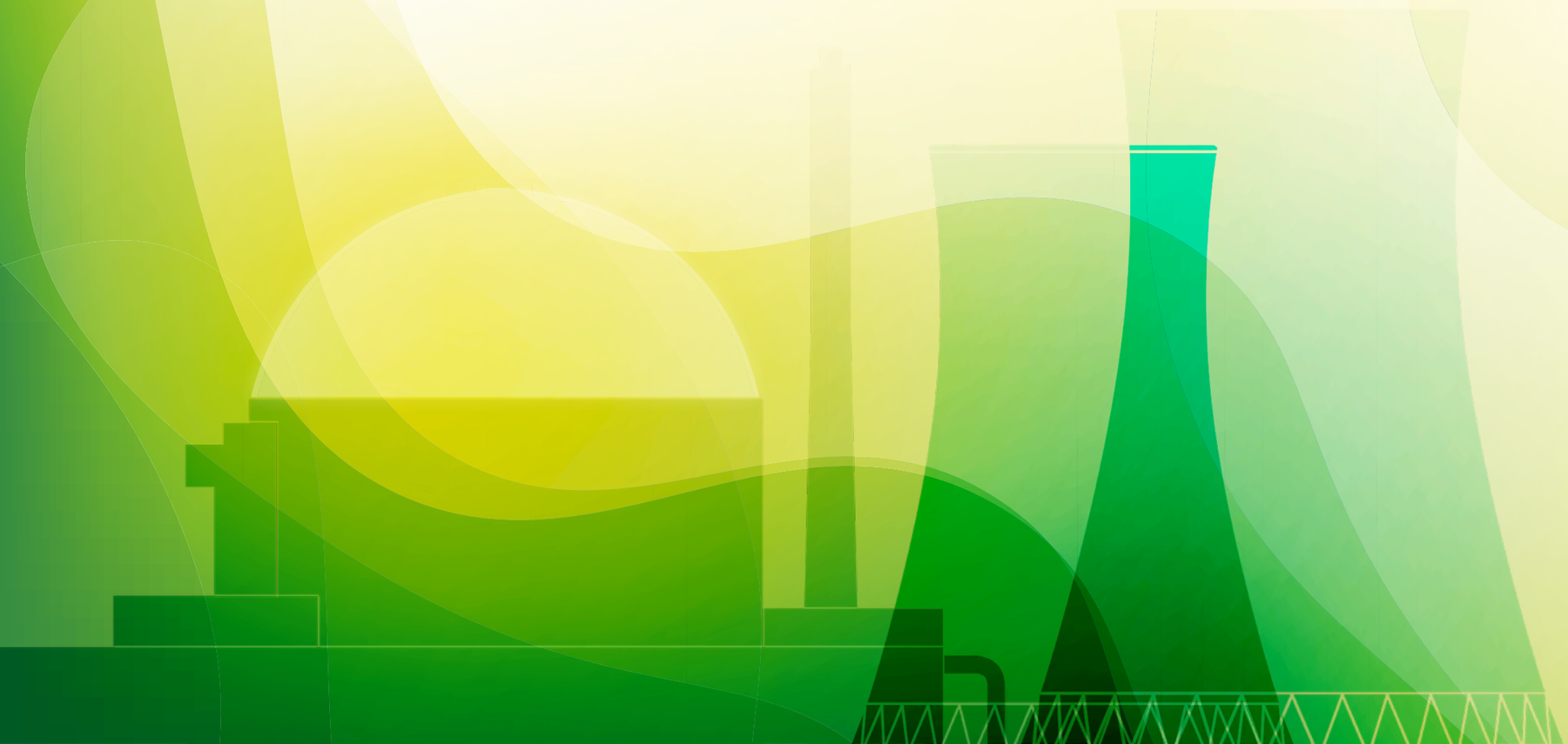
# ENVIRONMENTAL REPORT CNAT 2022

ALMARAZ TRILLO



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# Almaraz & Trillo nuclear power plants

## Owner companies

The owner companies of the Almaraz and Trillo Nuclear Power Plants established in 1999 the Economic Interest Grouping known as *"Centrales Nucleares Almaraz-Trillo, A.I.E." (hereinafter "CNAT")* with the aim to jointly operate, manage and administer both stations. Their shares in each station have remained unchanged since then. Currently, in application of *Royal Decree Law 13/2014, CNAT* also holds ownership of the Operating Licenses for these facilities.

The shares of owner companies in the combined installed power of both power plants, is as follows:

Iberdrola
51,44%

endesa
24.18%

Naturgy
19.14%

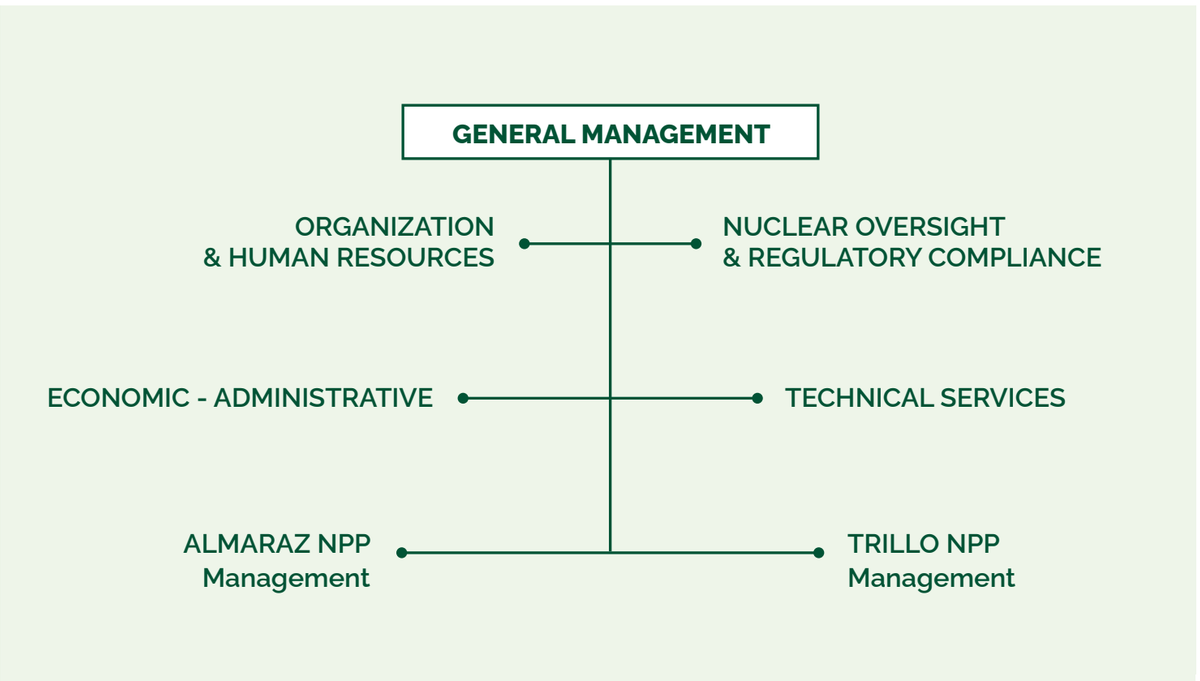
edp
5.24%

## Organizational Structure

The structure of *CNAT* is based on the creation of a single organization, with management unity, clear definition and accurate allocation of roles and responsibilities.

The Company's governing bodies are the Members' Assembly, which includes the owner companies, and the Board of Administrators, which is comprised of representatives from each owner company.

The basic organization chart of *CNAT* is as follows:



# Main Power Plant Features

### ALMARAZ NUCLEAR POWER PLANT (U1-U2)

The Plant is located in the municipality of Almaraz de Tajo (Caceres, Spain). The land owned by the station covers a surface area of 1.683 hectares, located in the municipalities of Almaraz, Saucedilla, Serrejon and Romangordo.

The station has two nuclear reactors, each with a cooling circuit made up of three loops, each of which is equipped with a cooling pump and a steam generator. Both cooling circuits are contained within their respective containment in each reactor building.

Steam from generators is driven to the turbine building, which houses both turbine-generator sets in the same room, although each of them is independent from the other. The Arrocampo reservoir, cold source specially built for this purpose, is common to both units and supplies water to the cooling intake.

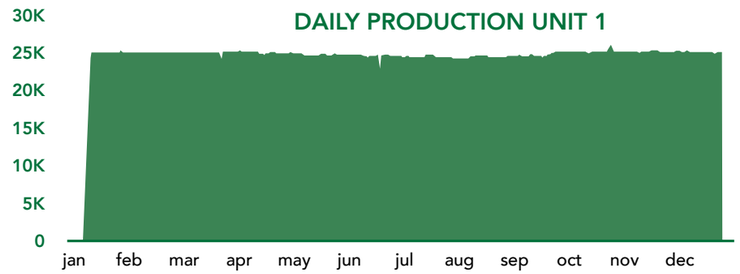
The following table shows the main technical features of the plant:

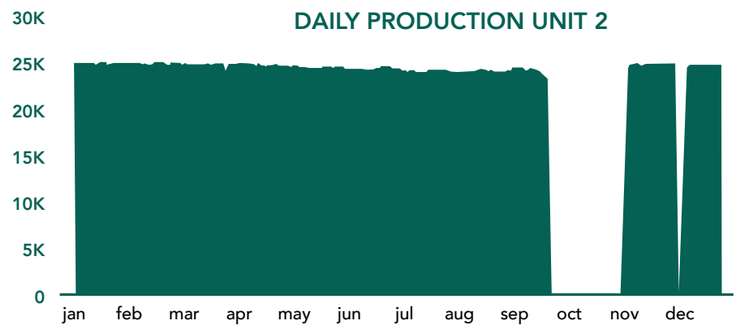
## ALMARAZ NPP DAILY PRODUCTION 2022 (MWh)

In 2022, the gross power generated between both Almaraz Nuclear Power Plant units amounted to 16,682.93 million kWh, whereas the joint net generation reached 16,032.95 million kWh.

