Non-Technical Summary

Environmental Report of the National Programme (NP)
for the management of spent fuel and radioactive waste

Ministero dello Sviluppo Economico

MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE

Contents

Definitions

Competent Authority – The Public Administration responsible for drafting the reasoned opinion, taking into account public consultation, in the assessment of the plan or programme and the environmental report. In collaboration with the Proceeding Authority, defines the public consultation forms and entities as well as the configuration and contents of the environmental report.

Proceeding Authority – The Public Administration which drafts the plan or programme, subject to provisions set forth in Legislative Decree no. 152/2006. In case the entity which drafts the plan or programme is a different public or private entity, the Public Administration which transposes, adopts or approves the plan or programme.

Characterisation - The ensemble of activities aimed at defining the product nature and chemical-physical-radiological characteristics of radioactive waste. May be carried out in several phases and enables the definition of the radiological classification of waste, with the purpose of identifying the most appropriate type of permanent accommodation. Configures the element of the profile for identifying the most suitable treatments to be carried out on waste, aimed at preparing it for successive phases.

Conditioning - A series of operations which enable the conversion of radioactive waste into solid form (grouting or vitrification, for example) and its insertion into special containers. The waste packages resulting from this process present characteristics of chemical and physical stability which make them suitable for handling, shipment, temporary storage and permanent accommodation.

Packaging - The assembly of components required to entirely enclose radioactive waste for handling, shipment, storage and permanent accommodation of radioactive waste. It can be carried out with one or more containers and with screens designed to shield from radiation, prevent damage caused to the container by any impacts and insulate from heat produced by waste.

Consultation - All forms of information and participation, also direct in nature, of administrations, the general public and the public involved in the collection of data as well as the assessment of plans and programmes.

Institutional Control - Control, by an authority or an institution designated by the laws of a country, of a site where there is a radioactive waste repository. It has the purpose of guaranteeing the isolation of radioactive waste from the surrounding environment for as long as it constitutes a danger. This control can be active (monitoring, surveillance, maintenance), or passive (territorial use restrictions) and in the case of superficial definitive repositories, have a duration of a few hundred years.

Currents (waste) - The complete flow of waste, deriving from nuclear and industrial, medical-hospital and research activities, including all management phases, up to storage and permanent accommodation.

Decay - The transformation of a radioactive nuclide into a different nuclide (or a different state), due to the spontaneous emission of alpha, beta or gamma particles. The end product is a lower energy and more stable nucleus. Each decay process has a defined half-life, characterised by the specific radioactive nuclide.

Decommissioning - A series of decontamination and dismantlement operations of nuclear installations, including the management of derived radioactive waste. The objective of decommissioning is to free the site of installation from all radioactive constraints and to return it to the community for different use.

Definitive repository - An installation for the disposal of radioactive waste. There are different types of definitive repositories (e.g. surface, geological), chosen according to type of radioactive waste requiring disposal (see also disposal).

Surface disposal - A structure constructed at ground level, or a few metres underground, for the permanent accommodation of long to medium activity radioactive waste. This structure may be an engineered structure, namely constructed using reinforced concrete structures designed to contain radioactive waste packages, or trench-type structures.

Geological repository - A repository structure for the disposal of high activity radioactive waste, constructed at considerable depths (usually several hundred metres below the ground), in a suitable and stable geological formation. This enables the long-term isolation (hundreds of thousands of years) of radionuclides from the biosphere.

Background radiation - The presence of radioactive substances of natural origin in the ground, water and air (radon, for example), or of artificial origin, such as those deriving from nuclear tests carried out in the 1950s and 1960s. There may be significant variations in radioactivity from one place to the next, according to territorial geological conformation, altitude, the distribution of ground deposits (fall-out), or other factors.

Inventory (waste) - Analytical documentation of radioactive waste on national territory which also includes a projection of future waste. The objective of the National Inventory is to guide radioactive waste management as a whole, including stocking and permanent accommodation. This is why waste is generally volumetrically calculated in its conditioned form, namely in its final waste package state.

Siting (process of) - Selection of a site suitable for the construction of a radioactive waste repository. The process consists of the following phases: environmental analysis, based on specific criteria, exclusion of unsuitable areas, site selection, site characterisation and confirmation of said site. The procedure enables the exclusion of all portions of territory which, based on site qualification and characteristics of specific interest, render unsatisfactory values with reference to predefined safety standards, also according to socio-environmental assessments.

Reasoned opinion - compulsory provision with any observations and conditions which concludes the VAS assessment phase, expressed by the competent authority and based on investigations carried out and the outcome of consultations.

Plans and Programmes - Planning acts and provisions, however described, including those which are co-financed by the European Community, as well as any amendments:

1) which are drafted and/or adopted by an authority at national, regional or local level, or drafted by an authority for approval via a legislative, administrative or contractual process and 2) which are set forth by legislative, regulatory or administrative provisions;

Typically the distinction between “plan” and “programme” is based on the fact that the former is characterised by more operative purposes, whereas the latter is linked to the pursuit of more general objectives.

Post-closure - The end phase of a plant’s life cycle, regarding the permanent accommodation of radioactive waste, successive to authorised closure and verification by Control Authorities. With surface repositories, this typically coincides with the start of institutional controls, in which case active and passive monitoring of the effective isolation of waste from the environment is carried out.

Artificial radioactivity - Generated as a result of human activities: the production of nuclear energy, medical devices for diagnosis and treatment, industrial devices, research activities and activities linked to the manufacture of war material.

Natural radioactivity - Generated by natural sources of radiation. Cosmic radiation which penetrates the atmosphere and reaches the earth is an example. Other natural radioactive elements are present in

geological formations, the ground, the air and human body. Examples include: the presence of uranium in numerous geological formations, radon, a gaseous element belonging to uranium's radioactive family which emerges the most in many domestic environments, potassium, present in the human body. Natural radioactivity varies from place to place, essentially according to geological characteristics and altitude.

Radioactive waste - Material, for which no reuse is foreseen, containing higher radionuclide concentration levels than release levels of non-radioactive waste.

- **short-lived waste -** Radioactive waste containing radionuclides with a half-life lower than that of Cesium -137 (approximately 30 years). Usually beta-gamma emitting radionuclides.
- **long-lived waste -** Radioactive waste containing radionuclides with a half-life greater than that of Cesium -137. Generally these are alpha transmitting radionuclides with a half life typically spanning thousands of years.
- **very short-lived waste -** Radioactive waste containing radionuclides with a half life of a maximum of 75 days and which, according to relative laws and regulations in force, are disposed of as conventional ones.
- **low and medium activity waste -** Radioactive waste containing high concentrations of short-lived radionuclides, and a low concentration of long-lived radionuclides. This characteristic enables its permanent accommodation in surface repositories. This type of waste derives from the decommissioning of nuclear installations as well as medical-hospital, industrial and research activities.
- **high activity waste -** Radioactive waste containing a high concentration of short-lived radionuclides, at higher concentrations compared to low and medium activity waste, and/or high concentrations of long-lived radionuclides. This characteristic means that permanent accommodation must be sought in a deep geological repository which guarantees isolation for comparable, if not longer periods of time of contained radionuclides' half-life. Therefore, geological formations (halite, clays, granites) are required to ensure stability over hundreds of thousands of years.

Reprocessing of fuel - Re-treatment of irradiated fuel, which is carried out using chemical processes, with the purpose of recovering fissile or fertile material (in particular plutonium and uranium 235), by separating it from all products of fission present in irradiated fuel, with the purpose of re-using it.

Integrated Service – A technical-operative instrument capable of undertaking all cycle phases for the management of radioactive sources no longer in use. Said instrument guarantees a national service for the management of all medical-hospital, industrial and research-derived radioactive waste which single producers are not capable of managing directly. ENEA is the Manager of the Integrated Service, and all major national Operators have adhered to the service: Protex S.p.A., Campoverde S.r.l. and Nucleco S.p.A. They ensure the collection, shipment, temporary storage, and in the case of Nucleco S.p.A. alone, treatment and conditioning, for definitive conferral to the National Repository.

Permanent accommodation of radioactive waste - Indicates the placement of radioactive waste in a specially designed, authorised and built installation (surface or geological). Constitutes the last phase of radioactive waste management as it guarantees isolation from the biosphere for the entire period required for progressive radioactive decay, until reaching levels which are negligible for health and the environment.

Competent subjects for environmental matters - Public Administrations and public bodies which in virtue of their specific competencies or responsibilities in the environmental field, may be interested in the environmental impact caused by the implementation of plans, programmes or projects.

