensive, a gram of tritium is traded at a high price, from about \$30,000 to about \$35,000 [8] [9]. Therefore, a facility produces the equivalent of a few million to a few tens of millions of US dollars a year.

The measurement accuracy of the tritium quantities exchanged between the producer and the user is therefore critical because it has a direct economic impact. The slightest measurement uncertainty would result in an under- or over-estimation that would strongly disadvantage one party or the other.

TRITIUM QUANTIFICATION FOR ITS TRANSPORTATION

Compared to storage, the transport of radioactive materials presents increased risks, particularly in terms of loss, theft or misappropriation. Thus, international regulations govern the transport of these materials and require the measurement of their quantity (or activity).

IAEA indicates for example that « *the material to be transported should be characterized to identify the radionuclides, the form and activities of the material in order to assign a transport security level. In some cases, a shipment might consist of a single radionuclide, either in a single package or multiple packages. In other cases, there might be multiple radionuclides within a single package or multiple packages containing multiple radionuclides within a single shipment. The identity and activity level of each of the radionuclides should be identified* » [10]

A shipment containing tritium must therefore be quantified in order to assign the appropriate level of transport security.

Tritium storage, today highly centralized on specific sites, combined with increasing commercial exchanges, will thus impose the need for accurate measurements on all shipping sites and all recipient sites

TRITIUM REMOVAL

Countries who are producing Tritium can take the opportunity of Tritium high value to extract it and store it for future use.

A removal Tritium facility include several high-technology areas: liquid phase isotopic separation, cryogenic distillation and high-vacuum operation.

WHY A NUCLEAR VALLEY H3 GROUP ?

France has a long relationship with nuclear from innovation to operation through project management, construction, maintenance, confinement, dismantling, waste/water treatment and storage, measurement, monitoring, We cumulate strong knowledge and know-how in nuclear field thanks to decades of nuclear deployment.

State owned research centres provide a high capacity for innovation including in tritium. France has also laboratory capabilities to handle tritium (characterization, experimentation) Whatever the project around Tritium, from characterization, storage to detritiation plant, it requires many specific competences that cannot be found in a single company.

Nuclear Valley, with 430+ members, covers all required skills and experiences to address projects.

H3 group has been created by dynamic Nuclear Valley members who have solutions for all tritium management needs.

Members of the group are working altogether in a team spirit to propose global solutions with high expertise for French and international industries.

Purpose of this catalog is to provides an overview of each member and their multicompetence for project including tritium management.

[1] Le tritium et l'environnement – Société Française de radioprotection

[2] Richard J. Pearson, Armando B. Antoniazzi, William J. Nuttall, Tritium supply and use: a key issue for the development of nuclear fusion energy, Fusion Engineering and Design, Volume 136, Part B, 2018, Pages 1140-1148, ISSN 0920-3796, <https://doi.org/10.1016/j.fusengdes.2018.04.090>.

[3] Livre blanc du tritium, Autorité de Sureté du Nucléaire, page 132, <https://www.asn.fr/sites/tritium/132/>

[4] Soon-Hwan Son, Sook-Kyung Lee, Kwang-Sin Kim, Tritium production, recovery and application in Korea, Applied Radiation and Isotopes, Volume 67, Issues 7–8, 2009, Pages 1336-1340

[5] <https://laradioactivite.com/le-phenomene/letritium>

[6] <https://www.iter.org/fr/mach/tritiumbreeding>

[7] F. Bachelet et al, Calorimétrie : une méthode non destructive pour la mesure du tritium et son inventaire, revue « CHOCS AVANCEES » du commissariat à l'énergie atomique et aux énergies alternatives, numéro 15 d'octobre 2021, page 40 <https://www-physique-chimie.cea.fr/science-en-ligne/chocs-avancees.html>

[8] Daniel Clery, Out of Gas, Science, Vol 376, Issue 6600, doi: 10.1126/science.add5489

[9] Pearson, THE TRITIUM WINDOW: AN OPPORTUNITY FOR ACCELERATED FUSION DEVELOPMENT, Tritium 2022, Book of Abstracts

MATRICE

Legend :

- Main know-how (sold alone)
- Complementary know-how (included in solutions)