Individually, the gross power generation of Unit 1 was 8,766.60 million kWh, whereas for Unit 2 it amounted to 7,916.33 million kWh.

The following graphs show the daily gross generation of both units throughout 2022.




# Almaraz NPP (U1-U2)

**TECHNICAL FEATURES**

**Reactor Type**
Pressurized Water Reactor (PWR)

**Supplier**
Westinghouse

**Thermal Power**
2,947 MWt (U-I) - 2,947 MWt (U-II)

**Fuel**
Enriched Uranium Dioxide ($UO_2$)

**Number of Fuel Assemblies**
157

**Gross Electric Power**
1,049.43 MWe (U-I) - 1,044.45 MWe (U-II)

**Net Power Generation**
1,011.30 MWe (U-I) - 1,005.83 MWe (U-II)

**Cooling**
Open circuit. Arrocampo Dam

**OWNERS**

*Iberdrola Generación Nuclear, S.A.U.* **(52.7%)**

*Endesa Generación, S.A.U.* **(36%)**

*Naturgy Generación Térmica, S.L.U.* **(11.3%)**

**LOCATION**
Almaraz (Cáceres)

**START OF COMMERCIAL OPERATION**
September 1, 1983 (U1) – July 1, 1984 (U2)

**OPERATING LICENSE VALID**
until November 1, 2027 for Unit 1,
and until October 31, 2028 for Unit 2

**CYCLE DURATION**
18 months for both units

# Main Power Plant Features

### TRILLO NUCLEAR POWER PLANT

Trillo Nuclear Power Plant is located in the Alcarria region, next to the course of the Tagus River, in an area known as *"Cerrillo Alto"* in the municipality of Trillo (Guadalajara). Trillo NPP is the most modern power plant within the Spanish nuclear fleet, with an installed power of 1,066 MWe.

The station has a pressurized water reactor with a thermal power of 3,010 MWt and three cooling loops of German Siemens-KWU technology, using enriched uranium as fuel.

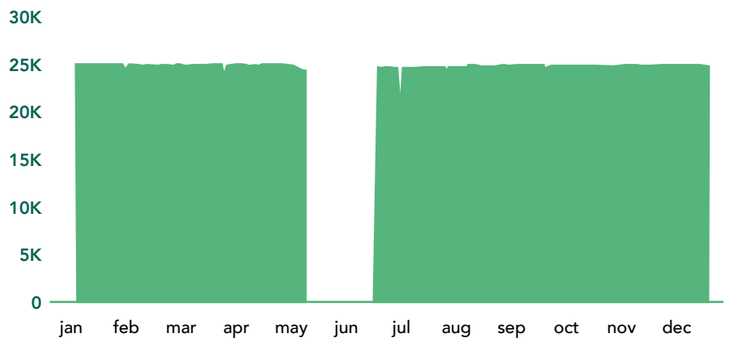
Unlike the Almaraz Nuclear Power Plant, two natural draft cooling towers are used for cooling, whereas a water collection channel and its corresponding booster pumps are used to cool the condenser and lift water inside the towers. The water flow evaporated by the towers is compensated by the weir water intake located on the Tagus River.

The following table shows the main technical features of the plant:

### TRILLO NPP DAILY PRODUCTION 2022 (MWh)

The gross power generation of Trillo Nuclear Power Plant from January 1 to December 31, 2022, amounted to 8,224.07 million kWh, with 7,679.73 million kWh corresponding to the net generation during this period.

The following graph shows the daily power generation over the year 2022.




# Trillo NPP

### TECHNICAL FEATURES

**Reactor Type**
Pressurized Water Reactor (PWR)

**Supplier**
KWU

**Thermal Power**
3,010 MWt

**Fuel**
Enriched Uranium Dioxide ($UO_2$)

**Number of Fuel Assemblies**
177

**Gross Electric Power**
1,066 MWe

**Net Power Generation**
1,003 MWe

**Cooling**
Natural Draft Cooling Towers (Tagus River)

### OWNERS

*Iberdrola Generación Nuclear, S.A.U.* **(49%)**

*Naturgy Generación Térmica, S.L.U.* **(34.5%).**

*Iberenergía, S.A.U.* **(15.5%).**

*Endesa Generación, S.A.U.* **(1.0%).**

### LOCATION

Trillo (Guadalajara)

### START OF COMMERCIAL OPERATION

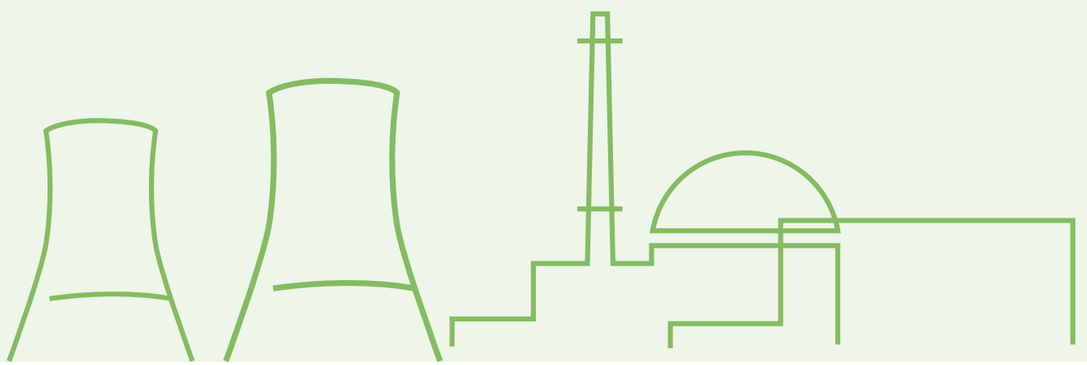
August 6, 1988

### OPERATING LICENSE VALID

November 17, 2014 for a period of 10 years

### CYCLE DURATION

12 months



# Mission, Vision, Strategic Pillars

CNAT's Mission is to generate electricity in a safe, reliable, economically sound and environmentally friendly manner, ensuring long-term operation by means of optimal operation of Almaraz and Trillo nuclear power plants.

Our Vision is aimed at placing Almaraz and Trillo nuclear power plants amongst the best in terms of safety, quality and costs, using a management model in which individual participation and development favors higher safety, productivity and efficiency standards.

To achieve its mission and move forward on the course set by its Vision, CNAT develops its strategy based on the following strategic pillars:

# Environmental quality management

In order to achieve its mission within a socially responsible framework, CNAT has different corporate policies which establish working guidelines for the entire organization.

The Environmental Policy drives ongoing performance improvement and the application of the Environmental Management System, reflecting Management's commitment and constituting the guiding principle from which environmentally-related annual target programs and business activities in general, are derived.

Each and every department within the organization have taken onboard CNAT's environmental policy, integrating the commitment of respect for the environment within their processes.

The policy established by the organization is presented below:

## Environmental policy

CNAT's environmental policy is defined according to its organizational goal and context, taking into consideration the environmental nature, magnitude and impacts of activities, products and services, and establishing itself as the master reference framework of its Environmental Management System, which sets and reviews environmental targets.

The policy establishes the following commitments:

- To fully integrate environmental aspects into the organizational strategy with the aim to ensure protection of the environment, preservation of the natural setting and prevention of contamination.
- To improve continuously all processes with environmental consequences.
- To know and assess the environmental risks and opportunities of activities carried out, with the aim to ensure expected results are achieved.
- To comply with applicable environmental regulations and requirements voluntarily subscribed, keeping an attitude of ongoing compliance.
- To integrate environmental management in all organizational activities and levels, including design, supply, operation and maintenance; identifying, preventing, controlling and minimizing their environmental impact as much as possible:
  - USING primary materials and energy rationally, and minimizing the generation of waste and conventional and nuclear effluents.
  - AVOIDING inadequate stockpile of waste and effluent discharge in non-authorized places.
  - CONSIDERING the development or application of new technologies to improve efficiency in the generation of electrical power, in the research of environmental aspects and in the promotion of energy savings.
- To motivate, inform and train personnel on the importance of respect for the environment, fostering the development of an environmental culture and disseminating the Environmental Policy in and out of the Organization, including collaborating companies.
- To be transparent in the sharing of information on environmental results and actions, ensuring the availability of channels needed to favor communication with stakeholders.
- To implement and maintain an updated, standardized Environmental Management System.

In line with this Policy, CNAT's Environmental Management System was certified by AENOR INTERNACIONAL SAU back in 2005, in accordance with the international standard UNE-EN-ISO 14001 (certification number GA-2005/0519).

This three-year certificate was last renewed in 2020, as required by standard UNE-EN-ISO 14.001:2015, valid until November 2023.

This way CNAT is able to use its Environmental Management System to identify organizational and environmental risks and opportunities which need to be addressed every year, considering environmental aspects, legal requirements and other voluntarily subscribed requirements, internal and external organizational issues, as well as stakeholder needs and expectations. All these considerations are managed by means of specific prevention and mitigation tools in the case of risks, and through action plans when it comes to opportunities.