Temporary storage - Safe and temporary storage of radioactive waste in suitable repositories, from which they are recovered for successive management phases. Temporary storage may concern waste which has

not undergone any treatment or conditioning, or the waste package which is then conferred for permanent accommodation in successive phases. The storage repository and methods of waste disposal must guarantee safe management and a reduction to a minimum of risks linked to storage activities.

Treatment - A series of operations which may change the physical form and chemical composition of radioactive waste, through the application of physical and/or chemical processes, with the purpose of reducing volume, radiological load, and preparing waste for the successive phase of conditioning.

Environmental assessment of plans and programmes (Strategic Environmental Assessment) - The process, which according to provisions set forth under title II of the second part of Legislative Decree no. 152/2006, includes the carrying out of a verification process of subjection, the drafting of an environmental report, the carrying out of consultations, plan or programme assessment, report on and outcomes of consultations, the expression of a reasoned opinion, information on the decision and monitoring.

Classified area - A work area subject to regulations in order to protect from ionising radiation. Classified areas may be: controlled areas or supervised areas. A controlled area is any area in which there is a possibility of receiving an annual dose of over 6 mSv (millisievert), based on checks and assessments carried out by a qualified expert. A supervised area is any area in which there is a possibility of receiving an annual dose of over 1 mSv (millisievert) but lower than 6 mSv (millisievert), based on checks and assessments carried out by a qualified expert.

Introduction

Directive 2011/70/Euratom of the Council dated 19th July 2011 and which institutes a community framework for the responsible and safe management of spent nuclear fuel and radioactive waste, obliges Member States of the European Union to draw up a National Plan for the implementation of a safe management policy for spent fuel and radioactive waste, when both derive from civil activities, from generation to disposal. Said directive has been transposed with Legislative Decree no. 45, 4th March 2014.

Through the implementation of the aforementioned Directive, the European Union aims to create a binding regulatory framework for all Member States, with the purpose of reinforcing obligations pertaining to protection from danger deriving from ionising radiation, for workers, the population and the environment, with the ultimate aim of avoiding any unfair burdening of future generations. For this purpose, the adoption of "'general principles"' is required, represented by policy guidelines and contained within a "'national framework"' with the aim of identifying clear roles and responsibilities in the management of spent fuel and radioactive waste, as well as a "'national programme"' for the implementation of said policy guidelines.

Therefore, within the field of the Strategic Environmental Assessment Procedure for the National Programme at hand, the purpose of this Non-Technical Summary is to provide competent entities and the public the chance to express themselves, also on the basis of a document which guides them in the construction of necessary skills for an informed opinion.

In compliance with specifications in ministerial guidelines issued within the scope of the "Operative National Governance and System Action programme" (PON GAS 2007-2013) for better document use, the Non-Technical Summary is drafted on a "Question and Answer" basis, to aid the reader in progressively focusing on elements under discussion.

National Programme contents referred to in this document constitute an articulated set of elements, including those fundamental to what is typically referred to in the environmental field as a "programme". Said elements are listed at a general level in the aforementioned Directive and cited Legislative Decree 45/2014.

The elements and articulation of a National Programme require reflection on the unique characteristics of the Member State at hand, with particular reference to current and/or foreseen activities which generate radioactive waste and any spent fuel, consequent to the radioactive waste inventory, the practical possibilities offered by the national territory in terms of waste management solutions, including storage and permanent accommodation options, as well as policy, legislative and regulatory aspects included in general principles and the national framework, on which, as we have seen, the programme depends.

Aware of this requirement, the European Commission's ENEF (*European Nuclear Energy Forum*) has adopted (2013) and spread specific guidelines (NAPRO), with the aim of helping Member States to comply with provisions set forth in the 2011/70/Euratom Directive.

Furthermore, it is obvious that a document such as the National Programme, insofar as subject to Strategic Environmental Assessment, pursuant to European and National legislation (Directive 42/2001/EC transposed with Legislative Decree 152/2006), also develops on the basis of the legislative framework and reference procedures, including particular elements of a participatory process. This is the case, for example, of transparency provisions which underline how both public access to information and occasions for actual participation must comply with *"national legislations and international obligations"* (Art. 10 paragraphs 1 and 2 of Directive 2011/70/Euratom).

With reference to the aforementioned, in its capacity as Proceeding Authority pursuant to title II of Legislative Decree 152/2006, the Central Department for electric, renewable, nuclear energy and energy

efficiency of the Ministry of Economic Development and the Central Department for waste and pollution of the Ministry of the Environment and the Protection of Land and Sea, have drafted an Environmental Report which aims to provide an exhaustive analysis of the entire national panorama with reference to radioactive waste and spent fuel management, to assess the Programme's significant impacts within a "'national"' dimension, including all necessary attention to sites which to date accommodate different types of radioactive waste.

Furthermore it specifies, pursuant to new radioactive waste classification established by interministerial decree dated 7th August 2015, all high activity radioactive waste as well as a part of medium activity radioactive waste with concentrations in excess of those established for surface disposal installations, will be sent to the National Repository temporary storage facility.

Therefore, with reference to the terminology used in this document regarding the management of radioactive waste in the National Repository, high activity radioactive waste also means part of medium activity waste, pursuant to the aforementioned decree.

1. What does the National Programme consist of?

The single aspects a National Programme is required to contain are specified in art. 12 of Directive 2011/70/Euratom and integrally transposed in art. 8 of Legislative Decree 45/2014. They constitute all elements necessary for guaranteeing the *"safe and responsible management of spent fuel and radioactive waste".*

They include:

a) national policy general objectives regarding the management of spent fuel and radioactive waste;
b) the most significant steps and temporal references for the implementation of said steps, in light of the National Programme's primary objectives;
c) the inventory of all spent radioactive fuel and waste as well as estimates of future quantities, including those coming from decommissioned plants, with clear indications of placement and the quantity of radioactive waste and spent fuel, in compliance with radioactive waste classification;
d) projects or plans and technical solutions for the management of spent fuel and radioactive waste, from generation up to disposal, including the National Repository and geological Repository;
e) projects and/or plans for the post-closure phase of a disposal plant, including the period in which appropriate controls are maintained, and the means used to conserve knowledge with reference to the plant over the long-term;
f) research, development and demonstration activities necessary for the enactment of solutions for radioactive fuel and waste management;
g) responsibility for the implementation of the National Programme and key performance indicators to monitor implementation progress;
h) assessment of National Programme costs, as well as premises and hypotheses constituting the basis of said assessment, including the time frame;
i) financing regime or regimes in force;
l) the transparency policy or procedure as per article 58-qater of Legislative Decree no. 230, 17th March 1995;
m) any current and concluded agreements with a European Union member state or a third country concerning the management of spent fuel and radioactive waste, including the use of disposal plants.

In order to put these objectives into practice, the National Programme has adopted appropriate strategies and action lines, as specified in documents to be submitted for Strategic Environmental Assessment.

2. What is Strategic Environmental Assessment?

Strategic Environmental Assessment (SEA), introduced by the European Union with Directive 2001/42/EC and transposed in Italy with Legislative Decree 152/2006, is the instrument for the assessment of environmental effects of plans and programmes, which must be activated from initial phases of the decision-making process to ensure effective preventive action.

3. Which entities are involved in the Strategic Environmental Assessment procedure?

The Proceeding Authority consists of the Ministry of Economic development – *Central Department for the Electric, Renewable, nuclear energy and energy efficiency market* and the Ministry of the Environment and the Protection of Land and Sea – *Central Department for Waste and Pollution*.

The Competent Authority is the Ministry of the Environment and the Protection of Land and Sea – *Central department for Environmental Assessments and Authorisations*, in agreement with the Ministry for Cultural Assets and Activities and Tourism and with the Ministry of Foreign Affairs, and International Cooperation, which issues the reasoned opinion of the SEA (art. 7 paragraph 5 of Legislative Decree 152/2006). Technical-scientific support for this function is provided by the technical Commission for environmental impact verification - Environmental Impact Assessment Procedure and SEA (art. 8 Legislative Decree 152/2006), in turn supported during the investigation phase, upon request, by the Institute for Environmental Protection and Research.

Participation in the SEA process is also extended to other institutional and non-institutional actors, specifically:

competent entities for environmental matters - Public Administrations and public bodies which in virtue of their specific competencies or responsibilities in the environmental field, may be interested in the environmental impact caused by the implementation of plans, programmes or projects;

territorially interested bodies: other Bodies deemed to be actively interested and involved in the drafting of the Environmental report, with the purpose of informing and sharing knowledge regarding the specific context constituting the study subject;

the public: one or more physical or legal persons or entities, according to relative laws and regulations in force, and their associations, organisations or groups, which satisfy conditions included in the Aarhus Convention and Directives 200/4/EC and 2003/35/EC; Citizens and Associations.

