

SPENT FUEL

Independent Spent Fuel Storage Installation (ISFSI)
Handling heavy loads

MANAGEMENT

Idom Nuclear Services

 **Idom**
Nuclear Services





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Content developed by: Rubén Osorio Ibáñez & Ane
Puente Villares.

Editorial design: Belén Hermosa & Muak Studio.
www.muak.cc

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IDOM, Ingeniería y Consultoría, S.A.U.
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CONTENT



IDOM

IDOM is an independent international company that delivers professional integrated services in engineering, architecture and consultancy. Excellency, innovation and commitment are the main basis on which IDOM has built a solid group with offices distributed worldwide giving support to projects in more than 120 countries, accounting for 80 percent of the global turnover of the firm.

The market and new requirements of our clients mean that IDOM is on a path of continuous growth in the scope of the services being offered as well as in the training of personnel.

At present, more than 2,700 people carry out their professional activities in the Company's offices and projects all around the world.

THE GOAL

Providing the best possible service to each and every client

1957

IDOM was founded in 1957, as a result of the effort and unifying work of the engineer Rafael Escolá (Barcelona 1919 - Bilbao 1995).

1995

IDOM obtains accreditation of its quality management system to ISO-9001, awarded by Lloyd's Register Quality Assurance (LRQA).

2000

IDOM obtains accreditation of its Environmental Management System to ISO 14001.

2011

IDOM successfully gains accreditation to OHSAS 18001 of its Health and Safety Management System.

100%
employee owned

The company is employee owned, with 100% of the capital of IDOM distributed between staff currently working in the firm.

2700 employees

12000 clients

30000 projects

In recent years, IDOM has expanded the range of its services, both technically and geographically.

INDUSTRY
& ENERGY

ARCHITECTURE
& BUILDING

CONSULTING
& SYSTEMS

NUCLEAR SERVICES

ADVANCED ANALYSIS

TURNKEY
SERVICES

TELECOMMUNICATIONS

INFRASTRUCTURES

ENVIRONMENT



ALGERIA - ANGOLA - BELGIUM - BRAZIL - CANADA - COLOMBIA - CHILE - ECUADOR - FRANCE - GERMANY - INDIA - LAOS - LYBIA
MEXICO - MOROCCO - PERU - POLAND - PORTUGAL - SAUDI ARABIA - SLOVENIA - SPAIN - TURKEY - UAE - UK - USA - VIETNAM

IDOM NUCLEAR SERVICES

IDOM NUCLEAR SERVICES

IDOM's experience in the nuclear sector has its origins in the early nuclear generation projects in Spain in the late 70s and 80s, participating in the construction of Ascó and Vandellós II Nuclear Power Plants (NPPs). Our relationship with these and other projects has continued throughout the lives of these facilities.

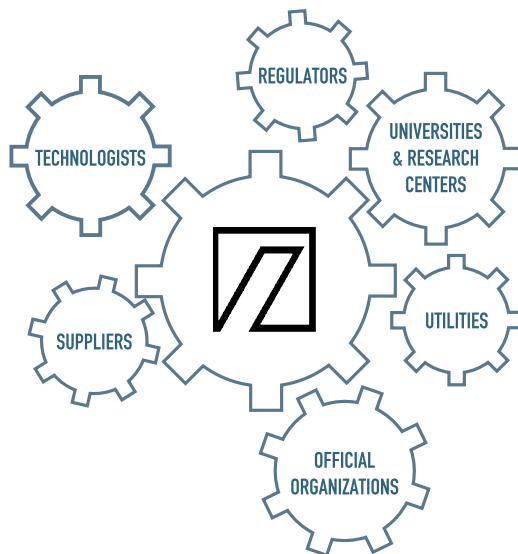
Working on these projects has enabled us to acquire technical abilities and experience in the fields of engineering technical support, industrial architecture, civil, mechanical, and structural engineering design and advanced analysis.