Furthermore, CNAT's environmental management includes the identification and evaluation of environmental aspects based on the life cycle perspective, with the aim to identify and assess the aspects with greater impact on plant activities.

# Action lines

Regarding environmental aspects, in 2022 CNAT further carried out important actions included within the Environmental Management Program, such as the following:

- Actions aimed at minimizing the production of low and intermediate radwaste: strengthening material declassification processes (used oil, active carbon, metals and others).
- Definition and implementation of action lines aimed at minimizing the generation of hazardous and non-hazardous waste in both stations.
- Improvement to contamination prevention systems: enhancements to the gas-oil containment system to prevent a potential diesel generator spillage in the Alternative Emergency Management Center (Spanish acronym: CAGE) building at Trillo NPP.
- Improvement of thermo-ecological conditions in the Arrocampo dam, through optimization of discharge line temperature control and progressive repair of thermal separation screen sections at Almaraz NPP.
- Actions aimed at reducing the risk of legionella by replacing the filling in cooling towers (TEVA).
- Reduction of greenhouse gas emissions through the analysis of fluorinated gas leaks in cooling systems.

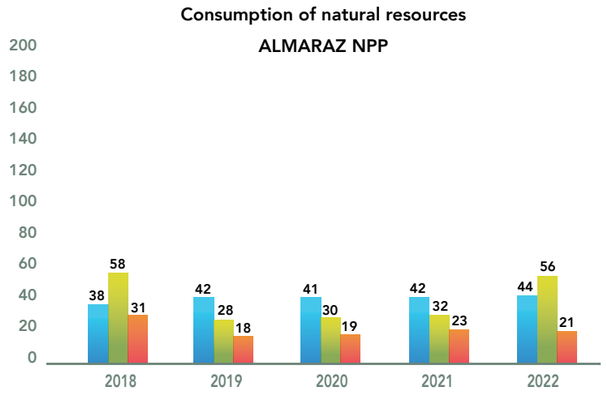
# Environmental management results

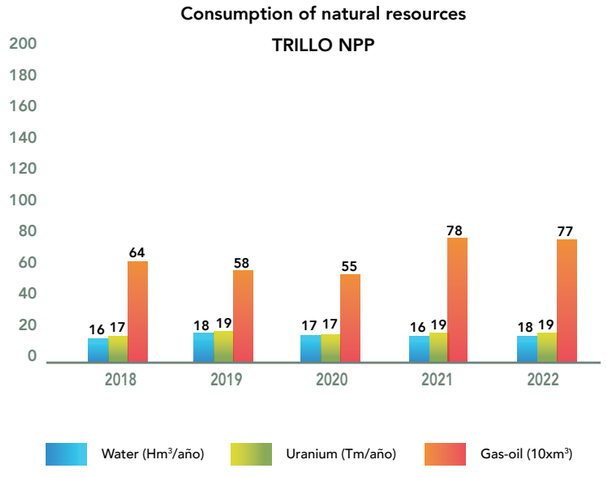
The Nuclear Power Plants of Trillo and Almaraz generate electricity from the fission of slightly enriched uranium atoms. Thermal energy resulting from uranium fission is used to produce the steam that drives the turbine, which, in turn, moves the electrical generator.

The basis for developing an adequate and effective environmental management system is the correct identification of all "elements in our activities, products and services which might interact with the environment", that is, the so-called environmental aspects, which are evaluated by CNAT to determine their impact and establish control measures aimed at managing them and guaranteeing environmental protection.

The main aspects are grouped into the categories presented below.

It is also important to point out that, similarly to previous years, the most relevant environmental aspects are related to the generation of radwaste and spent fuel, consumption of resources (cooling water), generation of hazardous waste and water quality (physical-chemical discharge and thermal discharge).




## Consumption of Material Resources

This category of Environmental Aspects refers to the use of abiotic resources, both within the main power generation process, as well as in auxiliary services.

The main consumption levels correspond to:

- Water.
- Enriched uranium.
- Gas-oil.
- Chemicals.

### Water consumption

Nuclear power plants need a water source as a primary circuit coolant to facilitate the condensation of steam which, after expanding in the turbine, drives the electrical generator to produce electricity. A small part of that condensation is consumed during in-house processes due to evaporation, whereas the remaining one is returned to the recipient natural environment.

Water consumption is directly related to the number of operating power plant hours and, therefore, to the generation of electricity. It is important to point out that water consumption depends not only on the cooling needs and operating regime of the power plants, but also on weather conditions (mainly temperature and humidity) because, during the summer months, increased temperature and evaporation entail a need to consume larger volumes of water.

Almaraz NPP and Trillo NPP are supplied with cooling water from the Tagus River, which is why both stations have the corresponding water collection permits granted by the Tagus River Water Authority.

On the other hand, there is additional water consumption for consumptive uses, mainly to do with plant supplies such as irrigation, FP, sanitation and circuit makeup. The latter includes, in the case of Almaraz NPP, makeup to compensate for evaporation in the turbine cooling system towers.

Both stations have a discharge point into the Tagus River, through which water used but not consumed, is returned to the environment.

Station effluents are treated before discharge into the receiving environment, undergoing thorough monitoring of physical and chemical parameters.

The totals consumed during the year and the above-mentioned applications (cooling and consumptive) in both stations, are presented below.

| WATER IN-TAKE | | QUANTITY Year 2022 (m³) |
|---|---|---|
| | | **TRILLO NPP** |
| Cooling needs | (EVAPORATED: Tagus River In-take – Discharge) | 17,495,714 |
| Consumptive use | (Cifuentes River In-take) | 57,120 |
| | | **ALMARAZ NPP** |
| Cooling needs | (EVAPORATED: Calculate Arrocampo Dam & Cooling Towers) | 43,360,243 |
| Consumptive use | (Gross Tagus River Water Intake) | 1,001,349[1] |

[1] The evaporated value included on the table is obtained from the cooling tower circuit in the case of Trillo Nuclear Power Plant, whereas for Almaraz Nuclear Power Plant it is taken from the Arrocampo dam and discharge line cooling towers, also used to refrigerate the plant.

### Uranium Consumption

The fuel used by the stations to generate electricity is enriched **uranium**, which is placed inside the reactor. Uranium consumption is directly related to the number of operating power plant hours.

Uranium is conditioned to form fuel assemblies which are then inserted into the nuclear reactor vessel. Core design (layout of fuel assemblies inside the reactor) is ultimately intended to ensure safety and reliability, and to comply with licensing parameters and criteria. Once this basic premise is achieved, the aim of core design is to optimize uranium consumption and to extract as much energy as possible

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### Gas-Oil Consumption

**Gas-Oil B** is used in both stations mainly for the emergency power generation system (diesel engines which would kick in should a total loss of offsite AC power supply occur), auxiliary shutdown steam (boilers only at Trillo Nuclear Power Plant).

Another type of fuel used is **gas-oil A**, used mostly by company vehicles and during exercises in the Firefighting field.

Specific gas-oil consumption in 2022 was as follows:

| GAS-OIL CONSUMPTION | QUANTITY Year 2022 ($m^3$) | |
|---|---|---|
| | ALMARAZ NPP | TRILLO NPP |
| Gas-oil B | 166.9 | 748.1 |
| Gas-oil A | 38.9 | 21.0 |

### Chemical Consumption

Almaraz and Trillo nuclear power plants store onsite various chemical products needed to guarantee the quality and purity of cooling circuit water and cycle make-up water. The most widely used chemicals are as follows: sulfuric acid, sodium hydroxide, sodium hypochlorite and ammonia.

The consumption of these chemicals is directly related to the amount of consumed and collected water, which in turn requires greater regulation of chemical parameters to ensure proper treatment.

CNAT strives to make an efficient use of materials, minimizing waste generation and environmental pollution, as proven by the implementation of environmental objectives referred to in the waste section and aimed at reducing chemical leaks through the improvement of specific plant areas.

The consumption of the main chemicals used onsite, expressed as a quantity of pure product, is shown below.

| CHEMICAL CONSUMPTION | QUANTITY Year 2022 (t of pure product) | |
|---|---|---|
| | ALMARAZ NPP | TRILLO NPP |
| Sulfuric acid | 72.15 | 4,715.58 |
| Sodium hydroxide | 12.03 | 39.06 |
| Sodium hypochlorite | 13.96 | 176.04 |
| Ammonia | 61.99 | 0.27 |
| Oils | 44.44 | 18.03 |

Based on the previous table, it is important to mention that in Trillo NPP sulfuric acid consumption is significant, as this chemical is used in the cooling tower circuit to maintain required chemical conditions (prevention of calcium carbonate fouling). The same system also consumes a significant amount of sodium hypochlorite as biocide.

As for ammonia, it is used in Almaraz NPP as an alkalizing agent in the secondary circuit (water - steam), whereas in Trillo NPP its consumption is lower due to the characteristics of this system.

### Energy consumption

The direct energy consumed within the operational limits of the power plants comes from primary sources: uranium (for the most part) and gas-oil.

From uranium, another intermediate form of energy is generated: electricity.

A part of the electricity generated by both stations is used for in-house power consumption (because most equipment and activities onsite require power for their daily operation), whereas the remaining generation is sold onto the Energy Market.

