# SPANISH NATIONAL STRATEGY FOR SPENT FUEL AND HLW MANAGEMENT
## *Considerations for a Centralized Storage Facility (CSF)*

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**Abstract**

The paper covers the Spanish national policy and strategy for spent nuclear fuel, high level and special radioactive waste management. The existing legal framework in Spain establishes the need to keep a General Radioactive Waste Plan (GRWP) up to date. The basic strategy for the management of the SF, HLW and SW aims for their future disposal in a deep geological repository (DGR). Such stage will be preceded by a temporary storage in a centralized facility (CSF). As this is not yet available, some actions have been performed in the NPPs to avoid the saturation of spent fuel storage pools and to allow, in this way, that they could either continue to operate or to be dismantled.

The paper also describes the main processes of the CSF, its design criteria, safety case, and site selection procedure.

## 1. NATIONAL POLICY FOR RADIOACTIVE WASTE MANAGEMENT

In Spain, according to the Law 25/1964 on nuclear energy, the Government shall establish the national program and policy on the management of radioactive waste, including spent nuclear fuel, and on the dismantling and decommissioning activities of nuclear installations, by means of the approval of the General Radioactive Waste Plan (GRWP). This Plan has to be approved by the Government, at the proposal of the Ministry that is in charge of energy policy (today, MITECO, Ministry for the Ecological Transition), when having succeeded the positive assessment from the Nuclear Safety Council (CSN) and after hearing the Autonomous Regions on urban planning and environmental related issues. Then, the approved GRWP has to be put to National Parliament for information purposes. In this framework, ENRESA, the national company entrusted with the management of radioactive waste and spent nuclear fuel, as well as with the dismantling and decommissioning of nuclear facilities, is responsible of submitting, every four years or when required by the MITECO, a review of the GRWP, taking into account scientific and technical progress, experience acquired, recommendations, lessons learned and best practices derived from the peer review process.

This GRWP addresses the strategies, the necessary actions and the technical solutions to be developed in the short, medium and long term, in order to ensure the spent fuel and radioactive waste adequate management. It includes the general objectives of the radioactive waste management policy, including the dismantling and decommissioning of nuclear facilities, the significant stages and schedules for compliance in view of the general objectives, an inventory of all SF and RW, as well as some estimates of future quantities, including those from decommissioning. It also includes concepts or plans and technical solutions for the final disposal facility, including the transport and the surveillance period, together with the means that must be used to preserve the knowledge of that installation in the long- term.

One of the key components of the GRWP is an evaluation of costs and the applicable financing regime. The Plan also addresses the R&D activities that are needed in order to apply solutions and some international references taken into account to define and stablish the national policy and strategy.

Finally, the GRWP shall also contain the criteria of transparency and public participation and, where applicable, agreements concluded with Member States or third countries on the management of spent fuel or radioactive waste, including the use of permanent disposal facilities.

In this context, the first GRWP was approved in 1987. Since then, the Plan has been updated several times and the sixth version (2006) is currently in force. The Government is now addressing the so-called

"Integrated National Plan for Energy and Climate 2021-2030", where the strategic bases for energy policy will be set for the coming decades. Taking into account this strategy, ENRESA is now preparing the draft for the seventh GRWP.

## 2. NATIONAL FRAMEWORK: RESPONSABILITIES AND INSTITUTIONAL CONTROL

As already mentioned in the previous section, the Spanish Government is responsible for the design of the national policy on the management of radioactive waste, with ENRESA technical assistance. The Nuclear Safety Council (CSN) is the independent regulatory body that holds all nuclear safety and radiation protection competencies, which has the major role of keeping the Government and the National Parliament informed about this matters. ENRESA was constituted in 1984 as a public company to the service of the MITECO and is responsible for transport, treatment, conditioning, storage and disposal of spent fuel and radioactive waste, in addition to the operations related to the dismantling and decommissioning of nuclear and, when appropriate, radioactive facilities.

In accordance with the Spanish national legal framework, the main responsibility with respect to spent nuclear fuel and radioactive waste shall rest on those who have generated them or, where appropriate, on the holder of the authorization to whom such responsibility has been entrusted. They are obliged to establish and apply integrated management systems, including quality assurance, which give due priority to safety in the global management of spent fuel and radioactive waste, and may be subject to periodic verification.

Nuclear and radioactive facilities working with radioactive materials are obliged to have dedicated facilities for storage, transport and handling of radioactive waste. They must also take appropriate measures at all stages of management to protect people, workers and the environment adequately, both now and in the future, against radiological risks, so that the production of waste, in quantity and activity, is the lowest possible, according to the scientific practice existing at each moment.