4. What phases does the Strategic Environmental Assessment procedure consist of?

The VAS procedure is governed by Legislative Decree 152/2006, which sets forth the following steps:

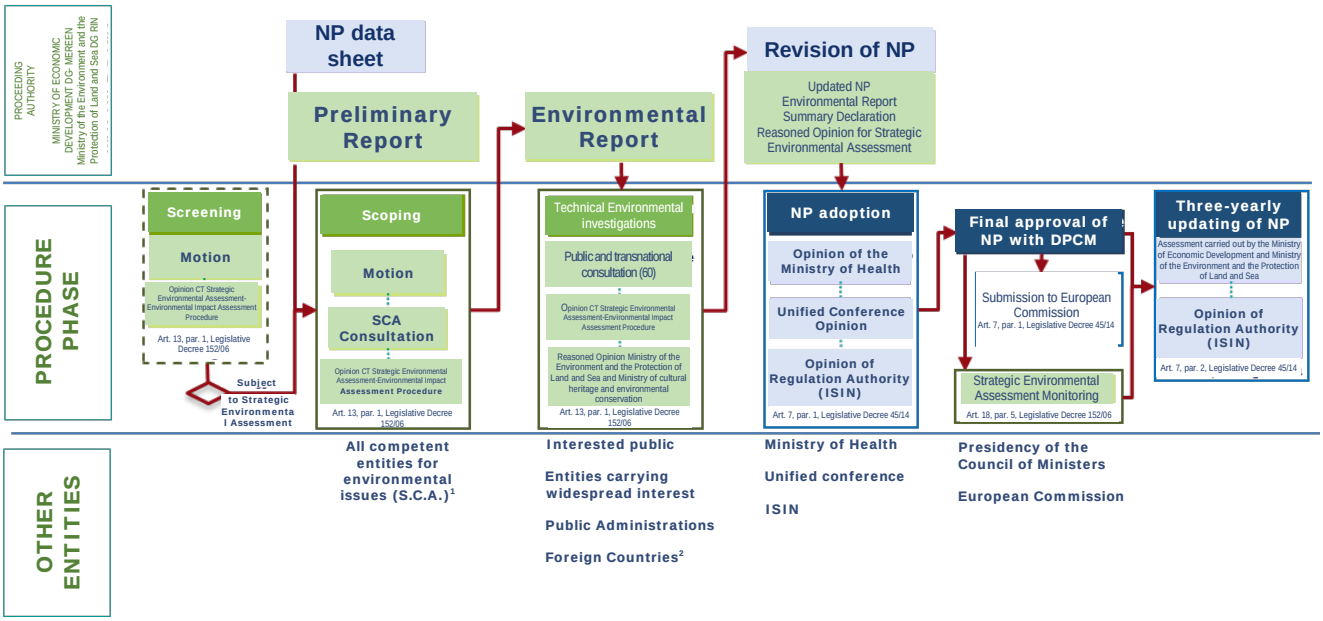


Figure 1 - Phases of the Strategic Environmental Assessment Procedure

In the case of the National programme constituting the subject of this document, the Strategic Environmental Assessment procedure has been announced by the **Proceeding Authority**, with the transmission (18th March 2016) of the Preliminary Report. On 22nd April 2016 said Proceeding Authority transmitted notification of the start of consultation for Competent Subjects.

The assessment procedure carried out by the Technical Environmental Impact Assessment / Environmental Impact Assessment Commission, concluded on 21st March 2016 with the transmission of the Scoping Opinion on 27th May 2016, containing observations and essential points to be analysed for the drafting of the Environmental Report. Said observations are also accessible in digital form via the link to internet pages contained in the appendix of this Non-Technical Summary.

The formation process of the National Programme is entirely governed by art. 7 of Legislative Decree no. 45/2014 and is contextual to the undertaking of the Environmental Impact Assessment procedure.

Environmental Impact Assessment should be considered to be a continuous process along the entire National Programme Cycle. Its significance depends on the capacity to integrate and render the planning process coherent, by orienting it towards sustainability.

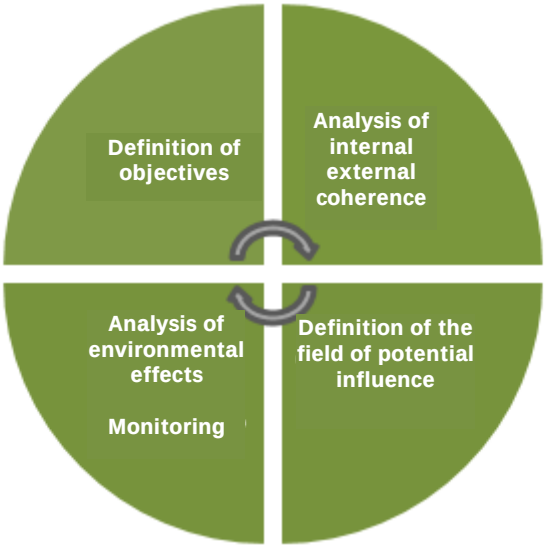


Figure 2 - Methodological Chart of Environmental Impact Assessment; Enplan Project, 2004 Guidelines

This iterative process is in line with Directive 2011/70/Euratom which stipulates periodic programme updating, and that a report is drawn up and transmitted every three years.

5. What is the general objective of the NP?

The objective of the NP is to describe the methods intended to guarantee the safe management of spent fuel and of all radioactive waste currently present on national territory, as well as those which will be produced during the entire reference period of the programme in force.

6. What specific objectives does the NP contain?

The specific objectives contained in the NP are to:

- enact the decommissioning of nuclear installations, up to the release of sites without restrictions of a radiological nature, and consequently, safely treat and condition all liquid and solid radioactive waste stored at sites, in order to transform them into certified waste packages, temporarily stocked at the production site, ready for transfer to the National Repository;
- update the national radioactive waste and spent fuel inventory on an annual basis;
- safely dispose of radioactive waste generated in Italy, with priority to the national territory, as set forth in Directive 2011/70/Euratom;
- localise, construct and commission the National Repository designated for the accommodation of radioactive waste generated on national territory, deriving from industrial, research and medical-healthcare activities, as well as previous management of nuclear installations, with reference to civil activities, included in a Technology Park containing a Study and Experimentation centre, as specifically governed by article 27 of Legislative Decree 15th February 2010, no. 31;
- dispose of low and medium activity radioactive waste in the National Repository, deriving from industrial, research, medical-healthcare activities and previous management of nuclear installations, in the case of civil activities;
- store, in the same National Repository, high activity radioactive waste and spent fuel derived from the previous management of nuclear plants, in the case of civil activities. The disposal solution for the latter which has currently garnished the most widespread consent from specialists at an international level is disposal in geological formations. In the case of Italy, given the limited quantity of high activity radioactive waste (including spent fuel) requiring disposal, the construction of a geological deposit on national territory appeared excessive and economically non-viable. Therefore during the transitory period of high activity radioactive waste accommodation in the

National Repository, the most suitable disposal solution will be identified for said waste in a geological repository, also taking into account any opportunities available in virtue of any international agreements which may come into effect during said period;

- the shipment abroad of spent nuclear fuel generated from the operation of decommissioned nuclear power plants still present on the national territory, for treatment and reprocessing, pursuant to specific directive/government agreements, notwithstanding any particular cases, for which management in line with the aforementioned principles of Directive 2011/70/Euratom is guaranteed nonetheless. Upon the conclusion of treatment, return radioactive waste deriving from specific spent nuclear fuel reprocessing contracts/agreements;
- guarantee compliance with commitments undertaken by the Italian Republic and EURATOM (European Atomic Energy Community) for the management of radioactive waste at the Joint Research Centre located in the Municipality of Ispra (VA);
- develop a programme for research and development activities focused entirely on the safe management of spent fuel and radioactive waste, in line with the contents of the National Programme;
- enact, as a priority, for the achievement of the aforementioned objectives, correct, objective and punctual information, with the purpose of guaranteeing transparency and effective public participation in decision-making processes concerning the management of spent fuel and radioactive waste.