Direct energy consumption is detailed below:

| POWER CONSUMPTION | AMOUNT Year 2022 (GJ) | |
|---|---|---|
| | ALMARAZ NPP | TRILLO NPP |
| Fuel: Uranium | 181,995,665 | 89,717,138 |
| Fuel: Gas-oil B | 6,129.56 | 27,471.77 |
| Fuel: Gas-oil A | 1,405.47 | 758.55 |
| Auxiliary Electricity (Self-consumption) | 2,339,913 | 1,959,602 |

# Conventional Emissions to the Atmosphere

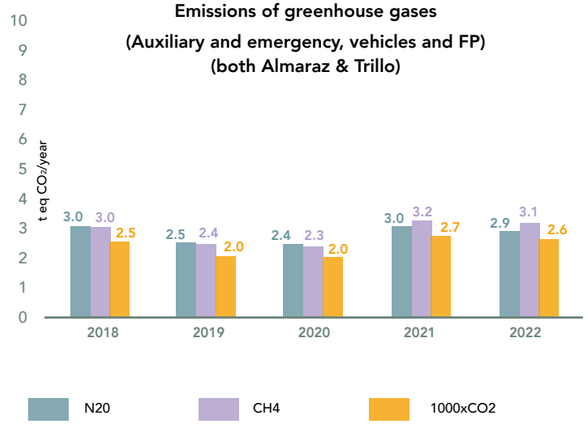
### Emissions from combustion activities

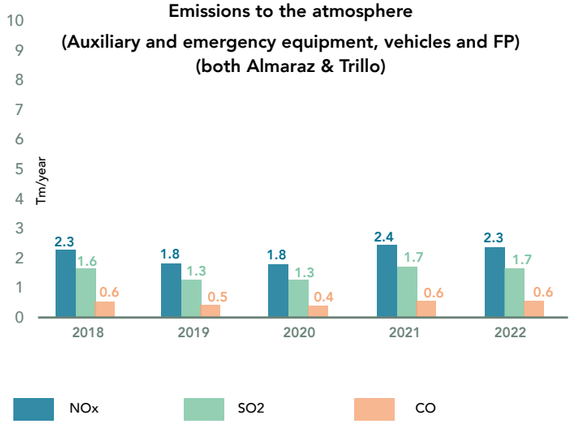
No greenhouse gases or other combustion products contributing to the greenhouse effect are generated in the nuclear power generation process.

However, the use of gas-oil B as fuel, mainly to power auxiliary boilers and emergency diesel units, causes the generation of atmospheric pollutants, including a small amount of greenhouse gases which are released into the atmosphere. Transport-induced emissions, mainly resulting from the use of vehicles and fire-fighting training activities, are also considered.

It should be noted that the operating regime of these combustion sources is not continuous because, during normal operation, diesel generators are started up only to conduct periodic tests or maintenance work, whereas normal operation of auxiliary boilers (only at Trillo NPP) occurs only during refueling outages with the aim to supply auxiliary steam.

The following graph shows an estimate of greenhouse gas **emissions from diesel combustion** ($CO_2$, $CH_4$, $N_2O$), expressed in metric tons of equivalent $CO_2$ (teq $CO_2$)[3], using the methodology and emission factors of Spain's Ministry for Environmental Transition and Demographic Challenge described in the "Carbon Footprint Calculator" for organizations[4].




The basic indicators of total emissions into the air are the annual quantities of sulfur dioxide ($SO_2$), nitrogen oxides (NOx) and CO emitted into the atmosphere from the consumption of gas-oil A and B, expressed in metric tons, calculating them according to the emission factors published on EMEP/EEA air pollutant emission inventory guidebook 2019.

### Emissions of fluorinated gases

Ozone depleting substances have a marginal presence at CNAT and are found in some cooling systems which still contain HCFCs. These equipment and systems are maintained according to the provisions of current regulations.

In compliance with Regulation (EC) No 1005/2009 on substances that deplete the ozone layer, CNAT has striven to replace equipment containing HCFCs with HFC-type gases at both plants over the years.

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[2] Actual annual uranium consumption is expressed as the thermal energy used in relation to the total reactor-generated energy which is then transformed into electricity, considering an average efficiency of 33%.
Auxiliary electricity for self-consumption is determined as the difference between gross energy and net energy generated at both stations. GJ conversion: 1 kWh = 0.0036 GJ.
Source of Lower Calorific Value (LCV) for gas-oil: MITECO, "Emission factors: Records on carbon footprint, offsetting and carbon dioxide absorption projects", dated April 2022.

[3] The conversion factors used to express these greenhouse gas emissions in metric tons of equivalent CO2, are those published by the IPCC in the Fifth Assessment Report on Climate Change (2013) and correspond to the potential values of global warming for CH4 and N2O relative to CO2 for a 100-year horizon.

[4] https://www.miteco.gob.es/es/cambio-climatico/temas/mitigacion-politicas-y-medidas/calculadoras.aspx.

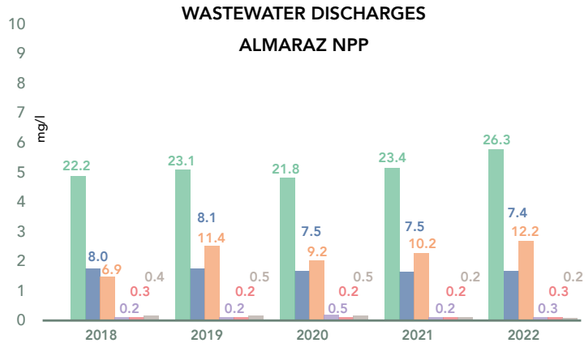
As for the use of greenhouse gases, they are present in HFCs of cooling equipment, air conditioning units, FP and SF6 in high voltage breakers. The only emissions to the atmosphere from these products would be those derived from possible losses, which is why both Almaraz NPP and Trillo NPP carry out preventive and corrective controls and maintenance to prevent leaks in accordance with current regulations.

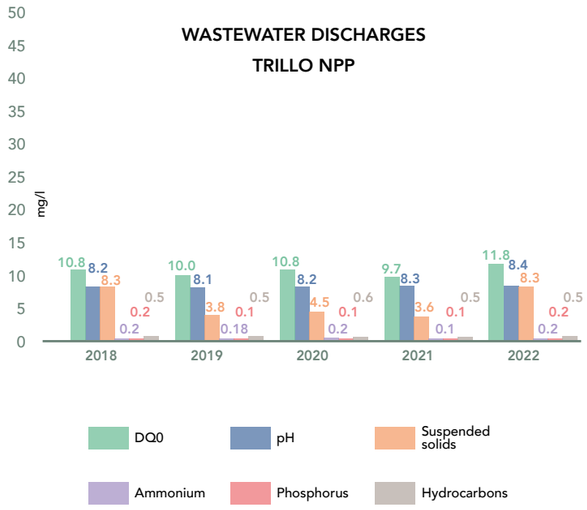
## Conventional Liquid Effluents - Physical-Chemical Discharge

To guarantee proper physical and chemical water quality prior to discharge into the receiving environment, both stations have wastewater treatment plants and a collection network for all liquid effluents, with exhaustive monitoring of physical and chemical parameters.

Water discharge activities are also regulated and have to be authorized by the Tagus Water Authority. On a monthly basis, samples are taken by an Inspection Body for analysis and verification of compliance with applicable limits.

The following graphs show the evolution of key parameters limited by their corresponding discharge permits. These parameters are sent monthly to the Tagus Water Authority.



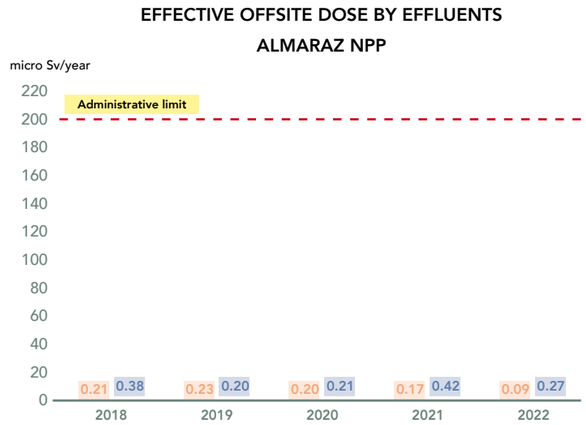



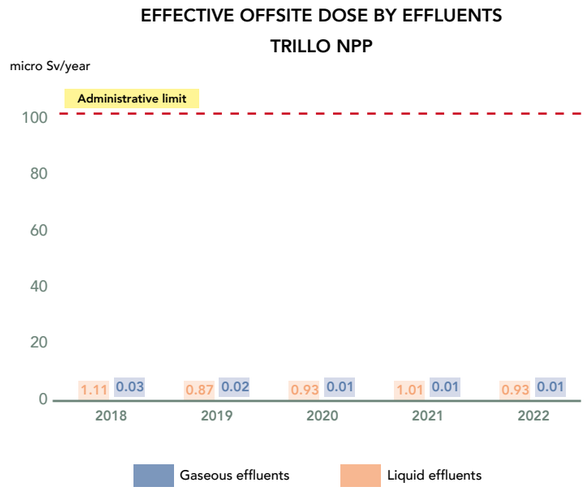

## Radiological Releases from Gas and Liquid Effluents

Radiological releases offsite, both atmospheric and liquid, are limited within the framework of the Operating License and regulated according to existing standards of Spain's Nuclear Regulator (CSN).

Offsite doses caused by liquid and gaseous effluents from both stations remain at very low values, clearly under thresholds required by the CSN and specified on the corresponding Offside Dose Calculation Manuals. These doses are negligible compared to those from the natural radiation background (attached graphs show the year-on-year evolution).