The license holders of nuclear and radioactive facilities are also obliged to prepare and sign some technical- administrative specifications for the management of their spent nuclear fuel and radioactive waste, with a view to their acceptance and subsequent collection by ENRESA. These specifications will establish their period of validity, which will extend to the end of the life of the facilities, including the dismantling and decommissioning, or closure, of the nuclear facilities and, where appropriate, of the radioactive facilities. Said specifications have to be approved by the MITECO, with the prior report of the Nuclear Safety Council.

It is important to highlight that Spanish national framework for the management of SF and RW complies with all the requirements stablished in the Council Directive 2011/70/Euratom, and very few changes have been required for its transposition, because of the great robustness of the Spanish national legal and regulatory framework for decades.

The Spanish nuclear system for SF & RW management is shown in Fig.1.

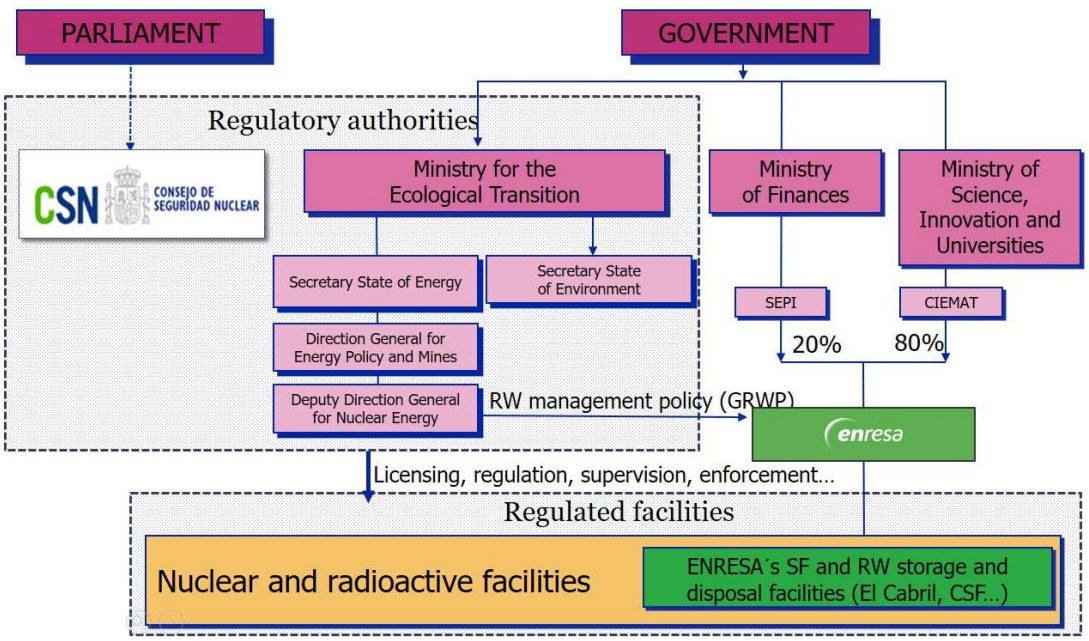


*FIG. 1. Spanish nuclear system for SF & RW management.*

## 3. SF&HLW MANAGEMENT STRATEGY, NATIONAL INVENTORY AND CURRENT SITUATION

The Spanish national strategy for the management of high level waste (HLW), included the SF, and special waste (SW), defined as the radioactive waste that does not meet the acceptance criteria of the El Cabril LILW & VLLW National Disposal Centre, aims for their future disposal in a deep geological repository (DGR). In line with the broad international consensus and with Directive 2011/70/Euratom, which recognizes that the idea generally accepted by technicians is that a deep geological disposal is the most sustainable and safe option for the SF and HLW long term management, the selected option in Spain consists of a temporary centralized storage facility, followed by a final disposal repository when available.

In this context, the Government of Spain has contemplated, in the successive GRWP since 1987, a centralized solution for the storage of SF, HLW and SW, taking into account strategic, technical, economic, safety and security considerations. This facility is named as Centralized Storage Facility (CSF). However, this project has been several times rescheduled since it was firstly conceived in 1987 as a result of the evolution and changes in the nuclear program in Spain. The CSF licensing process started in 2014, but the Secretary of State for Energy of MITECO requested the Nuclear Safety Council (CSN), by mean of a letter issued on July 5th 2018, to temporary suspend the issuance of the mandatory report regarding the request for the construction authorization. This was decided by the incoming Spanish Government in order to analyse, in further detail, the current circumstances and carry out a more precise planning adjusted to them, which will be specified in an update of the GRWP.