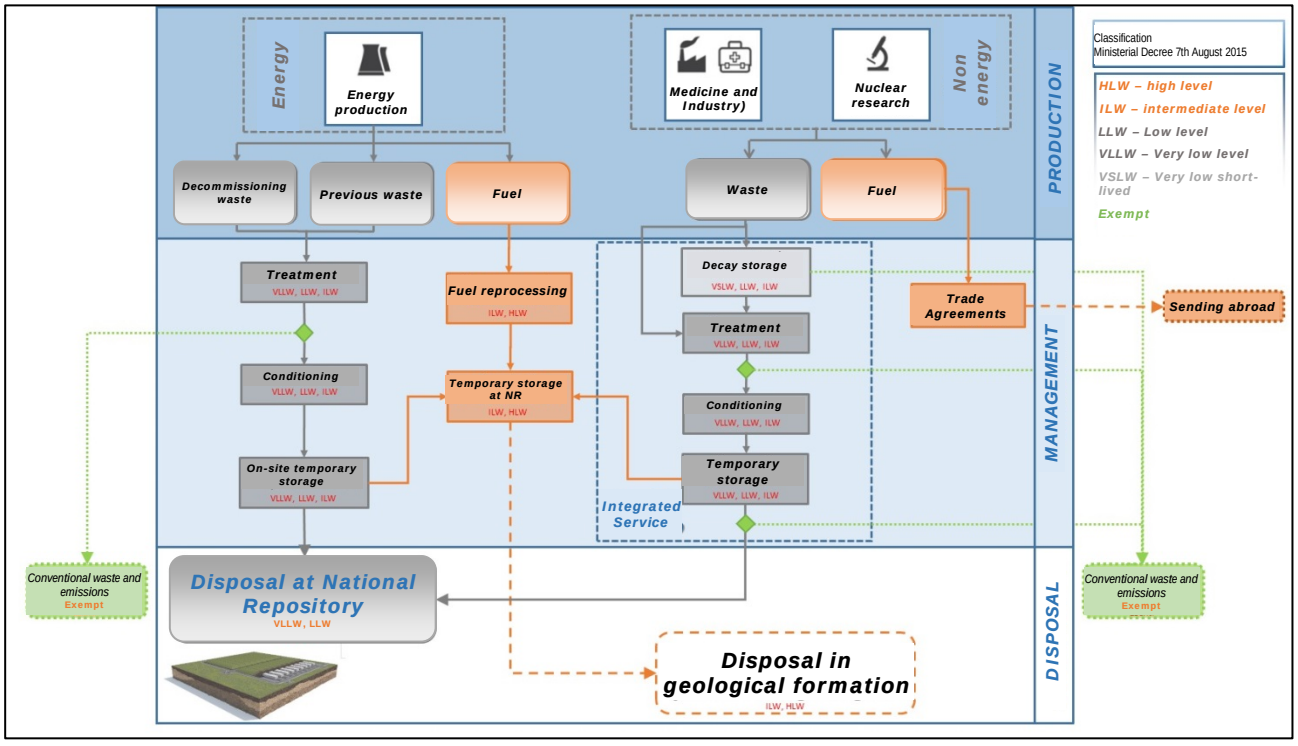


Figure 3 – Life cycle of radioactive waste and spent fuel

7. How does the NP pursue its purpose?

In order to pursue its far-sweeping scope, the NP takes specific strategies and lines of action into consideration, specifically:

THEME	NP STRATEGIES	NP LINES OF ACTION
Radioactive waste management	Decommissioning (Energy sector)	Treatment Conditioning Storage Disposal
	Integrated System (Non-energy sector)	
	Nuclear research (Non-energy sector)	
Spent fuel management	Decommissioning (Energy sector)	Treatment Storage Disposal
	Nuclear research (Non-energy sector)	

Table - 1 NP Strategies and lines of action

8. How is radioactive waste classified?

Radioactive waste is defined in article 4 paragraph 3, sub-paragraph i) of Legislative Decree 230/95, as any radioactive material in a gaseous, liquid or solid state, even if contained in equipment or devices in general, for which no recycling or further re-use is foreseen or taken into consideration by the competent regulatory authorities or by a physical or legal person or entity, whose decision is accepted by the competent regulatory authorities and which is regulated as radioactive waste by the competent regulatory authority.

To this effect, with an inter-ministerial decree dated 7th August 2015, Italy has adopted a new classification of radioactive waste, in line with specifications set forth in the most recent guidelines of the International Atomic Energy Agency (IAEA), the United Nations Agency which regulates the sector.

Here below please find the new classification, pursuant to the aforementioned inter-ministerial decree dated 7th August 2015, with relative final destinations of radioactive waste.

<table>
<tr><th>Category</th><th colspan="2">Conditions and/or Concentrations of activities</th><th>Destination</th></tr>
<tr><td>Exempt</td><td colspan="2">• Art. 154 paragraph 2 of Legislative Decree no. 230/1995
• Art. 30 or Art. 154 paragraph 3-bis of Legislative Decree no. 230/1995</td><td>Compliance with provisions set forth in Legislative Decree no. 152/2006</td></tr>
<tr><td>Very short lived</td><td colspan="2">• T1/2 < 100 days
Achievement of conditions in 5 years:
• Art. 154 paragraph 2 of Legislative Decree no. 230/1995
• Art. 30 or Art. 154 paragraph 3-bis of Legislative Decree no. 230/1995</td><td rowspan="2">Temporary storage (art. 33 Legislative Decree no. 230/1995) and disposal in compliance with provisions set forth in Legislative Decree no. 152/2006</td></tr>
<tr><td>Very low activity</td><td>• ≤ 100 Bq/g (of which alpha 10 ≤ Bq/g)</td><td>Achievement of conditions in T ≤10 years:
• Art. 30 or Art. 154 paragraph 3-bis of Legislative Decree no. 230/1995</td></tr>
<tr><td></td><td></td><td>Non-achievement of conditions in T ≤10 years:
• Art. 30 or Art. 154 paragraph 3-bis of Legislative Decree no. 230/1995</td><td rowspan="3">Surface or shallow disposal installations, with engineered barriers (National Repository Legislative Decree no.31/2010)</td></tr>
<tr><td>Low activity</td><td colspan="2">• short-lived radionuclides ≤ 5 MBq/g
• Ni59-Ni63 ≤ 40 kBq/g
• long short-lived radionuclides ≤ 400 Bq/g</td></tr>
<tr><td>Medium activity</td><td>• short-lived radionuclides >5 MBq/g
• Ni59-Ni63 ≤ 40 kBq/g
• long short-lived radionuclides >400 Bq/g
• No heat production</td><td>Alpha-emitting radionuclides ≤400 Bq/g and beta-gamma emitters in concentrations which comply with radioactive protection objectives established for the use of the surface disposal plant.</td></tr>
<tr><td></td><td></td><td>Radionuclides in concentrations which do not comply with radioactive protection objectives established for the use of the surface disposal plant.</td><td rowspan="2">Temporary storage plant of the National Repository (Legislative Decree no. 31/2010), pending disposal in geological formation</td></tr>
<tr><td>High activity</td><td colspan="2">Production of heat or high concentrations of long-lived radionuclides, or bearing both characteristics.</td></tr>
</table>

Table 2 - Final destination of different categories (waste containing radionuclides of natural origin is not included, article 2, paragraph 5 of inter-ministerial decree dated 7th August 2015)

9. How is Italian radioactive waste classified?

All radioactive waste management takes into account the aforementioned characteristics and typically consists of five phases: characterisation, treatment, conditioning, storage and permanent accommodation (disposal). These operations are interconnected: with characterisation waste is analysed and classified in preparation for successive phases, starting with treatment. The aim of conditioning is to produce a stable form, suitable for any shipment and successively, for storage and permanent accommodation. In general conditioning takes place with cementing. Conditioned waste is then ready for storage (temporary safe storage) or disposal (permanent accommodation). These final phases are closely linked to the classification of waste: medium activity very short-lived waste is temporarily stored and then disposed as conventional waste insofar as no longer classified as radioactive. Very low activity, low activity and a part of medium activity waste may be permanently accommodated in a surface disposal, such as the National Repository which will be built in Italy. A part of medium activity (long-lived) waste, high activity waste and spent fuel may be temporarily stored (50 years) in a centralised depot, however for their permanent accommodation,

the reference solution is a geological repository, to be constructed independently or in collaboration with other countries.