BIG Large dimension unit capabilities

H3 PROCESS

	CURJUM	DG SKID	ECM	EGIS	INNOV Consulting	JACOMEX	KEP Technologies	BEEN - Business Construction Expertise Nucléaire	ELKUM	GONZALES Groupe	VMS - Veolia Nuclear Solutions
Electrolysis	○	○	○								○
Purification : Detritation Gas	○	○			○	○	●				●
Purification : Detritation Liquid	○	○			○		●				●
Purification : Cryogenic distillation (concentration)	○	○	○								
Purification : Distillation desorption	○	○	●			○					
Solid waste treatment	●		●		○			○			○
Effluents treatment (gas & liquid)	●	○	○		○	○					○
Storage	●	○					●				
Disposal	●	○				○	●				
Separation / Traping	●	○	○			○					○

SKILLS

ENGINEERING & MANUFACTURING

	CURJUM	DG SKID	ECM	EGIS	INNOV Consulting	JACOMEX	KEP Technologies	BEEN - Business Construction Expertise Nucléaire	ELKUM	GONZALES Groupe	VMS - Veolia Nuclear Solutions
Fluid Process Engineering : P&ID Design, Line calculations, Process Equipement definition	○	●	●							●	●
Design	○	●	●	●	○	●	●	○		●	●
Measure & instrumentation	●	●	●		●	○	●	○	●	○	●
Digital (Modelization, AI...)		○		●				○	●		○
Robotics		○	○				●	●		●	●
EPC		●	●	●		○	○	○		●	●
Site management and coordination		●		●				○	●	●	○
Overall project management		●	○	●		○	○	○	●	●	○
Safety	●		○	○	●		○	○	●	○	○
HVAC	○		○	●		●	○	●	●		○
Radion protection	●		○		●	○	●	○	○	○	○
Regulatory	●	○		●			○			○	○
Environment surveys	●			●							
Geological analysis		○		●							
Metal Work		●	●			●	○				●
Piping engineering		●	○						●		
Automation : Design, Programming, HMI Developpment, Communication, Architecture,		●	●				○		○	●	●
Mechanical Engineering		●	●	○		●	○		●	●	●
Modular Construction		●	●	○				●		●	○
Carpentry / Metal Structure		●	●	●			●			○	○
Electricity LV		●	●	○			●	●	●		
Electricity HV				●				●	●	●	
Machining			○								●
Welding			○			●					●
Civil Works				●				●	●		
Decontamination	●						○	○			●
Mechanicam Simulation		○	●	●			○	○	●	●	●
Thermal Simulation			●	○			●	○	●	○	●

	CURILUM	DG SKID	ECM	EGIS	INNOW Consulting	JACOMEX	KEP Technologies	BCEN - Bouygues Construction Expertises Nucléaires	ELKLUM	GONZALES Groupe	VNS - Veolia Nuclear Solutions
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EQUIPEMENTS

Capacities : Tanks, Vessels, Reactors	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>								<input checked="" type="radio"/>
Process Equipments : Pumps, Heat Exchangers, Filters, Columns, Compressor, Cyclone/Separator, Agitators/Mixing...	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>			<input type="radio"/>			<input checked="" type="radio"/>		<input checked="" type="radio"/>
Furnaces (Induction, Resistor)	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>								<input type="radio"/>
Glove Boxes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input checked="" type="radio"/>			<input checked="" type="radio"/>		<input type="radio"/>
Containment solutions (confinement)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input checked="" type="radio"/>		<input type="radio"/>			<input type="radio"/>
Valves		<input type="radio"/>	<input checked="" type="radio"/>			<input type="radio"/>			<input checked="" type="radio"/>		<input type="radio"/>
Instrumentations : Flowmeters, temperature transmitters, ...	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>		<input checked="" type="radio"/>	<input type="radio"/>			<input checked="" type="radio"/>		<input type="radio"/>
Gas Analyzers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input checked="" type="radio"/>	<input type="radio"/>					<input type="radio"/>
Handling solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>			<input type="radio"/>
Cloche de dégazage - Degassing Solutions	<input checked="" type="radio"/>	<input type="radio"/>			<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>