Our participation in the Energhia consortium, providing engineering services to Fusion for Energy (F4E) and the ITER organisation in the ITER fusion research project marks a milestone in the development of the nuclear services provided by IDOM NS.

The spectrum of activities of the business unit covers a wide range of projects, from minor component or subsystems analysis to major design projects for new facilities.

IDOM NS can offer nuclear engineering services working both as an integrated resource within the client's engineering team on site and as a resource from the various IDOM offices.

Sustainability and innovation are valued aspects of IDOM NS' operations and, together with the knowledge acquired from our projects, we look forward to putting these aspects together to assist our clients on the path to a future with lower carbon emissions.



OUR TEAM

IDOM NS offers a committed international and multidisciplinary team dedicated to high level performance, ensuring that projects are planned and delivered efficiently. By combining international experience and multidisciplinary expertise, IDOM NS adopts a holistic approach to ensure the work is carried out to the client's satisfaction. When required, our core team will receive support from other highly skilled and experienced individuals within the company to ensure that momentum is maintained.

The IDOM NS team manages the projects complementing their knowledge and expertise with people from other IDOM technical areas working as a Task Force team.



In addition to the certified quality system of IDOM, IDOM NS operates according to its Nuclear Management and Quality Assurance System, based on UNE 73401, NQA-1 and KTA 1401.

IDOM NS is listed in the registry of the Spanish Nuclear Regulator (Consejo de Seguridad Nuclear, CSN), is an approved supplier of AREVA and of all Spanish NPPs and belongs to several communities of suppliers, such as UVBD (UK utilities), REPRO (Southern Europe Oil & Gas utilities industry) and SAGA 7 (Enel-Endesa).



IDOM NS is member of the most relevant associations in the field in Spain and Europe: European Nuclear Society (ENS), Spanish Nuclear Society (SNE), United Kingdom Nuclear Industry Association (NIA), Sustainable Nuclear Energy Technology Platform (SNETP) and Spanish Nuclear Forum.

IDOM NS is Centre of Reference of the Spanish NPPs for the Electric Power Research Institute (EPRI) projects.

SERVICES PROVIDED BY IDOM WITHIN THE NUCLEAR BUSINESS UNIT



SELECTED CURRENT TASKS RELATED TO THE SAFETY OF THE PLANTS



SAFETY SYSTEMS

Various Safety Related Systems projects have been carried out, from geological and technological studies and site evaluation against extreme natural events, to the development of basic and detailed engineering, equipment purchasing, construction, installation and commissioning of new safety systems of the plants.

IDOM NS is also currently carrying out the evaluation of fire protection systems, based on the new Nuclear Safety Council (CSN) IS-30 Safety Instruction, as well as the analysis of emergency Heating, Ventilation and Air Conditioning (HVAC) systems and adequacy to the new regulations.



STRESS TESTS

IDOM NS is conducting technical analyses to support the Western European Nuclear Regulators Association (WENRA) stress tests, including safety checks and risk analyses. Our tasks include assessment of the plants' defences against earthquakes, floods and other external events beyond the design basis of the plant, among other aspects.

IDOM NS has participated in stress test related services for all the Spanish plants: Ascó, Vandellós II, Cofrentes, Almaraz, Trillo and Santa María de Garoña.



LIFETIME MANAGEMENT

Commencing in 2003 IDOM NS developed the necessary studies and evaluations for the Santa María de Garoña NPP operating licence extension. Since 2006, IDOM NS has also offered technical support in various areas including planning, development, implementation and monitoring to the Ascó, Vandellós II, Almaraz and Trillo NPPs' Lifetime Management plans.

This task is developed taking into account the considerations included in Safety Instruction IS-22 (CSN document) based on 10CFR54, NEI95-10, NUREG 1800 and NUREG 1801 NRC regulations.

ISFSI

The capacity of the *Spent Fuel Pool (SFP)* of a large number of *NPPs* is currently close to saturation and there is not enough space in them to guarantee the long term operation of the *NPP*.