10. How is spent fuel managed in Italy?

Directive 2011/70 Euratom distinguishes between spent fuel and radioactive waste. Indeed most Member States, including Italy, do not consider it to be a radioactive fuel. It may be subjected to reprocessing.
The reprocessing of fuel enables the separation of re-usable materials from final waste, and the conditioning of the latter in a form which reduces its volume and guarantees its safe conservation.
Said process enables a 95% reduction in the volume of irradiated waste.
Most fuel used in Italy for electricity production in nuclear power stations is sent abroad (France and the United Kingdom), and must return to Italy in compliance with the regulation establishing that the onus of waste disposal is to be borne by its producer. A small part of spent fuel, at Deposito Avogadro S.r.l. (Avogadro Depot), is still awaiting transfer abroad for reprocessing, and an additional quota (uranium - thorium) is currently being held at the ITREC plant in Rotondella (Matera).
All Italian reprocessed and non-reprocessed spent fuel is safely stored in a temporary long-term (50 years) zone of the National Repository and successively transferred to a geological repository for definitive disposal. Currently in Italy the following structures host pools containing spent fuel: ITREC (Treatment and Refabrication Plant for Fuel Elements), the Avogadro Depot and the JRC in Ispra (Varese).

11. What is the economic impact of National Programme implementation?

Decommissioning and safe management activities for nuclear power plants (Trino, Caorso, Latina and Garigliano) and nuclear fuel cycle plants (Saluggia, Bosco Marengo, Casaccia and Trisaia) are carried out by SOGIN S.p.A., the State Company responsible for the sector and funded by the CSEA (Energy and Environmental Services Fund) which is funded with the A2 component of the electric tariff and according to procedures defined by AEEGSI (Regulatory Authority for Electricity Gas and Water). The electric tariff is also used to fund resources for the recognition of Territorial Compensation Measures, for territories where nuclear power stations and nuclear fuel cycle plants are located, up to definitive decommissioning and which will successively host the National Repository.

The management of waste produced in other fields (industry, research, healthcare) is presided by the Integrated Service, which includes public operators (Nucleco S.p.A.) and private operators (Campoverde S.r.l. and Protex S.p.A. for example). In the case of very short-lived waste, namely those whose radioactivity levels drop to negligible levels after a brief storage period, enabling their disposal in the same manner as conventional waste, producers pay a tariff according to the volume and type of waste. In the case of waste subjected to treatment and/or conditioning operations, a tariff is paid to the sole authorised national operator (Nucleco S.p.A.).

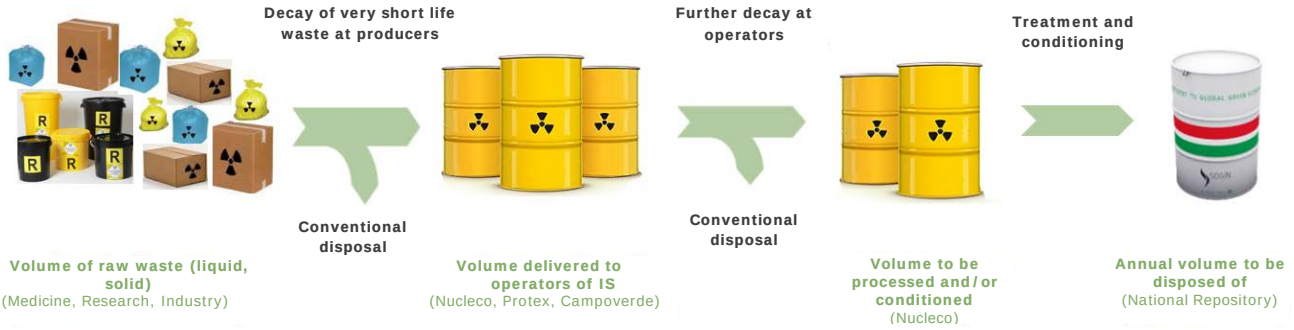


Figure 4 – Radioactive waste flows within the Integrated Service

Lastly, in the case of radioactive waste which must be permanently disposed of respectively in the National Repository or a deep geological repository, an adequate conferment tariff must be calculated, which takes into account overall costs and their fair allocation. Pending said calculation, Law 1/2012 (Art. 24, paragraph 5) establishes the possibility of recognising costs deriving from Integrated Service activities, from costs for the creation of the National Repository, as an advanced payment, namely the sizing of said repository which takes into account the need to confer non-energy waste of the same origin.

With reference to preliminary analyses carried out by SOGIN S.p.A., which according to Legislative Decree 31/2010 is required to site, design, construct and operate the National Repository and Technology Park, the total amount for the implementation of this project is approximately 1.5 billion Euros. In addition to this we have costs for research and development activities which are not immediately associable with National Repository operation, to be carried out in the Technology Park, in compliance with provisions set forth in said Legislative Decree. The total of said costs, which will be funded by both public and private entities, has been estimated by SOGIN S.p.A. at around 1 billion Euros.

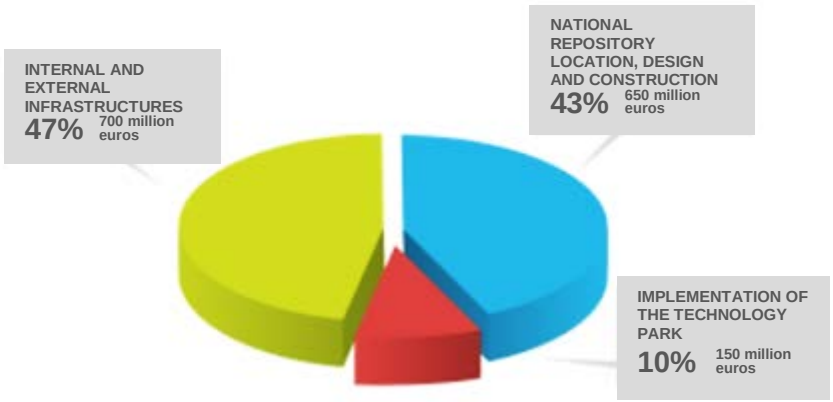


Figure 5 – Investments for the construction of the National Repository and Technology Park

12. How will the National Repository be sited?

The siting process for the National Repository and Technology Park is governed by art. 27 of Legislative Decree 31/2010 and is based on a mixed approach which includes the application of technical-scientific criteria (indicated by ISPRA in Technical Guide 29, issued in 2014), and in compliance with international guidelines set forth by the IAEA, as well as forms of participated decision-making, including a manifestation

of interest of Regions and local Bodies, to permit detailed investigation and in any successive phases, to host the National Repository.

SOGIN S.p.A. has drafted the National Map of Potentially Suitable Areas (CNAPI), applied requests formulated in successive inspection by ISPRA, the Ministry of the Environment and the Protection of Land and Sea and Ministry of Economic Development, and is now awaiting authorisation for publication of the CNAPI, Preliminary Project and relative documentation, as requested by Legislative Decree 31/2010. After publication, a Public Consultation phase will be opened (4 months), during which all stakeholders can submit any observations and technical proposals.

Public Consultation will culminate in a National Seminar for the discussion of presented observations. Successively, the National Map of Potentially Suitable Areas (CNAI) will be drafted, indicating the territories whose communities will be called to formulate manifestations of interest, to be drafted in a Memorandum of Intent, so that further investigations can be carried out to establish the siting of the National Repository. Said Memorandum of Intent may contain elements pertaining to long-term territorial development and extensive local community involvement.

On the basis of these Memorandums of Intent, it will be possible to proceed with successive site research phases: suitable areas will be taken to mean those with the most favourable characteristics, in line with requirements set forth.