In Spain there are ten nuclear power reactors: seven of them are currently in operation at five sites (Ascó I&II, Almaraz I&II, Vandellós II, Trillo and Cofrentes NPPs), one of them has been recently shutdown (Santa María de Garoña NPP), one reactor is being dismantled and decommissioned (José Cabrera NPP) and another reactor is in a safe-store period after partial initial dismantling (Vandellós I NPP).

On the one hand, as a result of the operation of these NPPs, and in accordance with the estimations of the current 6th GRWP, about 6,700 tU of SF will be generated in Spain, which will result in approximately 20,000 spent fuel elements (SFE) of various types. The irradiated fuel is considered a waste since the 1983 National Energy Plan established the open cycle as the reference scenario. Additionally, due to the shipment of the spent fuel from the Vandellós I NPP to France for its reprocessing, a certain amount of HLW and SW will be returned to Spain, in the form of CSD canisters. On the other hand, as a result of the dismantling activities of the NPPs, a quantity of special waste will be generated.

Once the SF is definitively discharged from a nuclear reactor, it is stored in the on- site temporary storage in the NPPs pools, as a first step. All the Spanish NPPs are storing part or all of their SF in their pools, except for Vandellós I and José Cabrera NPPs.

As the CSF is not yet available, it has been necessary to undertake several actions in each NPP to avoid saturation of spent fuel storage pools and to allow, in this way, that they could either continue to operate or to be dismantled.

Almost all the NPPs did re-racking in their pools in different phases, consisting in the replacement of the original racks with more compact units to increase the storage capacity of the pools, based on the corresponding safety analysis. In the case of Vandellós II NPP, this re-racking was partial and the pending re-racking is expected to be completed in 2020.

Beyond the re-racking projects developed in the NPPs, the Spanish national strategy considers the construction of on- site dry storage facilities, known as individual storage facilities (ISFs), in order to ensure the continued operation of the NPPs close to pool saturation, while there is no a CSF available, or to address dismantling on termination of their operation, as stated in the 6th GRWP currently in force. Once the CSF is available, the ISFs could eventually be used as a logistic support area that would facilitate the preparation for transports. As a common rule, the ISFs are licensed as a modification of the NPP design, according to the Regulation on nuclear and radioactive facilities.

The SF, HLW and SW is stored in the ISFs by means of dry casks, that can be dual- purpose casks (conceived for both storage and transport), or storage canisters and modules that need a specific transport cask for their future transport. The casks must also be licensed, not only the design of the storage system, but also the model of transport package. These casks will be transported to the CSF, when this facility will be in operation, to be unloaded and the SF assemblies being stored at the CSF vaults (in canisters). In the meanwhile, the casks will remain at the nuclear reactors sites and its integrity must be guaranteed at any time to allow the subsequent transport and unloading of SF and HLW. During the time the NPP is in operation, these ISFs, including the casks supplied by ENRESA, are managed by the utility. Once the NPP is going to be dismantled, the site is transferred to ENRESA, which becomes responsible for its supervision, maintenance and monitoring.

In Spain, there are 6 sites where extra dry storage capacity has been developed or is being developed with the construction of ISFs:

— Trillo NPP has an ISF in operation since 2002, due to the limitations imposed by the intrinsic features of its design, where the pool has a limited capacity. It is based on a concrete building for the storage of dual-purpose metal casks with a capacity of 80 positions. 32 DPT and 2 ENUN-32P casks are currently stored in this building. The following casks expected to be stored are also ENUN-32P type;
— José Cabrera NPP was shut down in 2006 and dismantling is undergoing since 2010. The ISF is based on a concrete pad outdoors which stores steel canisters with a concrete overpack (module) that provides the necessary shielding to ensure compliance with dose limits to the public and to workers. It was commissioned in 2009 with a capacity for 16 positions. All of them are occupied for the storage of all NPP SF in 12 casks (HI-STORM) as well as the SW resulting from dismantling activities in another 4 casks (HI-SAFE), containing reactor internals and other fuel- related operational waste (attachments, pieces of structural elements for the fuel, etc.);
— These casks are only prepared for storage, although there is another cask licensed and prepared for transport (HI-STAR);
— Due to the proximity of its pools saturation capacity, the Ascó NPP (I&II) has an ISF in operation since 2013, with a similar system that the one used in José Cabrera NPP. It has a capacity of 32 casks, of which there are already 21 charged (HI-STORM type);
— Almaraz NPP has an ISF in operation since 2018, when the first ENUN-32P cask was loaded. The ISF is based on a concrete pad outdoors which stores dual-purpose metallic casks;
— The ISF at Santa María de Garoña NPP is built and licensed but not yet in operation. In 2015, the facility obtained the positive Environmental Impact Statement. The authorisation for the execution and assembly of the modification was also granted in 2015, and the authorisation for the start- up of the modification was granted in 2018. The design of this ISF, which was originally conceived for the storage of 32 casks, shall be revised after a recent Ministerial Order, denying the authorisation to extend the lifetime operation of the NPP, in order to allow the storage of the full inventory of SF. The