One of the alternatives to avoid this risk lies in the construction of a temporary *Independent Spent Fuel Storage Installation (ISFSI)*. These installations are based on spent fuel dry confinement systems that guarantee the safety and protection of people and the environment during the time periods prior to long-term management (*Central Spent Fuel Storage Facility, CSFSF*) or final disposal (reprocessing of spent fuel, *Deep Geological Storage, DGS*, etc) of the fuel.

The spent fuel handling operations pose a safety risk in the areas where a load drop could damage safety-related equipment or components, along with the damage that could occur to the fuel stored in the *SFP* or to the core fuel. In some cases, this impact, under certain load weight conditions and where it drops, could lead to radioactive releases over the established dose limits of 10CFR Part 100.

Incorporating defense in-depth measures will reduce the impact probability to values that are sufficiently low so as not to have to be taken into consideration in the design or reducing the probability that something dropping can affect key safety equipment.

The main challenge facing *NPP* operators when incorporating these infrastructures is to select their appropriate site at the power plant and to establish storage cask technology to be used. Once these decisions have been taken, the preliminary planning work will begin, followed by the design, construction, licensing and commissioning of the *ISFSI*.

A photograph of a spent fuel storage facility. In the foreground, a large yellow mobile crane platform is positioned on a concrete pad. Two workers, one in a yellow hard hat and one in a white hard hat, are on the platform. To the left, a large white cylindrical storage container is visible. In the background, another similar container and a building are visible under a clear blue sky. A network of blue lines connects the text callouts to various parts of the scene.

SPENT FUEL STORAGE

SFP
(Spent Fuel Pool)

ISFSI
(Independent
Spent Fuel Storage
Installation)

CSFSF
(Central Spent
Fuel Storage
Facility)

TECHNICAL SUPPORT

The IDOM NS global approach consists of organising multidisciplinary qualified teams with the necessary experience, thus incorporating all the expertise of the company to provide integral management of the work from the safety, quality, economic and technical perspectives in all the stages of the project; from the preliminary studies to the commissioning of the spent fuel storage installation (ISFSI).

PLANNING AND CONSULTING

- SITE ASSESSMENT.
- GEO-TECHNICAL-GEOLOGICAL SURVEY.
- ENVIRONMENTAL IMPACT STATEMENT.
- TECHNOLOGY SELECTION: STORAGE *BEST AVAILABLE TECHNIQUES (BAT)* STUDY.
- FEASIBILITY STUDY.

DESIGN

- CONCEPTUAL, BASIC, FEED AND DETAIL ENGINEERING:
 - Soil remediation/improvement study.
 - Civil engineering (roads, foundations, concrete footing, transfer slab, etc.).
 - Electric engineering (power, lighting and earthing system).
 - *Instrumentation and Control (I&C)*.
 - Mechanical engineering (fire protection system,...).
 - Physical protection.
 - *Radiological Protection (RP)*: area zoning and dose study.
 - *Human Factors Engineering (HFE)*.



SPECIALISED ENGINEERING STUDIES

- NUCLEAR CASK DESIGN.
- SPENT FUEL:
 - Transport of ionizing radiation studies.
 - Characterisation of the spent nuclear fuel.
 - Source term assessment. Criticality and thermal aspects.
- MODERNISING THE NPPs: UPGRADING OF CRANES TO HANDLE CRITICAL LOADS.
- BUILDING STRUCTURAL ANALYSIS.

CONSTRUCTION

- PROCUREMENT MANAGEMENT.
- PROJECT MANAGEMENT (PMC).
- CONSTRUCTION MANAGEMENT.
- SITE SUPERVISION.
- SUPPORT TO THE OWNER.
- CONSTRUCTION (under contract *Engineering, Procurement and Construction (EPC)*, *Engineering, Procurement, Construction and Commissioning (EPCC)*, *Construction and Management as Agent (CMA)*, etc.).