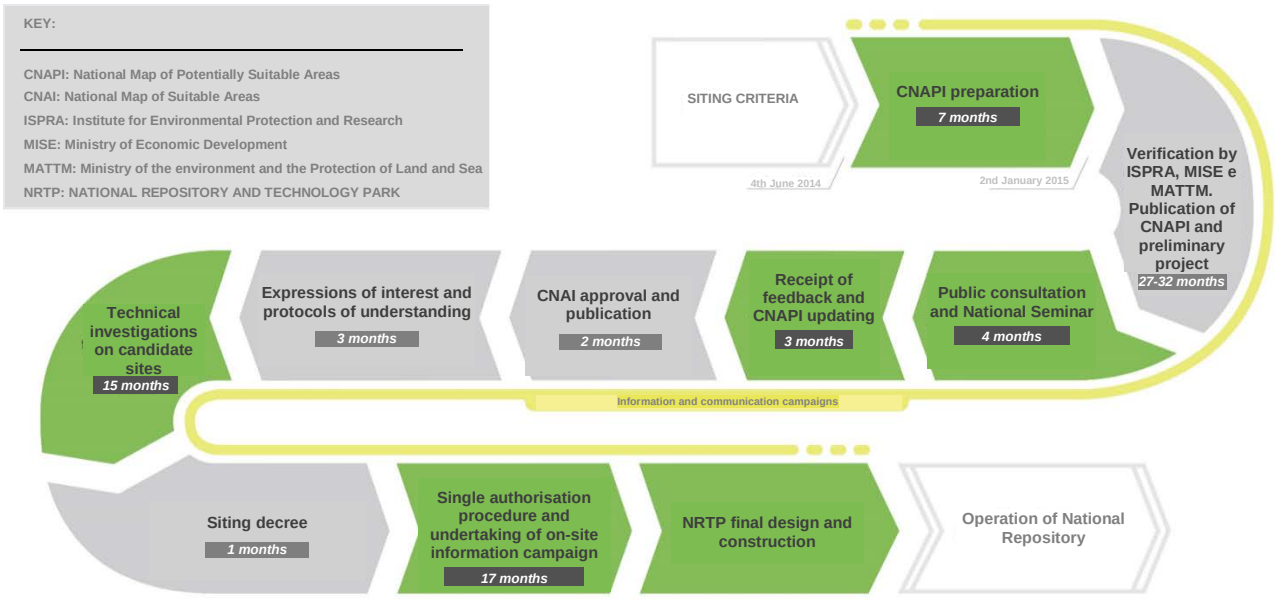


Figure 6 - Siting phases of the National Repository and Technology Park

13. How will the National Repository for radioactive waste be structured?

The National Repository will consist of two main surface structures, whose design is based on the best international experiences and in compliance with the most recent IAEA standards: a repository for the definitive disposal of low and medium activity waste, and a repository for the temporary storage of long-lived high activity waste (useful project life of 50 years), called ILW-HLW storage complex, awaiting definitive disposal in a geological repository.

Its construction and the transfer of radioactive waste to a single site will enable the decommissioning of nuclear plants (green fields) and the safe, efficient and rational management of all radioactive waste, including those generated by past and future nuclear medical, industrial and research activities.

The adoption of a waste isolation and confinement system has been planned for the National Repository, though engineered and natural barriers (namely "multi-barrier" systems which have previously been implemented with success and are still in use at an international level).

Therefore safety will be guaranteed during all of the repository's operational phases, specifically:
- during the Operation phase (approximately 40 years), when conditioned waste (waste packages) will be received, controlled, accepted and definitively disposed of;
- during the Closure phase (5/10 years), once all waste packages have been received, they will be closed off and protected with a multi-layer impermeable barrier to prevent contact with rainwater for the entire isolation period (Institutional Control);
- during the Surveillance phase (300 years - Institutional Control), when the repository, closed and covered by the multi-layer cover, will be monitored and controlled to confirm the barriers' isolation efficiency and capacity and to prevent undesired human intervention.

Once the Institutional Control phase ends, the radioactivity of waste will have dropped to negligible levels for man and the environment, and therefore the repository can be released without any radiological constraints, for conventional use (unconditioned release).

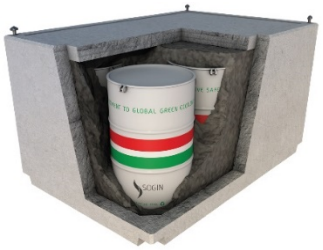
Engineered barriers in the National Repository which isolate low and medium activity waste from the environment are:

i. the Waste Package, consisting of container and cement mortar which is used to surround waste;
ii. the reinforced concrete Module and cement mortar which immobilises the waste packages;
iii. the Disposal Vault in reinforced concrete with strip foundation, which contains the modules;
iv. the multi-layer cover which protects the Disposal Vaults.

FIRST BARRIER: THE WASTE PACKAGE

Low and medium activity radioactive waste is conditioned in compliance with regulations as well as repository acceptance criteria. The waste package consists of waste, a container, which may be cylindrical or prismatic, and the solid immobilisation matrix of radionuclides.

SECOND BARRIER: THE MODULE (approximately 3mX2mX1.7m)

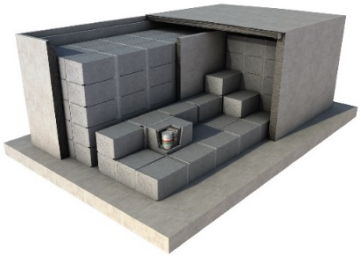


The module, a parallelepiped structure in concrete, constitutes the second barrier of the NR. Waste packages immobilised by a special mortar are placed inside it. The modules are built within the NR area, in a special plant. Each module can contain, according to geometry and size, from 1 to 8 waste packages.

Operations for the insertion of waste packages, the immobilisation and sealing of the module are carried out in a special plant. From here the module is shuttled to the next barrier for definitive disposal.

The packaged module guarantees both mechanical structural resistance properties and radionuclide containment properties.

THIRD BARRIER: THE CELL (approximately 27mX15.5mX10m)

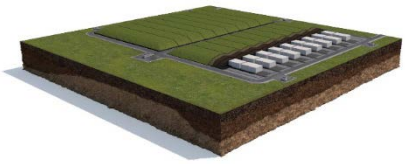


The cell is a box-shaped, partially buried structure with walls and strip foundation in reinforced concrete into which 240 modules are placed on five different levels. The cell constitutes the third engineered barrier for the confinement of radioactive waste.

During the operative phase of filling with modules, cells are protected from the elements with a mobile cover on tracks made using metal trusses and panels.

Once filling operations are concluded, the cell is closed and sealed with an integrated reinforced concrete cover. Additionally, a drainage pipe system underneath each cell ensures the collection and control of any seepage or possible condensation throughout all phases of Repository operation life.

FOURTH BARRIER: THE MULTI-LAYER HILL



The multi-layer hill, which constitutes the fourth barrier of the National Repository, is an artificial structure which covers the cells. It consists of layers made from different inert materials, with an overall thickness of several metres, with specific functions, such as preventing water from entering the repository, rainwater drainage, the isolation of waste from the environment and improving the structure's visual impact.

The outer part of the multi-layer cover consists of a lawn to favour harmonisation with the environmental context.

Lastly, it must be taken into account that cells are allocated to a site which fulfils all siting criteria set forth in the ISPRA Technical Guide 29, and as such guarantees site safety.

14. What is the ILW-HLW storage complex?

High activity radioactive waste awaiting permanent accommodation in a geological repository will be temporarily stored in the ILW-HLW storage complex, designed for a useful life of 50 years.

High activity radioactive waste designated for storage in said plant essentially consist of waste from the operation and decommissioning of former nuclear power plants, non-reprocessable irradiated fuel, residue deriving from the re-processing of irradiated fuel, most decommissioned sources located in Italy, and waste produced from previous and future activities in the medical-industrial-research fields.

Fuel and residue from reprocessing will be directly stored in *casks*, metal, shielding and high resistance containers, used for their shipment and conferral to the Temporary Depot, therefore suitable for the safe storage of highly radioactive materials.

Other high activity waste will be contained in special types of high integrity containers which are also in metal, prismatic or cylindrical, specially designed and qualified.

Containers and structures for storage in the ILW-HLW storage complex guarantee the confinement of radioactivity under normal conditions and foreseeable accidents and in case of storage of waste before it is sent for permanent disposal to a repository in a geological formation.

15. Who are the main producers/holders of radioactive waste in Italy?

Radioactive waste of civil origin come both from the energy and non-energy sectors.