ISF is based on a concrete pad outdoors which stores dual-purpose metallic casks. The design of these dual-purpose casks (ENUN-52B) was also approved in 2014 and the model for bulk transport in 2015, and it is expected that 5 casks to be loaded in 2019;

— The process for the licensing of the ISF of Cofrentes NPP began in 2016 with the request of the start of the Environmental Impact Assessment process. The authorisation for the execution and assembly of the NPP modification was requested in 2017. The technology is also based on a concrete pad outdoors with dual-purpose metallic casks (HI-STAR 150 type). It is expected the first cask to be loaded in 2021.

In decision-making about the characteristics of these ISFs, several variables are considered, but mainly the situation of the NPP (in operation or close to shutdown), the technologies available at that moment and the Spanish nuclear strategy development at the time of its design and licensing can be highlighted. In addition, in the selection of a specific storage system, the specificities of each NPP (maintenance means or available space) are also taken into account. For example, the ISF at Trillo NPP was conceived in the 90s when there were only preliminary plans to develop the CSF, so it was designed with a capacity that allowed the storage of the complete inventory of SF for 40 years of operation of the plant. The selected technology allowed the storage of a large number of casks (up to 80). On the other hand, in the case of José Cabrera NPP, its shutdown was scheduled at the moment of the decision, so the ISF was designed for the storage of the total inventory of the plant, including the SF from the operation and the SW that would be generated as a result of dismantling activities. The required capacity (16 casks) enforced ENRESA to select a most optimal storage technology in technical and economic terms, based on steel canisters with a concrete overpack (module) that provides the necessary shielding to ensure compliance with dose limits to the public and to workers.

The rest of ISFs were conceived and planned when the CSF Project was already initiated in design and licensing process and, for that reason, those ISFs were designed with lower capacities than the maximum required in each plant for the complete inventory of SF. In general terms, these facilities were complementary to pool capacity to reach 40-years scenario inventories. Again, in these cases, the chosen technologies were selected according to technical and economic considerations.

It is important to highlight that the design of these ISF facilities is modular to be adapted if necessary to meet the future needs of each NPP, depending on the operating scenarios that arise from the Integrated National Energy and Climate Plan, and according to the waste management strategy adopted in the planned seventh GRWP.

In any case, the solution of temporary storage of SF, HLW and SW, either in a centralized facility (CSF), or in individual facilities in each NPP (ISFs), represents an intermediate stage in the management of radioactive waste prior to the development of the Deep Geological Repository (DGR) for its definitive long-term management. In this sense, ENRESA has addressed different projects in order to enhance the knowledge on the state of the art of the different technologies available for final disposal, as well as a site identification program. Additionally, ENRESA has developed its own R&D plans for decades, and will continue doing in the coming future, where several projects focused on these aspects have a major presence. Following the recommendations transferred by the ARTEMIS mission carried out by the IAEA in October 2018, ENRESA is preparing a roadmap to undertake the activities on deep geological repository to be carried out in the next decade.

## 4. CENTRALIZED STORAGE FACILITY (CSF)

### 4.1. Main functions

The centralised storage facility (CSF) shall provide a safe dry interim storage for the spent nuclear fuel (SNF) of the Spanish nuclear power plants, as well as the storage of other radioactive waste that do not meet the acceptance criteria of El Cabril disposal facility:

— Reception, process and temporary storage of the complete spent fuel coming from the operation of Spanish NPP (approximately 20,000 spent fuel elements);

— Reception, process and temporary storage of HLW coming from the reprocessing of the spent fuel of Vandellós I NPP from the French facility of La Hague (68 vitrified canisters CSD-V);

— Reception, process and temporary storage of SW (defined as them which do not meet the acceptance criteria of the El Cabril LILW & VLLW National Disposal Centre), among others.

- Vitrified and metallic compacted waste from the reprocessing of the spent fuel of Vandellós I NPP from the French facility of La Hague (12 CSD-B and 12 CSD-C canisters);
- Waste coming from NPPs decommissioning activities. These are activated metallic materials, mainly reactor vessel internals, or substituted BWR fuel channels;
- Radioactive Encapsulated Sources (≈ 15.000 units).