PACKAGES

Process Skids : Injection, Treatment, Compression, Filtration...	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>			<input type="radio"/>			<input checked="" type="radio"/>		<input checked="" type="radio"/>
Process Units	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>						<input checked="" type="radio"/>		<input checked="" type="radio"/>
Plant pilot	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>						<input checked="" type="radio"/>		<input checked="" type="radio"/>
Gas Panel	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>			<input checked="" type="radio"/>					<input checked="" type="radio"/>
Test Benches	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>						<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Prototypes	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>			<input checked="" type="radio"/>			<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

SERVICES (Operations)

Dismantlement	<input checked="" type="radio"/>			<input type="radio"/>				<input checked="" type="radio"/>			<input checked="" type="radio"/>
Installation :		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input checked="" type="radio"/>		<input checked="" type="radio"/>	<input checked="" type="radio"/>		<input type="radio"/>
Piping		<input checked="" type="radio"/>	<input type="radio"/>						<input checked="" type="radio"/>		<input type="radio"/>
Electrical		<input checked="" type="radio"/>	<input type="radio"/>					<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Automation		<input checked="" type="radio"/>	<input type="radio"/>			<input checked="" type="radio"/>			<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Assembly/Erection/Handling		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Commissionning		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input checked="" type="radio"/>	<input type="radio"/>
Regulatory compliance	<input checked="" type="radio"/>			<input checked="" type="radio"/>					<input checked="" type="radio"/>		<input type="radio"/>
Risk Management	<input type="radio"/>			<input checked="" type="radio"/>					<input type="radio"/>		<input checked="" type="radio"/>
Chemical/Radiological characterization	<input checked="" type="radio"/>	<input type="radio"/>							<input checked="" type="radio"/>		<input checked="" type="radio"/>
Essais laboratoire	<input checked="" type="radio"/>	<input type="radio"/>					<input checked="" type="radio"/>		<input checked="" type="radio"/>		<input checked="" type="radio"/>
Transportation (ADR / EURATOM)	<input type="radio"/>	<input type="radio"/>									<input type="radio"/>
Operation	<input type="radio"/>								<input type="radio"/>		<input checked="" type="radio"/>

CERTIFICATIONS

ISO 45001		<input checked="" type="radio"/>		<input checked="" type="radio"/>				<input checked="" type="radio"/>			<input checked="" type="radio"/>
ISO 9001		<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>		<input checked="" type="radio"/>	<input checked="" type="radio"/>			<input checked="" type="radio"/>	<input checked="" type="radio"/>
ISO 14001			<input checked="" type="radio"/>	<input checked="" type="radio"/>				<input checked="" type="radio"/>	<input checked="" type="radio"/>		<input checked="" type="radio"/>
MASE	<input checked="" type="radio"/>	<input checked="" type="radio"/>						<input checked="" type="radio"/>	<input checked="" type="radio"/>		
CEFRI	<input checked="" type="radio"/>					<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
ISO 19443				<input checked="" type="radio"/>					<input checked="" type="radio"/>		
ISO 50001 : Energy management										<input checked="" type="radio"/>	
ISO 37001 : Anti-Corruption				<input checked="" type="radio"/>					<input type="radio"/>		
Qualification EN 1090 Exc4											<input checked="" type="radio"/>



CURIUM

FOCUS 3H EXPERIENCES

- Characterization and measurement
- Radioprotection
- Water and gaz treatment
- Waste treatment
- Liquid Waste Assembly and packaging
- Experimentation
- R&D (PATCH 3 project in partnership with CEA)

CERTIFICATIONS



CONTACT



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WHO WE ARE

Since 1994, CURIUM has been dedicated to the management of critical environmental (chemical, radiological, biological) risks. Our team of experienced chemical and radiological engineers conducts technical studies and performs in-situ operations for all sectors working with hazardous substances.

KEY INFORMATION

CURIUM experts are involved in the management of chemical and radioactive risks, as well as combined risks associated with hazardous products: toxic, flammable, corrosive, carcinogenic, mutagenic and toxic to reproduction (CMR), explosive, infectious, radioactive, water-reactive, self-reactive.