The natural radiation background is between 700 to 1,200 μSv/year near the sites, while doses deriving from plant operation range between 50 to 100 times lower in the most unfavorable scenario. Realistic dose calculations, which take into account human geography and actual activities in the area, yield values even lower than those above-mentioned. Thus, it is concluded that plant operation has a negligible contribution to environmental radiation.

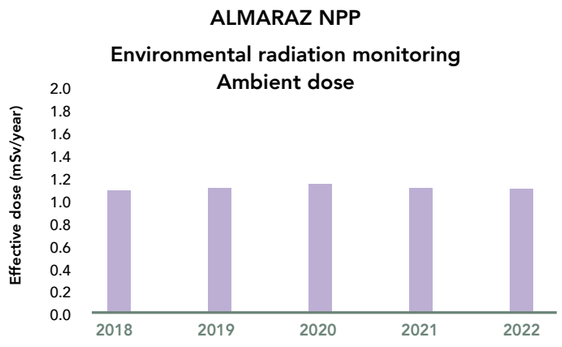


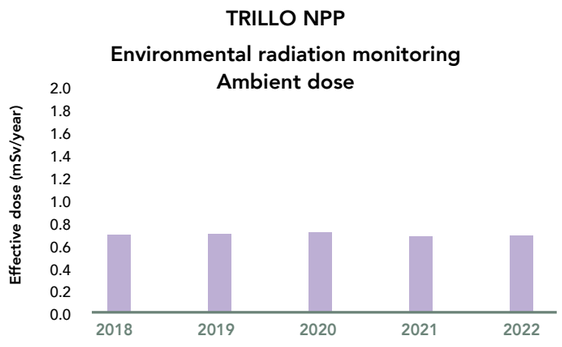




The stations have Environmental and Radiological Monitoring Programs aimed at detecting possible radiological impacts on the environment.

**Doses measured within the Framework of Environmental Radiation Monitoring Programs**

The existing Environmental and Radiological Monitoring Programs provide information on the evolution of dose values measured around both stations.




# Waste Generation

As a result of their activities, the Nuclear Power Plants of Almaraz and Trillo generate hazardous waste, non-hazardous waste, Low and Intermediate Level radioactive Waste (LILW) and Very Low Level radioactive Waste (VLLW). All this waste is identified, stored and managed according to existing regulations and Environmental Management System procedures.
In addition to the above-mentioned waste, High Level Waste is generated during refueling outages onsite. Approximately one third of fuel assemblies in the reactor vessel are removed and transferred to the spent fuel pools after their replacement with fresh fuel.

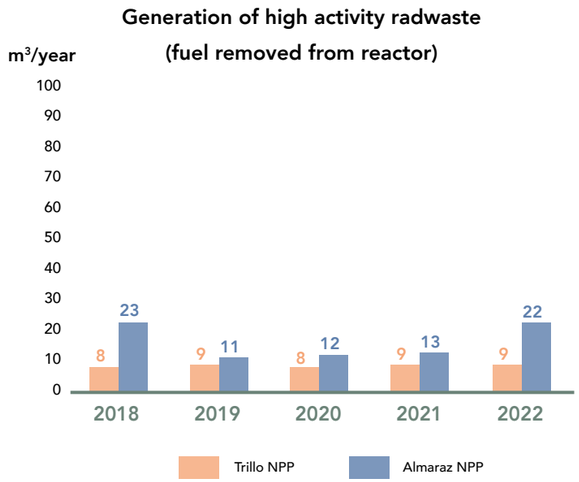
**High Level Waste**

In 2022, a total of 160 spent fuel assemblies were removed from the reactors: 40 fuel assemblies from Trillo NPP and 120 assemblies from Almaraz NPP (60 from Unit 1 and 60 from Unit 2), all of them replaced with fresh fuel assemblies. The volume of fuel removed from both station is approximately 31.12 $m^3$.

The spent fuel is stored onsite, in designated pools inside the controlled area. By December 31, 2022, a total of 1,540 spent fuel assemblies of Almaraz NPP Unit 1, 1,596 of Almaraz NPP Unit 2 and 608 of Trillo NPP, were stored. In addition, both stations now have an Individualised Temporary Storage Facility (ITS) enabling dry storage inside double-purpose storage-transport casks.

At the end of 2022, a total of 800 fuel assemblies were stored in 36 casks at Trillo NPP and 256 spent fuel assemblies were stored in 8 ENUN-32P casks at Almaraz NPP.

The graph shows the evolution of spent fuel generation at both stations over time. The higher values at Almaraz NPP correspond to periods coinciding with two refueling outages in the same year.




**Very Low Level Waste and Low and Intermediate Level Waste**

This type of waste is a consequence of plant operation and maintenance of the plants, during activities carried out in the radiologically controlled area. They include both depleted filtration and purification coolant means, as well as maintenance materials, coveralls and protective clothing.

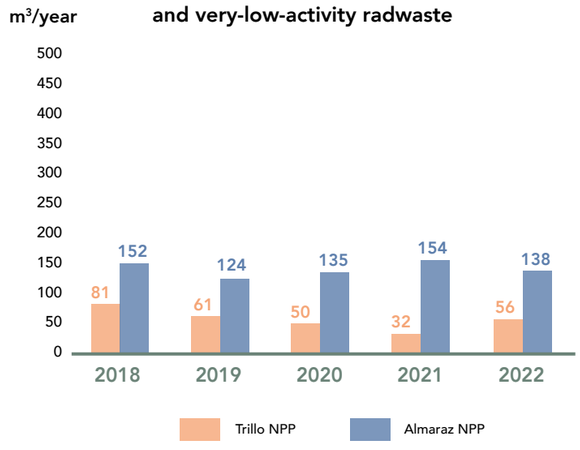
Depending on the specific activity (concentration) of their radionuclides, radioactive wastes can be classified as LILW or VLLW. All waste types have been optimized since the beginning of operation of the plant, making use of state-of-the-art working procedures and waste treatment and conditioning facilities, and fostering amongst all station personnel an environmental culture aimed at reducing, sorting and recycling (where possible) all waste materials. As a result of waste sorting measures implemented in recent years, the content of radioactive isotopes in the waste is being reduced and its concentration is decreasing, thus favoring waste classification.

Low and Intermediate Level Waste is treated at the stations to facilitate its final disposal. Each type of waste, depending on its origin, has a specific conditioning process. The main waste products are as follows:

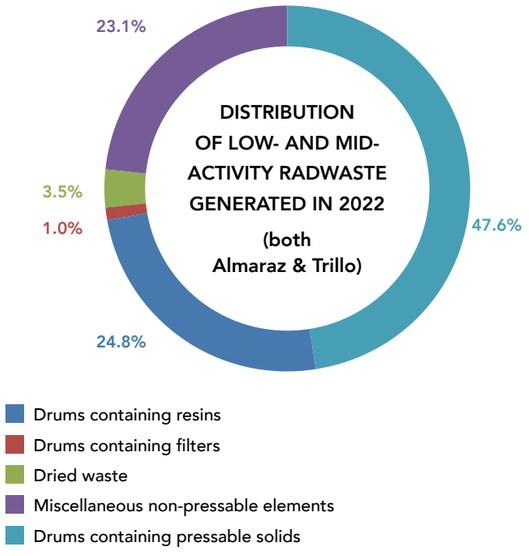
- Heterogeneous solid waste.
- Dried waste from boiler concentrate.
- Pressable solid waste.
- Depleted ionic-exchange resins.
- Depleted filters.
- Boiler concentrate.

In 2022, Almaraz NPP generated 54.56 $m^3$ of Low and Intermediate Level Waste (LILW) and 85.11 $m^3$ of Very Low Level Waste (VLLW), whereas in Trillo NPP the volumes were 46.20 $m^3$ and 9.68 $m^3$ respectively. The graph includes the joint evolution of this waste generation.

**Generation of low- and mid- activity, and very-low-activity radwaste**




The diagram shows the proportional distribution of each category.




Low and Intermediate Level Waste and Very Low Level Waste, once conditioned and with the aim to make them suitable for final disposal, are temporarily stored at the stations and periodically removed by ENRESA (Spain's National Radwaste Company) to the El Cabril facilities in Cordoba.

During 2022, several waste shipments were made to El Cabril from each plant (150.70 $m^3$ sent by Almaraz and 62.04 $m^3$ by Trillo).

**Generation of Hazardous and Non-Hazardous Waste**

Non-radioactive industrial waste is generated too, mainly due to preventive maintenance on conventional machinery and equipment: oil changes, sludge from cleaning equipment, filters, containers, etc. All these activities result in the generation of different categories of Hazardous and Non-Hazardous Waste.

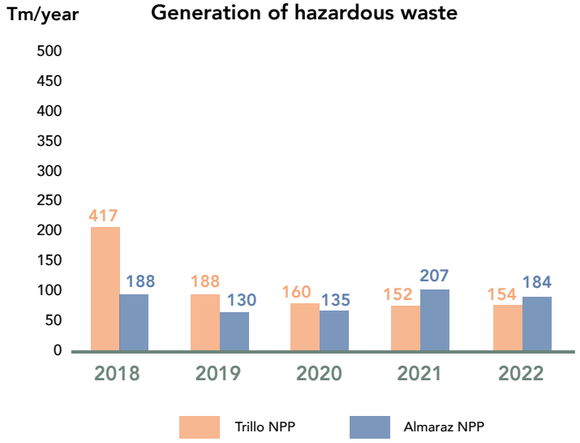
In exceptional cases, waste may also be generated as a result of design modifications, work implementation and uncommon corrective maintenance activities. This type of waste leads to fluctuations in historical series.