— Reception and temporary storage of transport casks (78 positions);
— R&D activities related to the behaviour of temporary and definitive storage of SF;
— Others (cask maintenance, solid and liquid waste treatment, etc.).

### 4.2. Site selection

The site selection for the CSF required the development of an ad- hoc procedure based on the principles of transparency and voluntariness that included a public participation phase. In this respect, the Government created in 2006 an Interministerial Commission in charge of establishing the criteria to be met by a candidate CSF site and whose functions were to establish the reference framework with the technical, environmental and socio- economic conditions to be met by potential candidate site for the CSF, to establish and promote the process of public information, to develop the procedure by which the interested municipal areas might opt to be candidates for the site and to draw up a proposal of candidate sites to submit to the Government.

Fourteen municipalities responded to the call, although several withdrew and one did not meet all the requirements, this leaving 8 municipalities to be evaluated by the Interministerial Commission. It is worth noting that 14.420 allegations from the public and entities were formulated during the public participation process. All the process was publicly followed by a freely accessible official website, which is still available.

In September 2010, the Interministerial Commission approved a report with the sites proposal to be presented to the Government. Finally, the site to host the facility was selected in 2011.

### 4.3. Design criteria

The CSF design is based on a dry vault storage system for the SF and vitrified waste, while the SW is to be temporary stored in canisters at pits in a concrete building. In addition, the facility will have a temporary storage cask building (specific ISF for the CSF) in order to efficiently manage the inflow of containers from the NPPs and to temporary store casks before unloading, as well as other buildings dedicated to the storage of radioactive encapsulated sources and operational waste and a Cask Maintenance Facility (CMF) and parking area. The CSF is complemented by a SF and HLW Laboratory (SFRWL) devoted to the study of medium and long term behaviour of these materials.

The CSF design was developed according to a generic design approved by the regulatory body in 2006, based on the operative experience of some international reference facilities upon the principle that all services are integrated in the same site.

The safety objectives of the CSF, stated in the national regulatory framework applicable to the project, establish that the facility must be designed, constructed and operated in such a way as to prevent the occurrence of accidents and, if they occur, mitigate their consequences below the normative limits of application. In order to comply with this basic safety objective, the installation is designed in such a way as to comply with the following safety functions, under normal, off-normal and accident conditions:

— Confinement: double barrier (canister, casks);
— Heating removal: passive by natural convection;
— Critically: spent fuel elements geometric disposition inside canister / casks;
— Shielding: reinforced concrete walls thickness and casks;
— Retrievability: casks and canister retrieval.

In order to ensure that safety functions are met at all operating conditions, the following design criteria will be taken into account:

— Defence in depth and multiple-barrier protection;
— Prevention of the degradation of barriers;

— Hierarchy of passive design measures;
— Double contingency in the face of criticality events;
— Failure in safe position;
— Redundancy, independence and diversity of safety systems. Single Failure Criterion;
— Application of ALARA considerations.

### 4.4. Layout and main processes

The CSF is divided into several buildings (Fig.2).

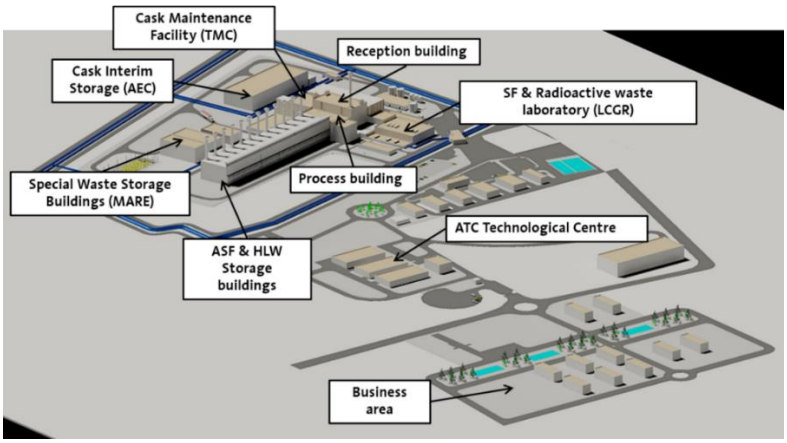


*FIG. 2. General CSF layout.*

The scheme of the main process is shown in (Fig. 3).