CURIUM's areas of expertise :

- Hazardous waste management
- Chemical and radiological characterization, measurement, decontamination
- Works on site
- Experimentation, R&D and engineering
- Environmental studies and projects

CUSTOMER REFERENCES



OUR ADDED VALUE

- Multi risk expertise
- Safety certifications
- Our own laboratory
- Reactivity and innovation
- Circular economy culture
- Turnkey approach/solutions
- International perspective
- Knowledge of regulatory frameworks



DG SKID

DG SKID SUPPORT

DG SKID is a process systems and equipment integrator, supporting its clients at every stage of their project: from engineering phase till commissioning, including construction in our workshops, on-site installation, testing and qualification phases.

CERTIFICATIONS



CONTACT



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WHO WE ARE

DG SKID is a reliable partner for the Nuclear industry, offering specialized expertise in process engineering, pressure vessels, piping systems, automation, and process equipment. We supply fluids process packages or treatment units specifically tailored to the nuclear industry needs.

Thanks to our engineering & workshop capabilities, we successfully execute turnkey projects end to end while ensuring strict conformity to all regulatory or contractual constraints.

KEY INFORMATION

- Project Management (EPC, EPCM, PMCS)
- Process equipment
- Automation and Control including safety systems
- Electricity
- Temperature, Flow & Pressure Control
- Instrumentation
- Mechanical & Steel Structure
- Piping, Vessels, Reactors
- Management of CEFRI certified contractors
- Process Engineering including Equipment technology selection and related sizing
- Focused on fluid process applications featuring hazard
- Demonstrator unit Design & Build
- Prototype design and construction

CUSTOMER REFERENCES



OUR ADDED VALUE

- Pressure Vessels & equipment
- Cryogenic application
- Gas, Liquids and Powders expertise
- EX Proof area (ATEX, IECEx, NEC)
- Complex rheology
- Wide range of fluids application



ECM TECHNOLOGIES

NUCLEAR APPLICATIONS

Fuel Cycle

- Zirconium Tube Annealing
- MOX & UO₂ Pellets Sintering
- Calcination and Reducing Powder

Waste Treatment

- Calcination
- Vitrification Furnace
- MOX & UO₂ Pellets Sintering Furnace
- Metallic Waste Melting
- Tritium Degassing

Other Heat Treatment & Robotics Solution

CERTIFICATIONS

ISO 9001

Quality Management System

ISO 14001

Environmental Management System

Pressure Vessel Design according to ASME U,
European Pressure Equipment Directive DESP

CONTACT



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WHO WE ARE

ECM Technologies is a key player in the market of equipment for the heat treatment and transformation of materials.

We are world leader in low-pressure carburizing: heat treatment of mechanical parts, we provide turnkey solutions for various industries and we have a dedicated Business Unit answering to the specific needs and norms of the nuclear industry with leading edge skills and know how.

KEY INFORMATION

Our Mission: To design and manufacture low-carbon, high-tech solutions to improve the performance of industry and support its ecological transition.

- Family-own company / French Capital
- Based in Grenoble, France
- Over 600 Employees
- Dedicated Business Unit to Nuclear and Special Projects
- Dedicated Business Unit to Robotics solutions
- ECM operation abroad: ECM USA, ECM China, ECM Furnace India, ECM Kazakhstan, ECM GmbH (Germany), ECM Singapore

CUSTOMER REFERENCES



OUR ADDED VALUE

- Expertise in Heating Technologies up to 3000°C under Vacuum and Gas Atmosphere
- As a true skills-hub, ECM Technologies offers tailor made concepts and intervenes in the fuel cycle and in the waste management & recycling in confined environments: gloveboxes or remote controlled hot cells.
- Solutions for Tritium desorption from metallic waste
- Project management in highly restrictive and normative environment



EGIS

OUR CAPABILITIES

- Project and Program management
- Digital strategy, integration, PLM, BIM
- EPCM
- Site characterization, geotechnics, siting, seismology
- Environmental Impact Assessment
- Nuclear infrastructure design
- Site logistics, preparation, site management
- Nuclear safety support
- Water and maritime interface
- Waste management strategies and studies of tritium contaminated wastes (Gas, liquid and solid).