LICENSING

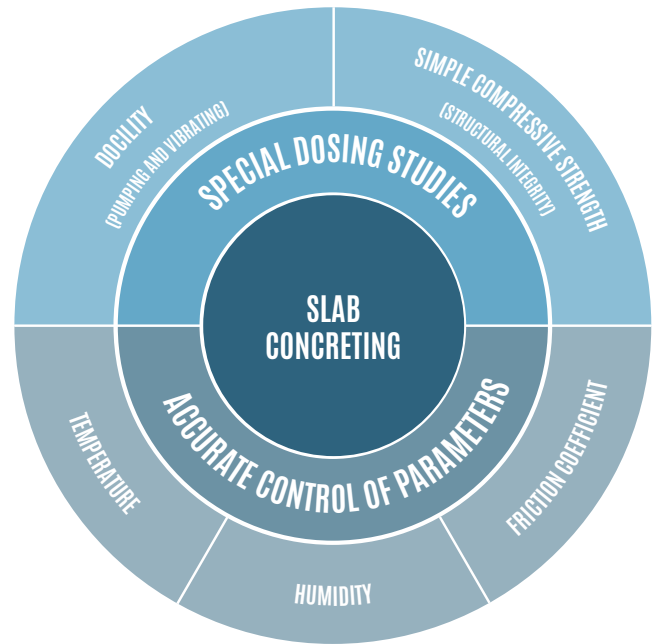
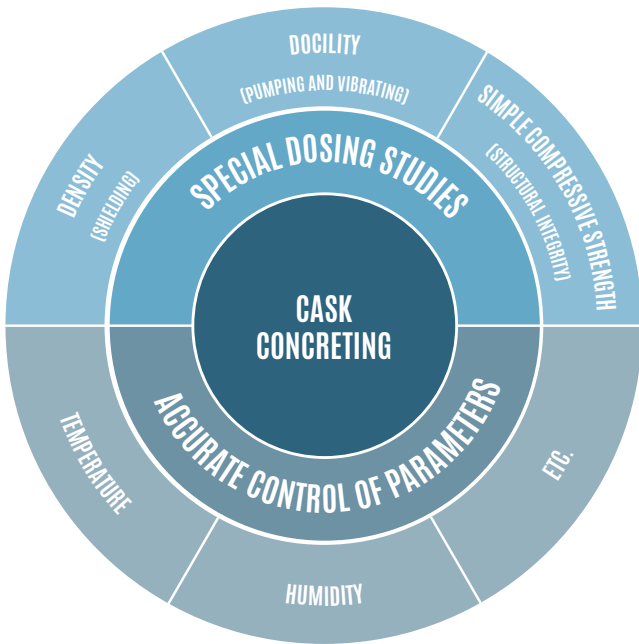
- MUNICIPAL PERMITS (BUSINESS LICENCE, BUILDING PERMIT, ETC.)
- ENVIRONMENTAL PERMITS.
- INDUSTRIAL LEGALISATION.
- LICENSING SUPPORT WITH PROCESS WITH THE NATIONAL REGULATOR:
 - *Final Safety Report (FSAR)*.
 - *Technical Specifications (TS)*.
 - *Probabilistic Safety Assessment (PSA)*.
 - ...