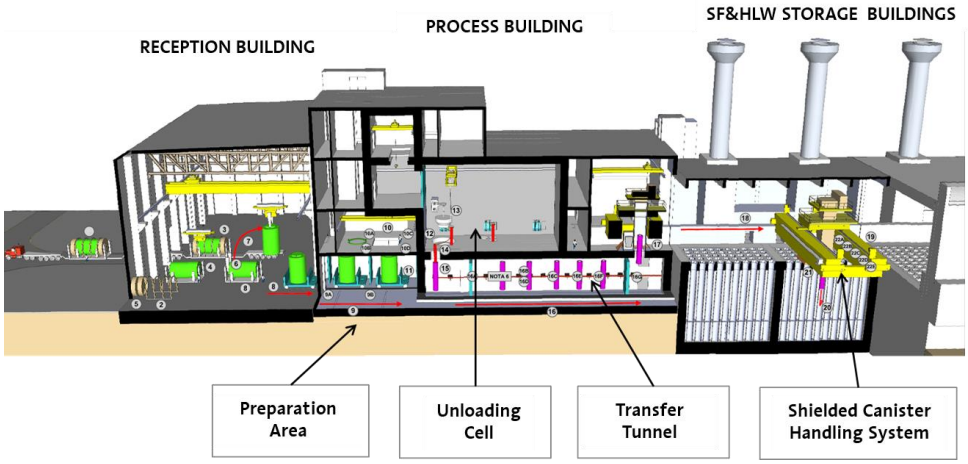


*FIG. 3. CSF main process.*

#### *4.4.1. Reception building*

The building has a rectangular shape and its function is to receive the vehicles that transport the casks with the radioactive waste. In this building the necessary handling and flipping operations will be carried out for the distribution of the casks with radioactive waste to the Process Building or the SF and Radioactive Waste Laboratory, while the empty casks after its unloading will be internally transferred to the Cask Maintenance Facility (CMF), by means of a specific crane. The main operations in this building are:

(a) Loaded cask reception.
(b) Binding system removal.
(c) External contamination measurement.

(d) Visual inspection.
(e) Cask unloading.
(f) Shock absorber removal.
(g) Cask flipping into vertical position.
(h) Displacement and location in transfer trolley.

*4.4.2. Process Building*

This building is divided into 3 different areas:

— Preparation Area;
— Unloading Cell;
— Transfer Tunnel.

In the Preparation Area, the different mechanical processes of casks preparation before unloading the spent fuel in the hot cell will be carried out. The main operations include the control of the atmosphere in the space between the two casks lids (internal & external), unbolting and external lid removal, external contamination control (lids), internal atmosphere control, internal lid unbolting or docking adapter ring positioning. This will allow the coupling of the transport casks to the Unloading Cell in safe conditions.

In the Unloading Cell, after the cask and canister docking operations are completed, the tasks of unloading and manipulation of spent fuel loaded in the transport casks will be carried out, as well as their inspection. After removing the spent fuel elements from the transport cask, they can be positioned in the storage canisters or in the dry temporary storage pits located inside the hot cell.

When a canister is completely loaded with spent fuel elements, an internal lid is placed on it inside the Unloading Cell and it descends to the Transfer Tunnel, where the drying, inerting and sealing operations will be carried out, among others. Once all these operations are completed, the full canister will be in adequate conditions to be transferred and safely stored in the wells of the SF&HLW Storage Building.

*4.4.3. SF&HLW storage building*

CSF canisters loaded with spent fuel elements in the Process Building, CSD canisters coming from the reprocessing activities (HLW or SW) and HLW canisters coming from the SF&RW Laboratory will be stored in vertical wells located at the bottom of the SF&HLW Storage Building, that is, in the storage vaults. This storage will be divided into 6 separate modules and will have two vaults per module (12 vaults in total). Each module will be structurally different from the next one, counting on a seismic joint between both.

The vaults will be structures with reinforced concrete walls of great thickness with independent air inlets and outlets for cooling by natural convection. In this way, the air flows through the wells and will naturally allow the evacuation of residual heat emitted by the canisters, without ever entering into contact with them.

The Management Area, common to all the vaults, will be extended over the storage vaults, through which the Canister Handling System will transit, which will transport the canisters to their storage location.