CERTIFICATIONS

ISO 45001

Occupational Health and Safety

ISO 9001

Quality Management System

ISO 19443

Quality Management Systems in Nuclear

ISO 37001

Anti-Bribery Management Systems

ISO 14001

Environmental Management Systems

CONTACT



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WHO WE ARE

Egis is a global company specialised in consulting, engineering, construction supervision and operation of large infrastructure projects.

Egis offers Owners Engineer, Architect Engineer as well as niche expertise for all nuclear facilities including power plants, SMR's, Research & Fusion Reactors, Fuel Fabrication facilities, Waste and Storage Facilities. We also provide radioactive waste management consultancy services through our subsidiary Galson Sciences Ltd.

Egis supports its customer along the lifecycle of nuclear infrastructures, from feasibility and design, construction management to operation, dismantling and up to soil remediation with our crosscutting and multidiscipline expertise.

KEY INFORMATION

Egis is a global company with 17,000 employees in over 120 countries with a turnover of €1.5 billion. We have supported 20 countries with their nuclear programmes over the course of our 70 years in the nuclear industry.

CUSTOMER REFERENCES



framatome



orano



EXPERTISES NUCLÉAIRES

OUR ADDED VALUE

- Provides upstream siting and EIA studies
- Acts as the project integrator to design the adequate building and utilities to host the process
- Takes over the position of Architect Engineer including all phases of the design and construction supervision.
- Proposes integrated tritium waste management strategy.



INNOW CONSULTING

NUCLEAR APPLICATIONS

- Tritiated Gaz Characterization
- Tritium Process
- Tritiated Water Analysis
- Nuclear Waste Characterization
- Tritium Measurement and Analysis Safety

WHO WE ARE

For 25 year we develop skills in measurement and analysis for the nuclear material and waste characterization. Former engineers at CEA, we have a feedback in design and safety for nuclear facilities and reactors. We manage for nuclear field professionals, projects about material characterization, dismantlement, nuclear material characterization, waste characterization, treatment and storage.

KEY INFORMATION

Thanks to our skills and feedback in tritium field, we propose solution for tritiated process and waste management.

We are leading projects from solution conception right through installation, training and maintenance.

CUSTOMER REFERENCES



CONTACT



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OUR ADDED VALUE

- Engineering & design
- Modelization
- Measurement & Analysis
- Instrumentation
- Safety analysis
- Software development



JACOMEX

JACOMEX

NUCLEAR APPLICATIONS

- Gloveboxes and Containment enclosures for:
- R&D for the manufacture of fuel assemblies
 - Gas purification (H₂O, O₂, tritium gas)
 - Online sampling of radioactive gases and liquids materials.
 - Gen IV & V nuclear reactors R&D,
 - Management and reprocessing of radioactive waste
 - Radiochemistry and Radioprotection
 - Nuclear medicine and production of radioisotopes

CERTIFICATIONS

ISO 9001
Quality Management System

ISO 3834
Quality requirements for fusion welding of metallic materials

ISO 10648
Classification of containments/gloveboxes according to tightness

CONTACT



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www.jacomex.com

WHO WE ARE

Jacomex is a French company located in Lyon area. We employ around 65 employees and for turnover of 8M€. Jacomex is an innovative company specializing in the design and manufacture of glove boxes and gas purifiers. For 75 years, Jacomex has been the ideal partner for customized gloveboxes and controlled atmosphere in various nuclear applications.

KEY INFORMATION

Jacomex's mission is to protect users and their products in the world of containment by accelerating technological innovation. Jacomex means perfection in the mastery of leak tightness and real expertise in gas treatment and analysis, containment, and safety. The nuclear sector is at the heart of Jacomex's expertise, and our teams are fully aware of the challenges of the field. Providing fit for purpose solution to the nuclear and innovation markets.

CUSTOMER REFERENCES



OUR ADDED VALUE

The experience acquired over the years enables Jacomex to offer turnkey solutions to its customers. With high-quality containment enclosures, gas purifiers, reliable and proven safety equipment, for R&D scalable to production projects.