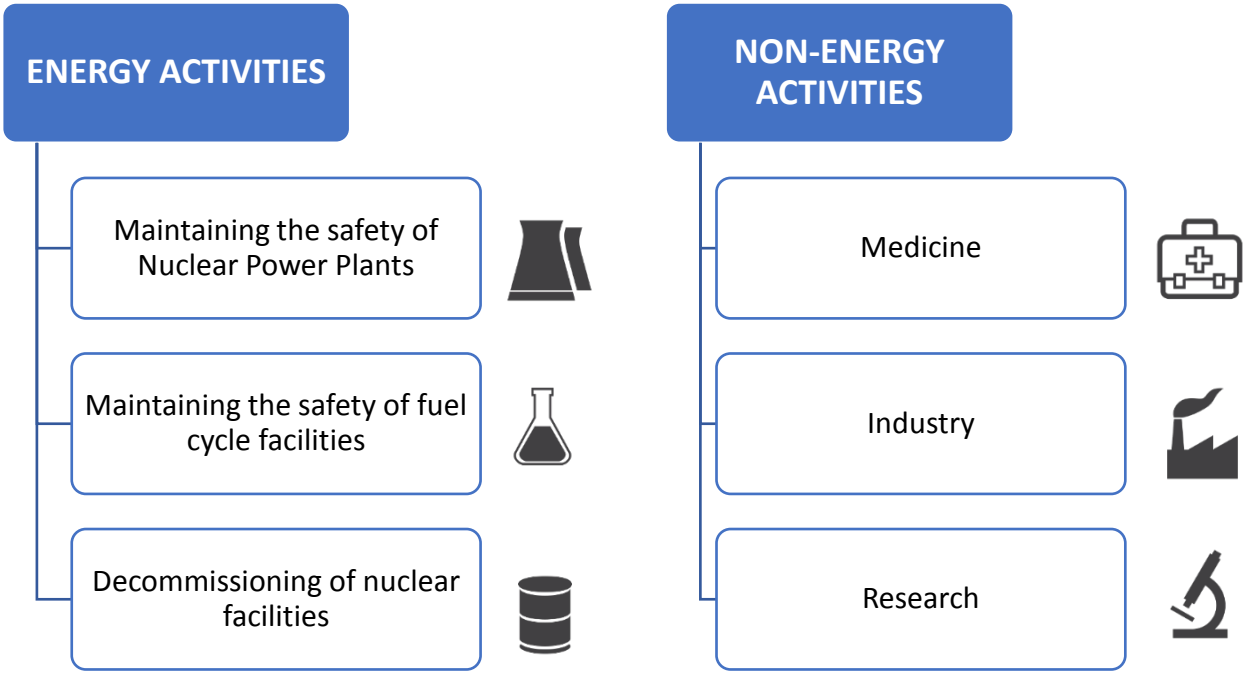


Figure 7 - Sectors which produce radioactive waste

The first produces waste deriving from the previous operation of nuclear installations and those from safe maintenance, decontamination and decommissioning operations. The non-energy sector produces all radioactive waste derived from existing and future medical, industrial and research activities.

The main producers/holders of radioactive waste of civil origin present on national territory are listed here below:

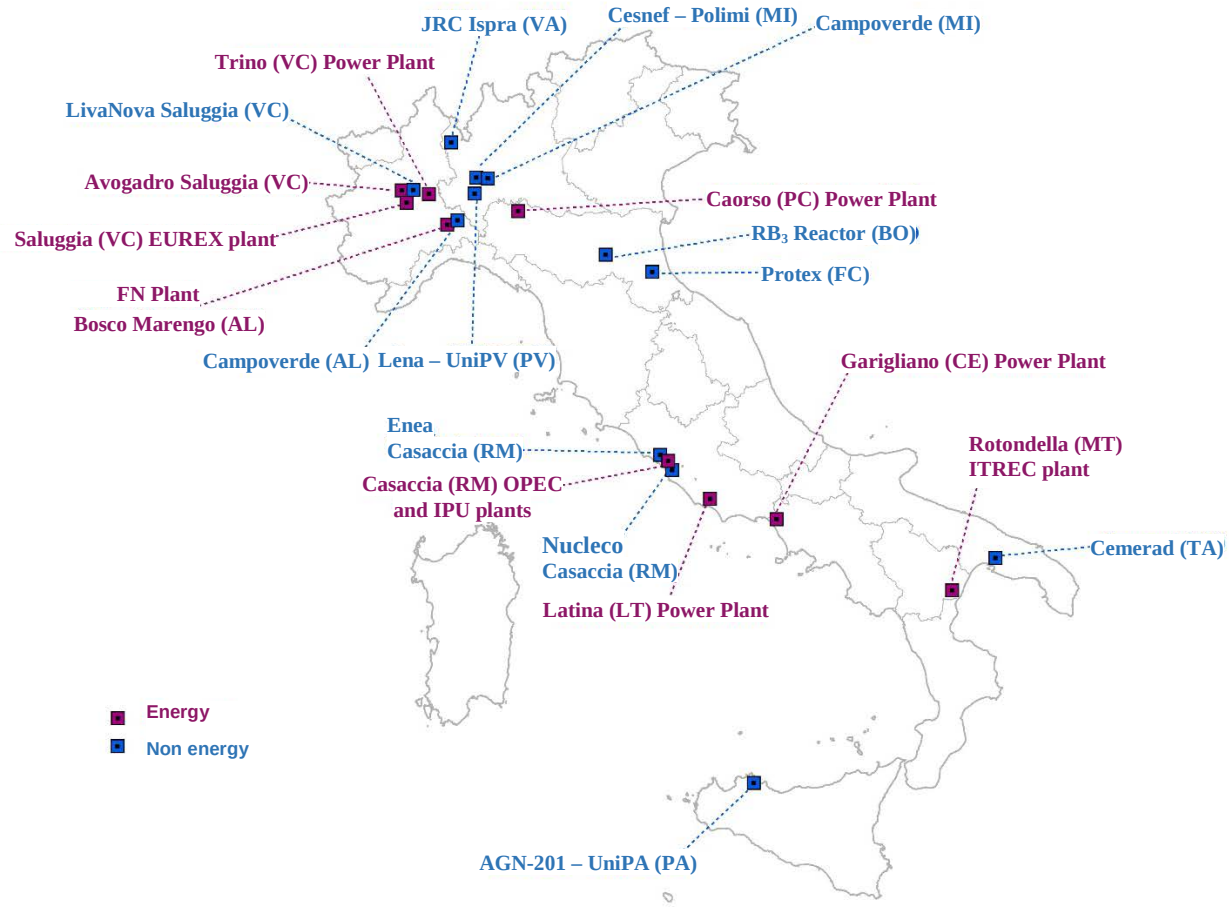


Figure 8 - Main producers/holders of radioactive waste in Italy

Origin of Radioactive Waste	Producers/holders	Interested Sites
ENERGY	4 SOGIN S.p.A. Nuclear Power Stations	Trino, Caorso, Latina, Sessa Aurunca
	5 SOGIN S.p.A. Nuclear Fuel Cycle Facilities	Saluggia, Bosco Marengo, Casaccia (RM), Rotondella
	Deposito Avogadro S.r.l.	Saluggia

Table 3 - Producers/holders in the energy sector

The 4 nuclear power stations (Latina, Garigliano, Caorso and Trino) and the Nuclear Fabrication plants of Bosco Marengo, EUREX (Enriched Uranium Extraction) of Saluggia, IPU (Plutonium Plant) and OPEC (Post Irradiation Examination Facility) in Casaccia, and ITREC (Treatment and Refabrication Plant for Fuel Elements), in Rotondella, are safely maintained and decommissioned by SOGIN S.p.A. The Avogadro Depot is made available by SOGIN S.p.A. for the storage of parts of irradiated fuel from nuclear power stations, awaiting transfer abroad for reprocessing.

Origin of Radioactive Waste	Producers/holders		Interested Sites
NON ENERGETIC	INTEGRATED SERVICE	Nucleco S.p.A.	Casaccia (RM)
		Campoverde S.r.l.	Milan, Tortona (AL)
		Protex S.p.A.	Forlì
		Cemerad S.r.l.	Statte (TA)
		LivaNova Saluggia	Saluggia
	NUCLEAR RESEARCH	JRC Euratom Ispra (JRC)	Ispra (VA)
		CESNEF (Reactor L54M)	Milan
		University of Pavia (Lena Reactor)	Pavia
		ENEA (Tapiro and Triga RC1 Reactors)	Casaccia (RM)
		University of Palermo (AGN 201 Reactor)	Palermo
		University of Bologna (RB3 Reactor)	Bologna

Table 4 - Producers/holders in the non-energy sector

Most waste from the non-energy sector is managed by the Integrated Service, which guarantees a widespread and uniform collection of radioactive waste generated by different producers on national territory.

In particular, the **Nucleco S.p.A.** site is located inside the ENEA centre, Casaccia (Rome), near the SOGIN S.p.A. area.

The company **Campoverde S.r.l.** is managing two storage depots for the decay of radioactive waste produced by industrial and biomedical activities, one of which is located in the Municipality of Milan, and the other in the Municipality of Tortona (AL).

The **Protex S.p.A.** Laboratory Group carries out a packaging, collection, transport, storage service for radioactive waste produced for medical and industrial purposes, throughout the national territory. As in the case of the company Campoverde S.r.l., the Protex S.p.A. depots are also designated for the storage of short-lived waste. Collected higher activity waste is transferred to Nucleco S.p.A. for any treatment required.

The **Cemerad S.r.l.** depot in Statte is currently being subjected to containment and reclamation operations coordinated by the extraordinary commissioner nominated by the governor.

In Italy there are nuclear research centres operating in the fields of medical science, physics and radiochemistry. All radioactive waste produced by research activities is managed in compliance with procedures set forth in Legislative Decree 230/95.

To date, and with the exception of the RB3 reactor (Nuclear Engineering Laboratory of Montecuccolino, University of Bologna, nearing the conclusion of decommissioning activities, authorised in 2010), authorisation for deactivation has not been granted to any other plant.