In line with the commitment to minimize waste generation, selective waste sorting is carried out to separate recoverable materials contained in waste, so that only residue which cannot be reused and/or recycled is sent for final disposal (landfill). To this end, plant personnel receive training and information to better sort generated waste at the source.

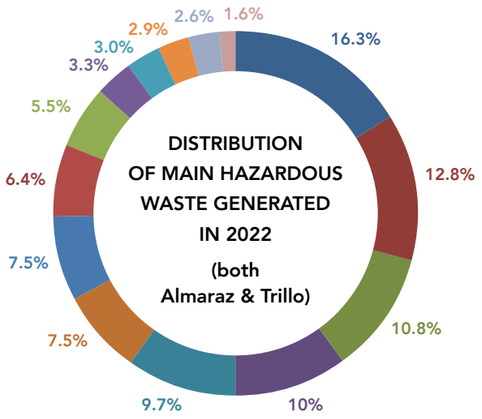
Hazardous waste is managed according to the corresponding Hazardous Waste Minimization Research guidelines for each plant.

The evolution of **Hazardous Waste** was as follows:

## Generation of hazardous waste




The following graph shows the proportion of each hazardous waste types in 2022:

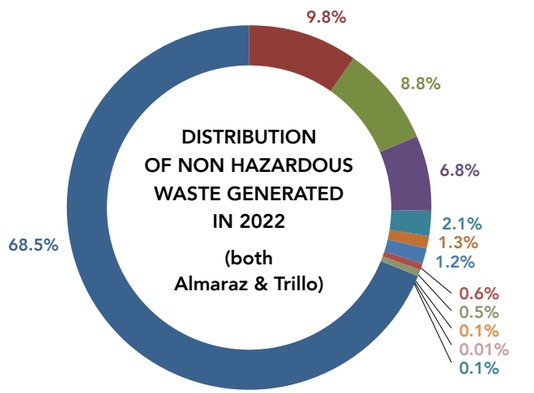



(It includes all waste generated amounting to over 5 metric tons)

- Machinery lubrication and motor oil
- Batteries
- Water mixed with other chemicals
- Water mixed with detergent or foaming agent
- Water with oil and hydrocarbons from separation facilities
- Other waste with hydrocarbons
- Declassified active carbon
- Diesel motor coolant
- Expirde or non-used chemicals
- Varnishes and paint which are expired or non-used
- Containers and packages which contained hazardous waste
- Water mixed with oil and sludge
- Absorbent material and rags
- Waster from disassembled components

As for **Non-Hazardous Waste**, the category most sensitive to extraordinary activities carried out onsite is rubble and Construction and Demolition Waste (CDW) generation, due to design modification works undertaken during the year.

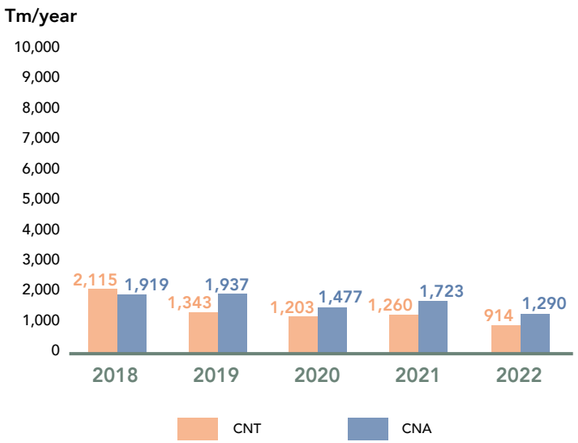
Another important contributor is the generation of sludge from makeup water pre-treatment at both stations. Following the commissioning of pre-treatment plants at Almaraz NPP and Trillo NPP in 2012, this non-hazardous waste is now generated routinely, as proportions in the following graph show compared to the remaining categories.




- Sludge
- Urban waste
- Scrap
- Plastics
- Wood
- Paper and cardboard
- Vegetable waste
- DCW and debris
- Waste from dissembled components (regular insulation, heat insulation and other)
- Flocculants and coagulants
- Ionic exchange resins and active carbon
- Tires out of service

The year-on-year evolution of Non-Hazardous Waste is shown below:

## Generation of non-hazardous waste



## Biodiversity

**Almaraz Nuclear Power Plant** is located in the region of Campo Arañuelo (Caceres, Extremadura), in an area bounded by the Tietar and Tagus Rivers.

Almaraz NPP covers a surface area of 428 hectares (excluding the fields flooded by the Arrocampo reservoirs), of which approximately 1,123,000 $m^2$ correspond to the industrial areas of the station, with the remaining surface area being mostly wooded land.

The area has a continental climate, with a scarce, irregular rainfall pattern, which makes the fields more prone to pasture than to farming. Meadow and irrigated land are the two predominant forms of land use. The site is close to a large number of environmentally protected areas, including the Monfragüe National Park SCI and SPA, as well as the grasslands of both the surrounding area and the Arrocampo dam.

**Trillo Nuclear Power Plant**, located in Castilla-La Mancha, in the Alcarria region (Guadalajara), next to the course of the Tagus River, covers a surface area of approximately 554 hectares, of which approximately 870,000 $m^2$ correspond to the industrial areas of the station, whereas the rest is mostly hilly land.

La Alcarria has a continental Mediterranean climate, typical of inland Iberian Peninsula areas, with strong changes in temperature: very hot summers and very cold winters, with low rainfall and occasional frost. The site of the power plant is located near the Upper Tagus Natural Park SCI and SPA.

## Flora and Fauna

Taking into account the principle of precaution, CNAT places great emphasis on strengthening knowledge on the environment, participating in different studies aimed at better understanding the behavior of species in the habitats where the stations are located. This is achieved within the framework of an Agreement signed with the University of Extremadura's Ecology Department of the Science Faculty, for development of scientific-technical work to monitor time-space structures and plant population successions around Almaraz NPP, as well as bird populations in the Arrocampo dam area.

It is also worth mentioning our collaboration with the University of Extremadura for an ornithological study of the Arrocampo SPA area, with implementation of various projects for local improvement and development. Furthermore, since filling of the Arrocampo dam began in 1978, a Monitoring and Control Plan including limnological and ichthyological studies, was established. Since then, these studies have been carried out uninterruptedly along the Arrocampo and Torrejon dams, in line with their corresponding permits.

More information on these studies is provided in the section on Environmental Monitoring Programs.

# Legislation

The facilities comprising CNAT are subject to compliance with a wide range of regulations, and are required to obtain the necessary administrative permits to carry out their activities, including wastewater discharges and waste generation, amongst other.

CNAT guarantees the legal compliance of its facilities through the application of a systematic approach ensuring the identification of and adherence to applicable environmental requirements.

The Environmental Management System includes an IT tool and monthly-updated legislative database which contains all legal or voluntary conventional provisions classified in the applicability scope of CNAT (including the corresponding detailed requirements).

The legal compliance verification process takes place every six months, reporting results to CNAT Management, more specifically to the Environmental Committees and to the Annual Management Board which reviews the Environmental Management System.

In terms of environmental legislation, the following laws were particularly relevant to our activities in 2022:

- Royal Decree 487/2022, **dated June 21,** on sanitary requirements for prevention and control of legionelosis.
- Law 7/2022, **dated April 8,** on waste and contaminated soils for a circular economy.
- Royal Decree 208/2022, **dated March 22,** on financial guarantees for waste.
- Extremadura Order **dated May 16, 2022**, establishing the period of high wildfire danger within the INFOEX Plan, regulating the use of fire and the activities that may cause a fire during this period in 2022.
- Law 2/2022, **dated February 18,** on Water in the Spanish Region of Castile-La Mancha.
- Law 4/2022, **dated April 22,** suspending the environmental water charge foreseen in Law 2/2022, dated February 18, on Water in the Spanish Region of Castile-La Mancha.
- Castile – La Mancha Order 15/2022, **dated January 22**, of the Regional Ministry for Sustainable Development, on Fishing Bans for 2022.
- Royal Decree - Law 29/2021, **dated December 21,** implementing urgent measures in the energy sphere to promote electric mobility, self-consumption and deployment of renewable energies.
- Royal Decree 1055/2022, **dated December 27,** on containers and container waste.
- Regulation (EU) 2022/2400 of the European Parliament and of the Council, **dated November 23, 2022,** amending Annexes IV and V to Regulation (EU) No 2019/1021 as regards persistent organic pollutants.
- Extremadura Order **dated October 11, 2022,** declaring the period of low wildfire danger within the INFOEX Plan, regulating the uses and activities which can result in a fire risk, developing general prevention measures and self-protection measures foreseen in the PREIFEX Plan, and regulating the procedure to grant exceptional approval to the burning of crop residues.
- Extremadura Order **dated November 9, 2022**, which declared the period of low wildfire danger within the INFOEX Plan, regulating the uses and activities which can result in a fire risk, developing general prevention measures and self-protection measures foreseen in the PREIFEX Plan, and regulating the procedure to grant exceptional approval to the burning of crop residues.
- Spain's Decree 132/2022, **dated October 26,** approving the Firefighting Plan of Extremadura.
- Castile - La Mancha Order 198/2022, **dated October 14,** of the Regional Ministry of Sustainable Development, amending the Order dated May 16, 2006, of the Regional Ministry of Environment and Rural Development, regulating wildfire prevention campaigns.
- Council Implementing Regulation (EU) No 2022/1203, **dated July 12, 2022,** amending Implementing Regulation (EU) 2016/1141 to update the list of invasive alien species of Union concern.
- Order dated November 7, 2022 on general fishing bans in the Spanish Region of Extremadura.
- Royal Decree - Law 14/2022, **dated August 1,** on economic sustainability measures in the areas of transport, fellowships and study grants, as well as measures to promote energy savings, energy efficiency and reduced energy dependency on natural gas.