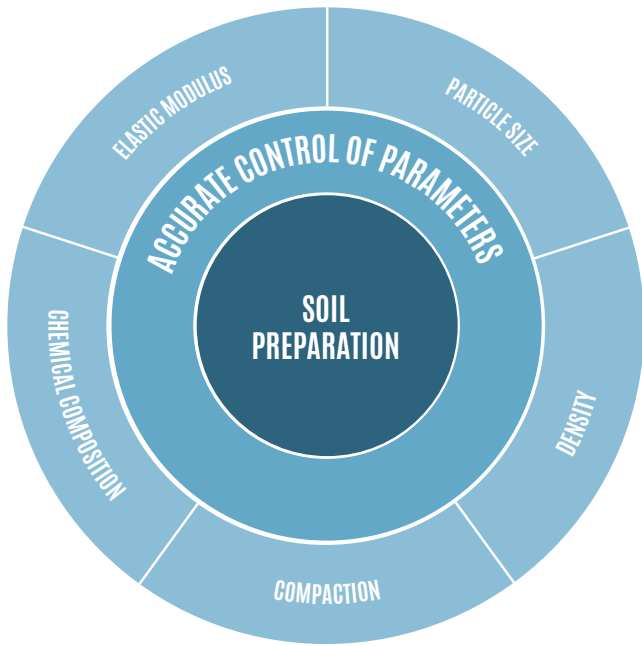
TEST AND START UP

- FAT/SAT TESTING PROCEDURES.
- INSPECTION AND SUPERVISING TESTING.
- COMPLETION CERTIFICATE.



SPECIAL PROCESSES CONTROL





Strict quality assurance of the processes and of the control of the critical parameters of the work is fundamental for the subsequent safe handling and storage of the spent fuel and the radiation protection of people and of the environment.



HANDLING HEAVY LOADS

In *NPP* operation, maintenance, and refueling activities, heavy loads may be handled in several plant areas. If these loads were to drop because of human error or crane failure, they could impact on stored spent fuel, fuel in the core, or on equipment that may be required to achieve safe shutdown or permit continued decay heat removal. The impact could damage such a number of fuel elements that the incident would lead to off-site radioactive releases over the accident dose limits, to criticality accidents or the loss of equipment needed for the safe shutdown of the plant.

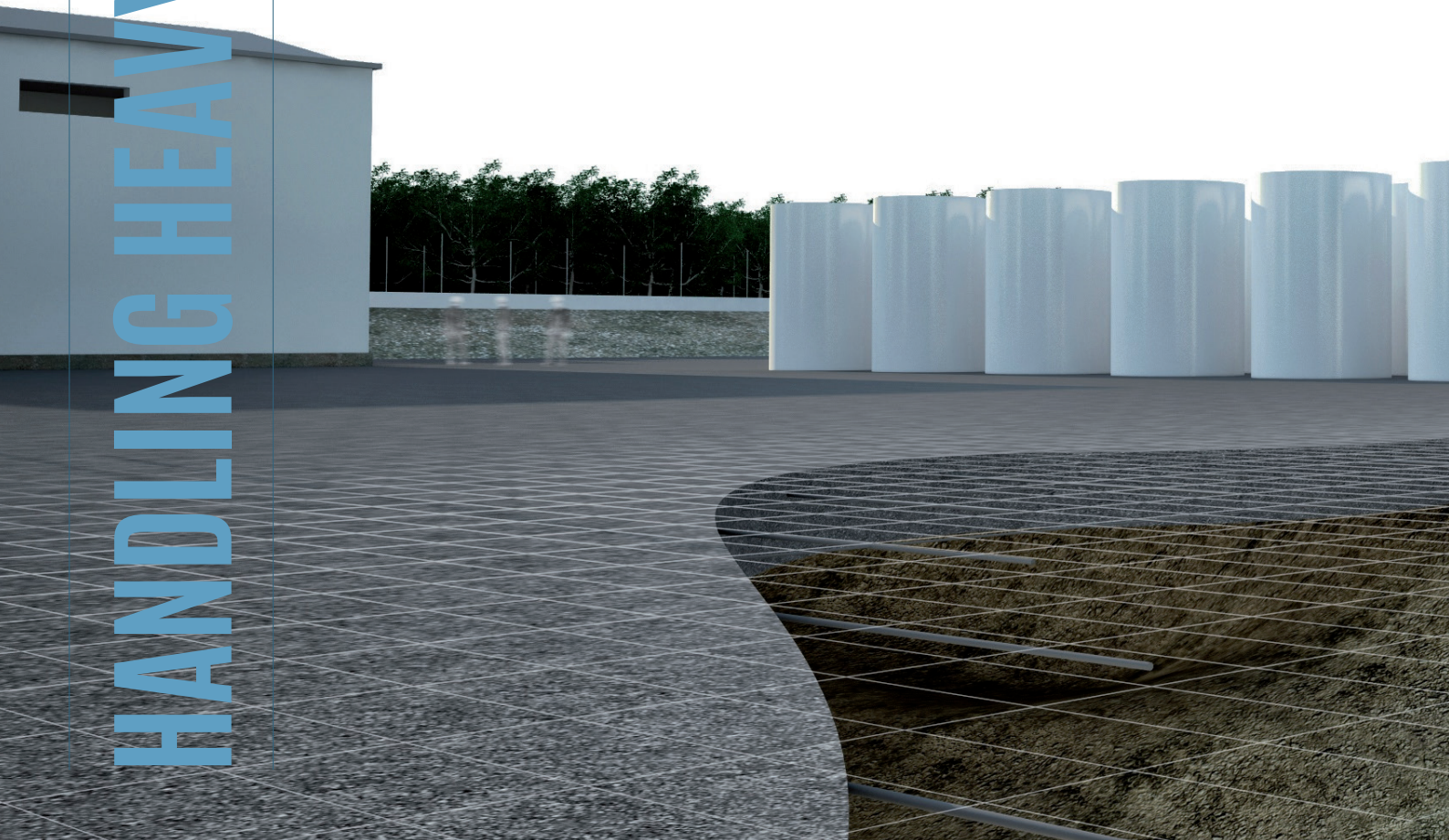
The most important design characteristics of the fuel handling systems (overhead travelling cranes, gantry cranes, horizontal transport equipment, etc.) of the *NPPs* provide the necessary guarantee that the fuel is received, handled, stored and recovered at no risk to health, safety or the environment.