KEP TECHNOLOGIES

CORE COMPETENCES

- Characterization of conditioned nuclear waste
- Characterization stations for low to high-level waste
- Nuclear waste management
- Tritium measurement
- Multiple hot cell measurements
- Automated storage and disposal
- Manual storage cell system

CERTIFICATIONS

ISO 9001

Quality Management System

CEFRI

Ability to carry out works under ionizing radiation

WHO WE ARE

KEP Technologies, through its Setsafe brand, partner with you to provide standard or customized solutions to meet your radioactivity measurement challenges, whilst respecting all constraints of the nuclear field. Our skilled team of engineers and academic doctors lead projects from solution conception right through to installation, training, and maintenance, or however you require.

KEP group's expertise also allows us to intervene on diverse and broader operations, along the life cycle of the nuclear fuel: extraction, enrichment, fuel manufacturing, use, sorting, recycling and storage.

KEY INFORMATION

KEP Group is a French group with a turnover of 75m€ and 620 employees

KEP Measurement Business Unit is 20m€ with 100 employees (Nuclear Activity 25%).

For 25 years, we have been supporting nuclear professionals in projects such as characterization of nuclear materials, decommissioning, waste management and storage.

CUSTOMER REFERENCES



CONTACT



Thierry GERVAIS

Commercial Director EMEA

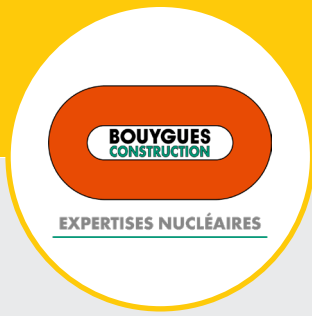
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www.setsafesolut.com

OUR ADDED VALUE

- Engineering, studies & design
- Project Management
- Measurement & instrumentation
- Robotic, automation & industrial IT
- Software development
- Production of mechanical parts
- Mounting & Assembly



BOUYGUES CONSTRUCTION EXPERTISES NUCLÉAIRES

OUR KNOW-HOW

- Tritium Gas Purification
- Tritium Liquid Purification
- Robotics
- HVAC (Heating, Ventilation, and Air Conditioning)
- Modular Construction
- Low Voltage (LV) Electrical Expertise
- High Voltage (HV) Electrical Expertise
- Civil Works
- Nuclear Waste Management
- Dismantling
- Installation/Erection
- Electrical Services
- Assembly/Erection/Handling

CERTIFICATIONS

ISO 9001
Quality Management System

ISO 45001
Occupational Health and Safety

ISO 10648
Environmental Management Systems



WHO WE ARE

Bouygues Construction Expertises Nucléaires, and its affiliate Kraftanlagen Heidelberg offers an integrated, innovative and high value-added service all over the world, based on a range of solutions covering all technical fields and the entire life cycle of nuclear infrastructures.

KEY INFORMATION

To summarize our many years of experience in the handling and processing of tritium, the following projects should be mentioned:

- Conceptual Design Tritium Confinement Systems for an European NPP
- Detailed Design for the ITER WDS (Water Detritiation System)
- Conceptual & Detail Design for the ITER Tokamak Complex – ADS (Atmosphere Detritiation System)
- Detailed Design for ADS at the ITER Hot-Cell Facility
- Pre-Conceptual Design Studies for the DEMO Fuel Cycle Architecture

CUSTOMER REFERENCES



CONTACT



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OUR ADDED VALUE

Specifically for Tritium, our offer covers the whole EPC package value from basic design to project execution :installation and commissioning



EKIUM

NUCLEAR APPLICATIONS

Scope of work :

- Feasibility studies,
- Pre-FEED, FEED,
- EPCm, EPC,
- Site Surveys, Construction Supervision,
- Testing,
- PMO,
- Technical Assistance

Fields covered :

- Mechanical,
- Calculation,
- Electricity, I&C,
- Civil Work,
- General Installation & Process
- Nuclear safety

CERTIFICATIONS

ISO 9001

Quality Management System

ISO 45001

Occupational Health and Safety

CEFRI-E

ECOVDIS

ISO19443 (ongoing)

CONTACT



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WHO WE ARE

Ekium is the engineering subsidiary of the French group SNEF – turnover of €1.7billion and 13,000 employees –. Ekium is the French leader engineering for industrial facilities, buildings, utilities and automation for process industries. Thanks to a proximity network in France and abroad offices, our Engineers and Technicians manage industrial's structuring projects from feasibility to maintenance. Since 1990, Ekium has been accompanying its clients with a common goal: to place industry at the heart of the new challenges faced by our society. Ekium is involved at all levels of the nuclear life cycle alongside the mains key players all around the world in this industry: upstream and downstream phases of the fuel cycle, reactors, dismantling, storage, but also research and testing programs and laboratory projects.