*4.4.4. Special waste storage buildings*

Its main function will be to store radioactive waste and packages of different types that not meet the acceptance criteria of El Cabril LILW & VLLW National Disposal Centre. To fulfil this objective, 4 different areas are designed, divided in 3 structurally different buildings:

— Operational Waste Storage (ARO). It will be a one single span reinforced concrete building which main purpose will be to store all operational wastes generated in CSF. This building will receive the Waste Management Units used for the Unloading Cell (Process Building) clogged filters and other special waste coming from maintenance and operational Unloading Cell process (lamps, MSM covers, etc.) as well as other special waste produced at CSF buildings;

— Pits Storage Building (AFO). It will be one single span reinforced concrete building which main function will be to store canisters containing metallic activated waste coming from NPPs decommissioning and dismantling activities;
— Sources Storage Building (AFU) & Extra Reserve Storage Building (ARE). It will be one single reinforced concrete frame building (two spans), which main purpose is to store all radioactive encapsulated sources (15.000 units) which will be located in shelfs or in specific areas on the floor.

#### *4.4.5. Cask interim storage*

This heavy reinforced concrete building represents a cask buffer facility to solve NPPs immediate needs of storage when there is no space at pools/ISFs and to accommodate CSF casks inflows. It is composed by independent structures, separated by seismic joints. The main areas in this building are:

— A reception area, where the casks that arrive at this facility in horizontal position in the transport vehicle will be received. In this cask loading and unloading area, the dumping platforms and the entry / exit doors of casks transport vehicles will be located;
— A transfer and maintenance area, with two transfer pits that will allow the operations in encapsulated systems (from transport systems to storage concrete modules);
— A storage area, where casks will be temporarily stored. The heat removal is ensured by natural convection (passive way) through lateral air inlets on the walls and upper air outlets on the roof;
— A decontamination zone and people control station, through which personnel can access to the outside.

#### *4.4.6. Cask maintenance facility*

It is a reinforce concrete building whose main function will be to provide the necessary facilities to carry out the maintenance and decontamination of the empty transport casks. Note that the external maintenance will be done in specific platforms located in Reception Building. Maintenance works and external and internal decontamination are planned. For this, it will consist of 3 different parts:

— Preparation Area, where the casks will be prepared for their subsequent coupling to the CMF Hot Cell. The main operations to be carried out are the external lid removal, internal lid unbolting, docking adapter ring positioning, and radiological controls;
— Hot CMF Cell, for the internal decontamination of the casks by humid way, by means of the use of steam and demineralized water;
— A Maintenance Area, for the maintenance of the interns of the casks.

#### *4.4.7. Spent fuel and radioactive waste laboratory (LCGR)*

This is a reinforced concrete building which main functions will be the study and experimentation of spent nuclear fuel and radioactive waste for the medium and long term activities. These R&D studies will be a fundamental part of the CSF project as they will support the national strategy and policies about SF&HLW management, allowing to enhance the knowledge and characterization of these materials.

The building will consist of a series of concrete cells and metal armoured cells for the study of spent fuel and radioactive waste. In addition, some glove boxes will be implemented for the works with less radioactive source term. The process will consist of the following activities, among others:

Among the operations to be performed are:

— Non-destructive tests, such as the dimensional analysis of the materials (rod length and gap), gamma spectrometry, ultrasonic inspection or induced currents tests;

— Destructive tests, such as bar cutting, pellet extraction, bar puncture and fission gas extraction;
— Specific tests, such as ceramography/metallography, mechanical tests of resilience and hardness, scanning electron microscopy, spectroscopy, mass spectrometry, etc.

#### *4.4.8. Other buildings*

The CSF project includes other facilities and auxiliary buildings, necessary to carry out the main processes and functions of the main CSF facilities: electrical building, general services building, access control building and physical security, etc.

### 4.5. Licensing process and safety regulatory requirements

The licensing process for both nuclear and radioactive facilities is governed by the "*Regulation on nuclear and radioactive facilities*" (RINR), approved by Royal Decree in 1999. These authorisations shall be granted by the Ministry for the Ecological Transition (MITECO) with the mandatory reports from CSN, which are binding when they are negative and deny authorisation and binding regarding the terms and conditions issued for the approval. These terms and conditions are part of the regulatory framework.

The request for authorization shall be submitted to MITECO, accompanied with the required supporting documentation. Afterwards, MITECO shall issue a copy of the application and the documentation to the Nuclear Safety Council (CSN) for issue of the mandatory report. This shall also be submitted to the Autonomous Communities with competencies in the area in urban and environmental planning in the territory in which the facility is to be located or the planning zone provided in basic regulation on planning of nuclear and radiological emergencies, for them to present their objections within one month. Having received the CSN report and subject to the rulings, reports and objections that may arise, MITECO shall adopt the appropriate resolution.

In this context, the CSF project licensing process is divided into 3 different steps:

#### *4.5.1. Preliminary or siting authorization*

The preliminary or siting authorisation is an official recognition of the proposal and the suitability of the chosen site. Its granting allows the licensee to begin preliminary infrastructure works that are authorised and request the authorisation for the construction of the facility. In the processing of this request, a public information period is opened, which is described in detail in answer to issue "Responsibilities for and approach to communication and public information" under this topic.