# Environmental audits

CNAT's Environmental Management System has been certified by AENOR since 2005, in accordance with international standard UNE-EN-ISO-14001:2015. From September 19 to 23, 2022, a quality system certification follow-up audit was conducted by AENOR INTERNACIONAL S.A.U, whose auditors reviewed the stations of Almaraz and Trillo, as well as the activities carried out at the Headquarters. The audit outcome was "Compliant Assessment".

The Environmental Management Certificate, valid until November 28, 2023 (last renewal in 2020), recognizes the engagement of Management and the collective effort of the entire Organization over the years. However, each milestone of this nature should be seen as a new starting point towards a better environmental performance of the company.

Prior to the AENOR audit, an internal audit is carried out as part of the verification process required by the system. The audit corresponding to 2022 took place in June, with no non-conformities being detected.

The Spanish Regulator also performed a number of inspections at both stations to determine compliance with various environmental aspects.

IQNet
THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

AENOR has issued an IQNet recognized certificate that the organization:

CENTRALES NUCLEARES ALMARAZ-TRILLO, A.I.E.

Oficinas Centrales:
AV MANOTERAS, 46 BIS, EDIFICIO DELTA
NOVA 6
28050 - MADRID

Central Nuclear de Almaraz:
CR N-V, KM 199
10350 - ALMARAZ DE TAJO
(CACERES)

Central Nuclear de Trillo:
CERRILLO ALTO, S/N
19450 - TRILLO
(GUADALAJARA)

has implemented and maintains a

Environmental Management System

for the following scope:

Nuclear power generation.

which fulfills the requirements of the following standard

ISO 14001:2015

First issued on: 2005-11-28 Last issued: 2020-11-28 Validity date: 2023-11-28

This attestation is directly linked to the IQNet Partner's original certificate and shall not be used as a stand-alone document

Registration Number: ES-2005/0519

Alex Stoichitoiu
President of IQNet

Rafael GARCÍA MEIRO
Chief Executive Officer

AENOR

IQNet Partners*:
AENOR Spain AFNOR Certification France APCER Portugal CCC Cyprus CISQ Italy
CQC China CQM China CQS Czech Republic Cro Cert Croatia DQS Holding GmbH Germany EAGLE Certification Group USA
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IRAM Argentina JQA Japan KFQ Korea MIRTEC Greece MSZT Hungary Nemko AS Norway NSAI Ireland
NYCE-SIGE México PCBC Poland Quality Austria Austria RR Russia SII Israel SIQ Slovenia
SIRIM QAS International Malaysia SQS Switzerland SRAC Romania TEST St Petersburg Russia TSE Turkey YUQS Serbia

* The list of IQNet partners is valid at the time of issue of this certificate. Updated information is available under www.iqnet-certification.com

AENOR

Certificado del
Sistema de Gestión Ambiental

AENOR
Gestión Ambiental
ISO 14001

GA-2005/0519

AENOR certifica que la organización

CENTRALES NUCLEARES ALMARAZ-TRILLO, A.I.E.

dispone de un sistema de gestión ambiental conforme con la Norma ISO 14001:2015

para las actividades: La producción de energía eléctrica de origen nuclear.

que se realizan en: Oficinas Centrales: AV MANOTERAS, 46 BIS, EDIFICIO DELTA NOVA 6. 28050 - MADRID
Central Nuclear de Almaraz: CR N-V, KM 199. 10350 - ALMARAZ DE TAJO (CACERES)
Central Nuclear de Trillo: CERRILLO ALTO, S/N. 19450 - TRILLO (GUADALAJARA)

Fecha de primera emisión: 2005-11-28
Fecha de última emisión: 2020-11-28
Fecha de expiración: 2023-11-28

Rafael GARCÍA MEIRO
Director General

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Génova, 6. 28004 Madrid. España
Tel. 91 432 60 00.- www.aenor.com

IAF ENAC IQNet

# Environmental monitoring programmes

The stations of Almaraz and Trillo have historically implemented different environmental monitoring programs to confirm that both their radiological and conventional activities have no significant impact on the environment.

The content of these programs is as follows:

## Studies of the Environment Around Almaraz Nuclear Power Plant

Basically, two environmental studies are being carried out in the area around Almaraz nuclear power plant, including the Arrocampo and Torrejon dams::

- Ecological research of the aquatic ecosystem.
- Thermal research of the reservoirs.

The scope of these surveillance studies is far-reaching because the Arrocampo dam is considered as another plant system built exclusively to provide industrial cooling and ultimately final heat dissipation to Almaraz NPP. Thus, it is necessary to have an accurate understanding of Arrocampo dam features in terms of its cooling capabilities in the short and long terms, as well as to ensure intensive control and monitoring of its physico-chemical parameters (especially temperature) and biological parameters.

The main characteristics of the Arrocampo dam are as follows:

- → Capacity of 35.5 $hm^3$.
- → Very elongated shape, with a length of over 10 km, a surface area of 7.73 $km^2$ and predominantly shallow waters.

The dam is divided into two parts by a thermal separation screen which forces cooling water to travel approximately 25 km along the length of the dam with the aim to cool it down before returning to the cooling intake.

Natural water input to the Arrocampo dam is very low, as it is fed mainly by water pumped from the Tagus River.

Water fed into the Arrocampo dam from the Torrejon dam has a high load of nutrients, particularly phosphorus and nitrogen.

These nutrients, together with the water temperature effect, cause Arrocampo to have a significant biomass of planktonic organisms which must be controlled and monitored because their metabolic processes have an impact on water quality.

### Ecological Research of the Arrocampo and Torrejon Dams

The monitoring of aquatic ecosystems in both dams consists of two independent, coordinated research studies:

- Limnological survey.
- Ichthyological survey.

The sampling and analysis program of the limnological survey includes sampling and measurement points and is carried out with the frequency indicated in the table below:

| DAM | NUMBER OF SAMPLING POINTS | |
|---|---|---|
| | LIMNOLOGICAL SURVEY | ICHTHYOLOGICAL SURVEY |
| ARROCAMPO | 7 | 9 |
| TORREJÓN | 8 | 10 |
| VALDECAÑAS | 1 | - |
| ESENCIALES | 1 | - |
| SAMPLING MEASUREMENT FREQUENCY | Monthy/Seasonal | Quarterly |

These surveys help to determine ichthyofauna conditions, as well as the diversity and abundance of species taking into account their evolution over time. From a limnological point of view, plankton conditions and a wide variety of physico-chemical variables are closely monitored.

The results of both surveys, which are submitted to the Administration, suggest there is a dynamic equilibrium in the Arrocampo dam ecosystem, which is mainly impacted by plant operation power levels, physical-chemical characteristics and flow of the Torrejon inflow, and weather conditions in the area. This equilibrium situation has not undergone any significant changes in recent years. As for the Torrejon dam, its initial section is conditioned by zoning from deep water turbine flow from the Valdecañas dam, whereas the middle section is conditioned by recirculated flow from the Arrocampo dam and the final section by flow pumped from Tietar.

### Thermal Research of the Arrocampo and Torrejon Dams

The evolution of water temperature in the Arrocampo and Torrejon dams, as well as of measured values, is thoroughly monitored with the aim to know the thermal impact of plant operation on these bodies of water.

There are also online measurement and registration systems for temperature, pH, dissolved oxygen and water flow in the Arrocampo spillway, with the intent to confirm the adequacy of Arrocampo discharge parameters.

In compliance with water usage permit conditions, on a monthly basis the most relevant information on thermal dam conditions is sent to the Tagus River Water Authority, competent body of the Administration, so that it can have uninterrupted knowledge of dam status.

## Studies of the Environment Around Trillo Nuclear Power Plant

The environmental analysis of aquatic ecosystems around the Trillo power plant currently involves monitoring the Tagus River, into which water from the plant is discharged, and the Entrepeñas reservoir, downstream from the plant.

The analysis scope includes a water quality assessment to monitor physico-chemical properties and the content of metals and other undesirable substances, as well as the characteristics of other aquatic ecosystem elements such as sediments, benthic algae, phyto- and zoo-plankton and ichthyofauna.

The Tagus River water intake is supplied with water dammed in the Ermita weir, built to ensure makeup pumps could supply to a constant water volume to the station. Once water has been used for cooling purposes, it is discharged back into the river, immediately downstream of the weir by means of a diffuser system allowing complete mixing with the river flow.

The plant is located at the far end of the Upper Tagus area, known for considerable river flowrate variations due to a lack of regulation upstream which at times causes minor floods when rainfall is intense and leads to solids being dragged, something which negatively impacts water quality.

Other than that, Tagus water quality in the area of the station is generally good and can be classified as oligotrophic.

The Entrepeñas reservoir, located downstream of the power plant, is characterized by its low water level over the last few years, with significant level variations throughout the year. The Entrepeñas reservoir stores water mainly used to irrigate and generate hydro power and, together with the Buendia reservoir, they supply water to the Tagus-Segura water transfer.

The sampling and analysis program comprises 4 sampling points both upstream and downstream of the Ermita weir, including a point in the Entrepeñas reservoir, taking water samples on a monthly basis, as well as of sediments, benthic algae, phyto- and zooplankton and ichthyofauna on a quarterly basis.