KEY INFORMATION

- +30 years old company
- Based in Lyon, France
- +2500 employees, +285M€ turnover
- Presence in 12 countries

CUSTOMER REFERENCES



OUR ADDED VALUE

- Expertise on operating as well as new generation nuclear power plant
- Support wide range of NPP technologies EPR & EPR2, AP1000, APR1400, CANDU, PHWR, VVER, ...
- Multi-skilled design office
- Capability to operate on all project lifecycle: from feasibility studies to site survey & testing



GROUPE GONZALES

OUR CAPABILITIES

- Project Management
- Supply chain
- Project quality
- Design and Conception
- Machining
- Mechanical welding (Steel, Stainless steel, Aluminium)
- Power cabinets manufacturing
- Electrical wiring
- Automation
- Robotics
- Assembly Integration
- Commissioning and Training

CERTIFICATIONS

ISO 9001

Quality Management System

Qualification 15085 CL1 (Welding)

Qualification EN 1090 EXC4 (Welding)

Qualifications

RCC-MRx / RCCM / ASME / EN

WHO WE ARE

Founded in 1971, Gonzales Group is an international company

400 employees

60 M€ turnover

8 operational subsidiaries around the world

France – Romania – Vietnam – USA

KEY INFORMATION

Conception and production of mechanical equipments

- Special machines
- Prototypes
- Tooling
- Production line assemblies

Integration of automated mechanical assemblies

CUSTOMER REFERENCES



CONTACT



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www.gonzales.fr

OUR ADDED VALUE

Quality, reliability and timeliness are the three key concepts for each of our actions in order to satisfy our customers.



VEOLIA NUCLEAR SOLUTIONS

NUCLEAR COMPETENCIES

- Decommissioning/Decontamination
- Engineering/Technical Services
- Maintenance
- Engineering & Design Services
- Nuclear Measurement and Characterisation
- Nuclear Consultancy Services
- Operation and Site Management
- Plant & Equipment (Electrical/Mechanical/Chemical/I&C/Etc.)
- Project Management
- Research and Development
- Waste Management/Disposal/Recycling

CERTIFICATIONS



CONTACT



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 www.nuclearsolutions.veolia.com

WHO WE ARE

VNS is a leading provider of advanced technologies and services for facility management, decommissioning, and radioactive waste treatment. We contribute to global environmental clean-up efforts by offering tailored solutions to address complex nuclear challenges worldwide.

KEY INFORMATION

Solutions-Provider

VNS specializes in innovative technologies such as Dexter™, presenting a complete integrated solution for complex nuclear projects. Our technology covers:

- Remote Handling/Robotics/Virtual Reality
- Waste Treatment (Solid and Effluent)
- Nuclear Measurement & Characterisation

Merchant Plant

VNS provides services and technologies, such as Geomelt®, offering complete waste management solutions throughout the nuclear waste lifecycle :

- Sort and Segregation, Waste Treatment
- Radioactive Material Processing
- Decontamination and Asset Recovery
- Disposal Site Management

On-Site Services

VNS provides on-site services which includes :

- Facility Services & Legacy Waste Management
- Decommissioning and Dismantling
- Nuclear Facilities Remediation
- Laboratory Operations
- Operations and Maintenance

CUSTOMER REFERENCES

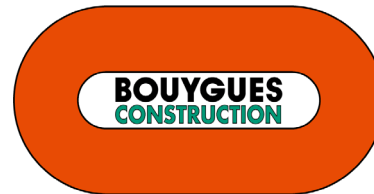


MEMBERS OF THE TRITIUM CLUB



EKIUM

A COMPANY OF GROUPE SNEF



EXPERTISES NUCLÉAIRES





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