The fuel handling and storage systems must be designed to be safely operated in all the operating statuses, taking into account both the effects of the envisaged initiating events that may affect it, along with the design-based accidents.

The implementation of defense in-depth measures (NUREG-554 and NUREG-612) will mean that the drop no longer has to be envisaged as an initiating event, so that without impact analysis needing to be performed in addition to those in place at the power plant, the activities can be carried out to move heavy loads needed for the loading process of the fuel elements in the casks and the eliminating of the operation restrictions that prevent heavy loads being handled over the fuel pool.

The main work carried out by IDOM NS both to upgrade the existing cranes and the new ones are:

- Selecting design criteria.
- Preparing technical specifications.
- Procurement management.
- Reviewing the manufacturer's technical documentation.
- Reviewing the manufacturing quality assurance programme.
- Assembly and commissioning support.
- Amending official operating documents (FSAR and TS).
- Preparing *Design Modification Packages (DMP)*.
- Licensing support.



REGULATORY FRAMEWORK



- NOG-1, *Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder.* July 2010.



- CMAA 70, *Specifications for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes.* December 2008.




- IS-20, *Requisitos de seguridad relativos a contenedores de almacenamiento de combustible gastado.* Febrero 2009.
- IS-29, *Instalaciones de almacenamiento temporal de combustible gastado y residuos radiactivos de alta actividad.* Octubre 2010.



- 10 CFR 50, *Domestic Licensing Of Production and Utilization Facilities.*
- 10 CFR 71 , *Packaging and Transportation of Radioactive Material.*
- 10 CFR 72, *Licensing Requirements for The Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor- Related Greater than Class C Waste.*
- RG-1.13, *Spent Fuel Storage Facility Design Basis.* Rev 2. March 2007.
- NUREG-0554 , *Single Failure Proof Cranes for Nuclear Power Plants.* May 1979.
- NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants.* July 1980.
- NUREG-1536, *Standard Review Plan for Spent Fuel Dry Storage Systems at a General License Facility.* Rev 1. July 2010.
- NUREG-1567, *Standard Review Plan for Spent Fuel Dry Storage Facilities.* March 2000.
- NUREG-CR/6407, *Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According To Importance To Safety.* February 1996.
- RG 7.10, *Establishing Quality Assurance Programs for Packaging Used In Transport Of Radioactive Material.* Rev 2. March 2011.