The application for preliminary authorisation must be accompanied by a site characterisation study. Other important documents are the declaration of the needs intended to be met by the facility, the draft generic design for construction and the quality assurance program.

#### *4.5.2. Construction authorization*

Entitles the licensee to initiate construction of the facility. This application is accompanied by the Preliminary Safety Analysis Report, which presents, among others, the description of the facility, the analytical radiological study and the analysis of the accidents foreseen and their consequences. Other important documents are the economic study or the previsions for dismantling and decommissioning.

During the erection of the facility and before proceeding with the loading of the fuel or nuclear material at the facility, the licensee of the authorisation is obliged to carry out a programme of pre-nuclear tests that accredits the adequate performance of the equipment or parts of the facility, both in relation to nuclear safety and radiological protection and in the applicable regulatory and technical regulations.

#### *4.5.3. Exploitation authorization*

This authorisation entitles the licensee to load nuclear fuel or to admit nuclear substances at the facility, to carry out the nuclear tests programme and to operate the facility under the conditions established in the authorisation. Initially, it will be granted provisionally until nuclear tests have been completed satisfactorily.

The application must be accompanied by the Final Safety Analysis Report, the Operating Regulation, the Operating Technical Specifications, the On-site Emergency Plan, the Radioprotection Manual and the Radioactive Waste and SF Management Plan, among others.

In 2003 ENRESA started the process by submitting to the CSN the Generic Design Safety Analysis Report, approved in 2006. After a period of site characterization and basic design, in January 2014 ENRESA submitted the application to obtain both the siting and construction authorizations. In July 2015, the CSN issued a favourable report for the siting authorization, establishing the terms and conditions to be solved by ENRESA.

On the other hand, regarding the construction authorization, work has been done on its evaluation in the period 2014-2018. However, the Ministry for the Ecological Transition, through a letter issued on July 5th 2018 by the Secretariat of State for Energy, has recently requested the CSN to temporarily suspend the issuance of CSF project evaluation reports, in order to analyse the current situation before the official submission of the 7th GRWP.

The regulatory requirements to which the CSF facility is subject are set out in the Nuclear Safety Regulation recently issued in the national regulatory framework, which includes the principles and foundations of the European Directive 2014/87/EURATOM. In accordance with this regulatory framework, the design of the facility ensures that, during all phases of the life cycle, an adequate level of nuclear safety and radiation protection is guaranteed to the workers and to the public, avoiding the occurrence of accidents and, in case of occurrence, mitigating its consequences below the normative limits considered acceptable.

In this sense, the Preliminary Safety Analysis Report presents an analysis of compliance with safety functions in all operating conditions of the installation (normal operation, operational events and accidents), which guarantees compliance with the objectives established in Directive 2014/87.

Additionally, it is important to highlight that, during the licensing process, the regulatory body has requested ENRESA the consideration of design extension scenarios and severe conditions in the design and construction of the CSF facility. This technical instruction required the analysis of the following scenarios:

- Natural extreme phenomena hazards.
    - Seismic scenarios (seismic margin and near field earthquake).
    - Other (extreme temperatures, winds, tornados, etc.).
- Human caused extreme phenomena hazards.
    - Commercial aircraft impact;
    - Reception of a spent fuel cask with degraded safety functions.
- Total Station Blackout scenario (SBO).
- Total loss of heat sink.
- Multiple failures.

## 5. CONCLUSIONS AND FUTURE ACTIONS

Spain has defined its national policy on the management of spent fuel and radioactive waste for more than 3 decades, through a legal framework in which the roles and functions of each of the agents involved are clearly established. The Spanish national strategy for the management of SF, HLW and SW aims for their future disposal in a Deep Geological Repository (DGR). Such stage will be preceded by a temporary storage in a centralized facility (CSF). As this facility is not yet available, some actions have been performed in the NPPs to avoid the saturation of spent fuel storage pools and to allow, in this way, that they could either continue to operate or to dismantle, such as re-racking or the construction of some Interim Storage Facilities (ISFs).

In this context, the Government is now addressing the so-called "Integrated National Plan for Energy and Climate 2021-2030", where the strategic bases for energy policy will be set for the coming decades. Taking into account this strategy, ENRESA is now preparing the draft for a future GRWP. In the meantime, the necessary actions are being carried out for the management of spent fuel and other radioactive waste in the NPPs that allow their operation or dismantling in safe conditions in the next years.