## Environmental Radiological Monitoring

The Almaraz and Trillo power plants continuously and strictly control and monitor their own radioactive effluent releases. Nevertheless, with the aim to experimentally verify the impact that their radioactive effluents might have on the environment, the stations implement an Environmental Radiation Monitoring Program (Spanish acronym, PVRA) which directly measures radiation levels near the station, as well as the content of radioactive substances in a series of environmental samples taken in a set of sampling points.

All abiotic elements and living organisms representative of the ecosystems in all natural areas around the plants (aerial, terrestrial and aquatic), are fully monitored.

The accuracy of analytical results is ensured through a quality control program carried out by an independent laboratory and also by an independent surveillance program (Spanish acronym, PVRAIN) carried out by the Spanish Regulator (CSN).

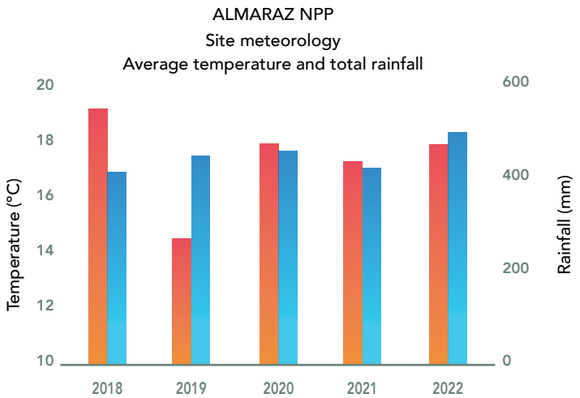
Furthermore, in the case of the Almaraz NPP, there is a collaboration agreement with CEDEX by which this official agency, which reports to the Ministry of Public Works, independently monitors the aquatic environment around the station. The Regional Government of Extremadura also monitors radiation independently through the University of Extremadura.

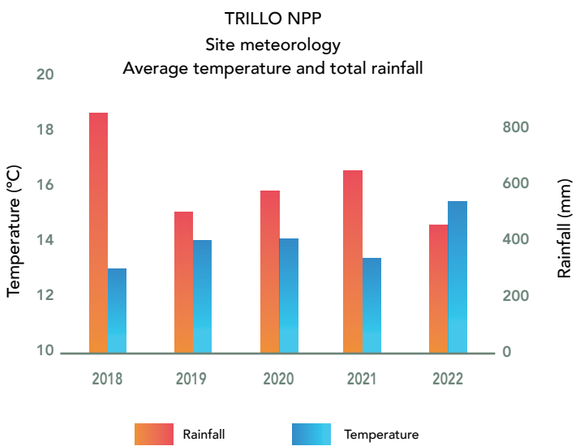
The results obtained in 2022 at both stations indicate that the radiological status of ecosystems in their vicinity has not changed significantly during the year. Natural background values have remained unchanged, thus confirming the absence of environmental effects caused by the release of radioactive effluents. These results were expected considering the nearly negligible radiological relevance of releases from both plants.

## Meteorological Studies

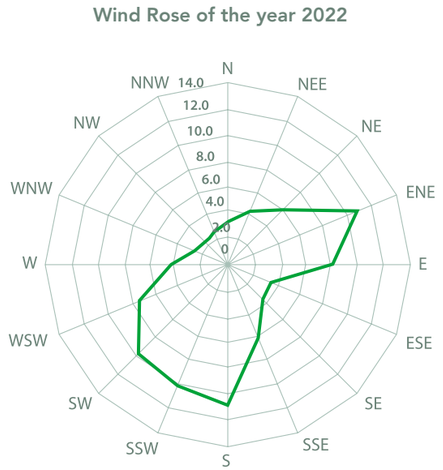
The nuclear power plants of Almaraz and Trillo have weather stations onsite which continuously measure and record key parameters, including temperature, rainfall, wind direction, wind speed, humidity and solar radiation. Meteorological information is very important for a number of environment-related applications. After more than thirty years monitoring and analyzing the meteorological conditions, the power plants have managed to accurately characterize weather patterns at their sites.

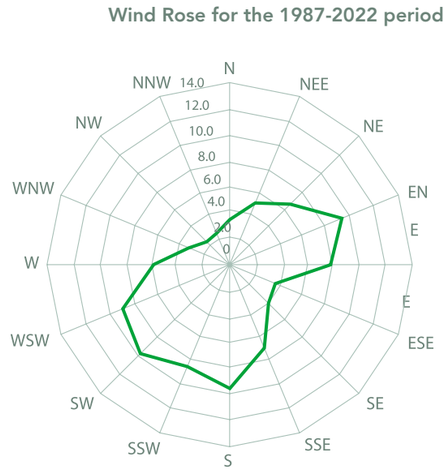
Both nuclear sites have the necessary redundancies to ensure ongoing availability of meteorological information. The average temperature and total rainfall values recorded during the last years in each plant, as well as the frequency compass rose for each wind direction, are presented below.



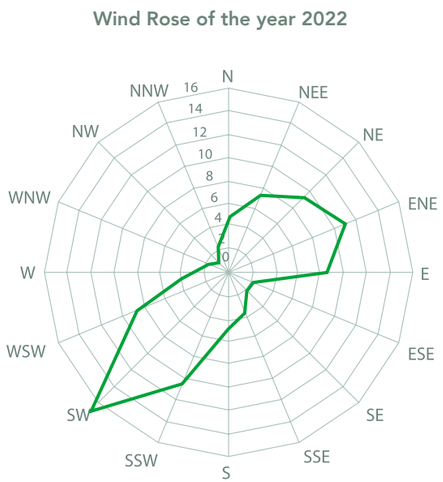



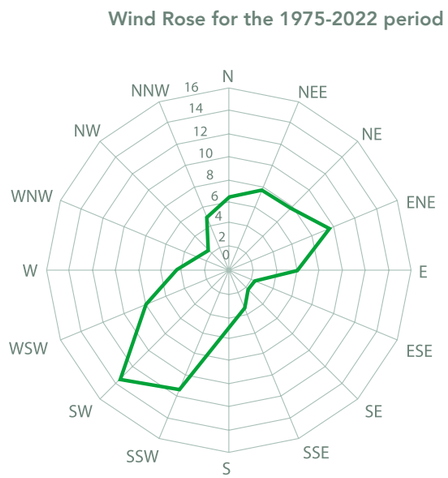

## ALMARAZ NPP




## TRILLO NPP



# Relationship with stakeholders

Communication is a key pillar within the Environmental Management System. Actions in this area, focused on disseminating information about our actions and raising awareness in environmental matters, are aimed at both employees and individuals outside the organization but somewhat linked to it: official agencies, neighbors, associations, the media and the general public: all these parties are called stakeholders.

## Local Corporations

CNAT continues to maintain fluid and dynamic relationships with institutions having competences in the plants' sphere of action, participating in Information Committees convened by the Ministry for Ecological Transition and Demographic Challenge (Spanish acronym, MINTERD), organizing meetings with mayors in the surrounding areas to bilaterally analyze the relationship between the station and each municipality and to determine possible collaboration options, as well as holding institutional meetings with local and regional agencies.

In 2022, half-yearly face-to-face meetings with majors of nearby municipalities and the media, were resumed. These encounters are useful to share detailed information on operational results and upcoming plans and projects. Similarly, the plants were represented at the Almaraz and Trillo Information Committee, organized by official nuclear energy agencies and intended to be a forum where required data is provided when needed.

## The Media

An intense relationship is also maintained with the media based on truthfulness, transparency and our permanent willingness to satisfy their demand for information. During 2022, 15 news items were distributed, providing information on the most significant events at the stations in a wide variety of operational and maintenance issues (refueling outages, drills, environmental issues and other information of general interest).

## The Public

Over the years, the Information Centers at Almaraz and Trillo nuclear power plants have consolidated themselves as effective channels of communication with society. Thanks to a diversity of audiovisual and exhibition resources installed at the centers, nuclear energy, more specifically the characteristics of nuclear facilities and their key environmental aspects, are now much better known to the general public.

CNAT continues to issue both periodical and specific publications. During 2022, several publications were made available to the general public, most of which are accessible on CNAT's website (www.cnat.es).

In addition, the organization has a corporate blog (www.energiaymas.es) used to inform the public about the activities carried out at our facilities and in the municipalities where they are located.

## Immediate Environment

The Almaraz and Trillo nuclear power plants represent an important socio-economic reference, as they are unquestionable sources of wealth and job creation in their areas of influence. The stations, as part of their commitment to their neighboring communities, support initiatives which enhance the quality of life and foster the economic and social development of their regions. In 2022, multiple initiatives were carried out, with the most significant in terms of the environment being the following:

- Framework Collaboration Agreement with the University of Extremadura to carry out technical and scientific projects.
- Collaboration agreement with the Chair of Energy and Environment of the University of Extremadura (UEX), in order to bring the professional world closer to university students so that once these finish their studies, they can benefit from scholarships to make their access to the business world easier.
- Collaboration with local town halls around Almaraz NPP to roll out a number of projects for improvement and development of the area.
- Agreement with the Valdecañas Irrigation Association.
- Collaboration with schools and associations around Trillo NPP in activities related to the environment (beekeeping observatories, workshops, tours in natural environments).
- Agreement with the Tagus Riverside Association to implement programs and actions in the areas of economic, social, cultural and environmental development.
- Agreement with the Mantiel Town Hall to promote their Beekeeping Observatory.

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**ALMARAZ & TRILLO**
**Nuclear Power Plants**

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