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- Knowledge of EPRI methodology for the planning, design and construction of *ISFSIs* and best available techniques.
 - Analysis of the soil-structure interaction and of the soil movement to calculate foundations (RG 1.132).
 - Analysis of soil seismic convolution and deconvolution (RG 1.208).
 - Advanced calculation of deep and surface foundations according to ACI 318 methodology.
 - Studies of the elastic and inelastic collision of the cask on the flagstone.
 - Designing roadways to move heavy loads.
 - Applying the conclusions reached from conducting the Stress Test, Life Management, Seismic Assessment, etc. studies to the design of the *ISFSI*.
 - Technical Support with the selecting of technologies, design, installation and licensing of the storage (10 CFR 72.48 and 10 CFR 72.212) and transport systems.
 - Advice on the electromechanical design and licensing for the upgrade of cranes (NUREG-554, NUREG-612) including the structural analysis of supports and building.
 - Designing the Physical Protection facilities by accredited staff.
 - Integrated Management System (IAEA- GS-R-3). Safety and Quality Assurance Programme; implemented and monitored by a team independent from the design group.
 - Management system certified by Lloyd's as per ISO 9001, ISO 14001 and OHSAS 18001; Nuclear Quality Assurance Programme favourably audited as per 10 CFR 50 App. B (ASME NQA-1), 10 CFR 21, KTA-1401 and UNE 73401; and certified by the Owners Group of Spanish *NPPs*.



- Geotechnical-Geological Survey of the *ISFSI* site at Ascó *NPP* (Tarragona, Spain).
- Works Management, as *built* project and development of the *Design Modification Package (DMP)* of the *ISFSI* at Ascó *NPP*. Tecnología HOLTEC (Tarragona, Spain).
- Conducting the Stress Tests in the *ISFSI* at Ascó *NPP* (Tarragona, Spain).



- Geotechnical-Geological survey of the *ISFSI* site at Santa María de Garoña *NPP* (Burgos, Spain).
- Basic engineering, detail engineering, licensing and works management (awarded) of the *ISFSI* at Santa María de Garoña *NPP*. ENSA Technology (Burgos, Spain).
- Reviewing the design of the upgrade of the overhead travelling crane and of the trolley of the reactor building at the Santa María de Garoña *NPP* to comply with NUREG-0554 and NUREG-0612 (Burgos, Spain).



- BWR fuel characterisation R&D project and analysis of cask shielding. University of the Basque Country (Bilbao, Spain).



- Detail engineering and Procurement Management of the *Cask Maintenance Facility (CMF)* and of the Empty Cask Parking of the *CSFSF*: Technologies DPT, ENSA, HOLTEC, and TN (Cuenca, Spain).
- Design, procurement requirements and help with licensing the bridge cranes and transfer trolley of the *CMF* and gantry crane of the Empty Cask Parking of the *CTS*: Technologies DPT, ENSA, HOLTEC, and TN (Cuenca, Spain).
- Study of Best Available Techniques to handle and transport containers inside the *CSFSF* (Cuenca, Spain).



- Project Management to supply HOLTEC HI-STORM casks for the Ascó *NPP* (Tarragona, Spain).
- Project Management to supply HOLTEC HI-STORM casks for the Zorita *NPP* (Guadalajara, Spain).





IDOM, Ingeniería y Consultoría, S.A.U.

www.idom.com

Avenida Zarandoa, 23

48015, Bilbao - Spain

T: +34 944 797 600

nuclear@idom.com