With reference to the “Deactivation project for the Essor Nuclear Plant Complex, Joint Research Centre in Ispra (VA)” the scoping phase has been completed, enabling the drafting of the study for the Environmental Impact Report.

Therefore a potential field of influence for research installations (JRC Ispra, CESNEF, LENA, TRIGA and TAPIRO, AGN 201) is not identified, and no environmental assessments are carried out.

16. What is the Integrated Service?

The Integrated Service (IS) guarantees the widespread and uniform collection of non-energy radioactive waste generated by different producers on national territory. Conferral occurs on the basis of contracts stipulated with one of the IS operators, prepared and approved for the collection of said waste. ENEA, with resolution of the Board of Directors dated 4th June 1986, instituted a service for the management of low and medium activity waste and radioactive sources, dedicated to producers or installations not in the possession of specific nuclear authorisations (e.g. research laboratories, nuclear medicine facilities, industries). ENEA is the Manager of the Integrated Service.

ENEA has entrusted the subsidiary company Nucleco S.p.A. with the centralised execution, at national level, of management activities, treatment (volume reduction) and conditioning of radioactive waste, with the production and successive temporary storage of final waste packages, ready for definitive conferral to the future National Repository.

National operators ensure:

- waste collection at single producers;
- shipment and temporary storage at own depots;
- the disposal of waste, which for decay reasons, can be reclassified as dangerous waste;
- conferral to Nucleco S.p.A. of radioactive waste requiring treatment and conditioning operations which will then, prior temporary storage, be definitively conferred to the National Repository.

17. Who are the national operators of the Integrated Service?

Integrated Service operators include:

- Campoverde S.r.l. and Protex S.p.A. who carry out radioactive waste collection throughout the national territory and who operate pre-treatment plants and depots, based on authorisation pursuant to art. 29 of Legislative Decree 230/1995.
- Nucleco S.p.A. where all radioactive waste collected on national territory and which have not been disposed of following storage for decay, converges (Very Short-Lived Waste). Nucleco S.p.A. is the main operator of the IS as, apart from managing the collection of radioactive waste on national territory, it is the only operator in the country, based on Authorisation pursuant to art. 28 of Legislative Decree 230/1995, which carries out waste treatment and conditioning activities. Nucleco S.p.A. also stocks generated waste packages in temporary depots, managed on behalf of ENEA, awaiting conferral to the National Repository.
- MITAmbiente which carries out Authorised Carrier activities on behalf of third parties through the national territory.

Based on the convention stipulated with Nucleco S.p.A., after conditioning activities, ENEA acquires the property title of radioactive waste, with consequent responsibility of their safe storage.

18. What are the phases of decommissioning?

In order to identify the different phases which can be imagined for decommissioning activities, normally a scale proposed by the IAEA, identifying three levels or stages, is used as a reference:

- Stage 1: the plant is placed in storage and decommissioning activities consist of those strictly necessary for simple safety containment;
- Stage 2: extensive decommissioning activities of less contaminated or conventional parts of the plant are carried out. The heart of the plant (nuclear island) is placed in storage;
- Stage 3: the plant is entirely demolished.

19. What decommissioning strategies are possible? Which ones have been adopted in Italy?

With reference to the IAEA scale, the possible strategies are:

- DECON: implementation of stage three immediately after plant closure;
- SAFESTORE: after closure, either stage 1 or stage 2 is implemented, typical duration is 30-60 years, to ensure radioactivity decays to more acceptable levels for decommissioning activities, after which the DECON strategy is implemented;
- ENTOMB: like SAFESTORE but for periods of 100-300 years. Radioactive plant parts are confined until radioactivity is reduced to more acceptable levels through decay, for decommissioning operations.

Over the years and after the cessation of electrical energy production from nuclear sources, Italy has modified its strategy for energy sector plants, passing from passive protective storage, to accelerated deactivation, aimed at releasing the site from radiological restrictions, consisting of the following phases:

- The management of activities in preparation for decommissioning (radiological characterisation of the nuclear site, processing of previous waste produced during operation);
- Activities for the decommissioning of systems and buildings on the site;
- The management of temporary on-site depots, guaranteeing the structural integrity of buildings as well as the control of waste packages contained therein (brown field);
- Definitive decommissioning (low and medium activity) and temporary storage (high activity) at the National Repository;
- Release of site, free from radiological restrictions, downstream from conferral at the National Repository (green field).

20. What are the main territorial reference regulations?

With reference to objectives and orientations contains in territorial planning, subdivisions were made based on regions and sites, analysing applicable laws and regulatory instruments in force (for example territorial constraints).

Summarising tables regarding relative Regions of interest can be found here below

21. Why are European Community, national and territorial regulations regarding environmental issues analysed in the Environmental Report?

For the definition of environmental protection objectives deemed to be relevant, issues listed under paragraph e) of annex I of European Directive 2001/42/EC - Strategic Environmental Assessment, and regulations of a general nature, deemed applicable to the NP for the management of spent fuel and radioactive waste with reference to potential interactions with the environment, were also examined.

The following themes have been taken into consideration in the Environmental Report:

- environmental protection,
- the protection of internal surface waters, transitional waters, coastal waters and underground waters,
- assessment of the good chemical state of underground waters,
- the quality of bathing waters,
- air quality,
- ground protection,
- the assessment and management of flood risks to reduce negative consequences upon human health, the environment, cultural heritage and economic activities linked to floods, within the Community,
- the protection of biodiversity,

- the protection of human health,
- the reduction of harmful aspects linked to noise,
- the promotion of research, development and innovation,
- the prevention of accidents involving certain dangerous substances,
- interaction between energy development and the environment,
- protection of the landscape and cultural heritage.

All major European Union and national laws and regulations were analysed for each of these themes.

22. What analysis is carried out to verify NP coherence?

Analysis will regard external and internal coherence. The former pertains to Report coherence in relation to objectives specified in the National Programme with environmental protection objectives and criteria, identified though the examination of applicable laws and regulations as well as territorial planning and programming instruments. In contrast, the aim of the latter is to verify the operative link between Programme actions and objectives in order to highlight any critical areas of foreseen implementation actions, and strategic objectives to be pursued.

23. How is external coherence analysis structured?

External coherence analysis is elaborated in two separate phases:

- "vertical" coherence": between objectives of the plan under consideration and the environmental protection objectives/principles deriving from relevant laws and regulations, at a supranational and national level;
- "horizontal" coherence: between objectives of the plan under consideration and environmental objectives/principles defined for planning at territorial level, with reference to areas of interest.

The following 4 assessment levels were used for verification:

- direct coherence: the objective of environmental protection and the objective of the NP pursue integrated purposes;
- indirect coherence: the objective of environmental protection and the objective of the NP pursue synergistic purposes;
- indifference: the objective of environmental protection and the objective of the NP pursue uncorrelated purposes;
- incoherence: the objective of environmental protection and the objective of the NP pursue contrasting purposes.

Objectives pertaining to laws and regulations with similar aims to respective Programme objectives, or integrated with the latter within the context of the broader objective of environmental sustainability, were deemed to be directly coherent. A verdict of indirect coherence was reached when different Programme objectives, or some programmed actions for the achievement of said objectives, involved management and operative procedures with an indirect effect on objectives set by examined laws and regulations.

Programme objectives which did not present any link to the environmental objectives or purposes set forth in examined laws and regulations were deemed to be indifferent, whereas those objectives in clear contrast with the principles of examined laws and regulations were deemed to be incoherent.

Furthermore, with reference to the coherence of Programme objectives regarding the National Repository, assessment focused on the coherence of Repository siting criteria (exclusion/in-depth analysis), as set forth in the ISPRA Technical Guide 29, 2014, with objectives established in examined laws and regulations.

Lastly, "vertical" coherence analysis also included further, detailed assessments of the coherence of Programme objectives with specific sectoral laws and regulations, to highlight the alignment of specific objectives or any Programme misalignment or shortcomings.

Based on completed assessments, with reference to the verification of "vertical" coherence, generally Programme objectives were found to be directly coherent with sectoral laws and regulations, as well as those regarding conventional waste management and environmental assessment, whereas in some cases indirect coherence with major laws and regulations regarding Air, Water, Noise, Biodiversity, Cultural and Landscape Heritage elements were also found. With reference to Repository siting and construction, indirect coherence was found with laws and regulations taken into consideration for the definition of exclusion of in-depth study contained in ISPRA Technical Guide no. 29.

External "horizontal" coherence aims to compare National Programme objectives with those of the territorial plans of eight Italian regions, considered insofar as home to sites containing radioactive material derived from energy and non-energy sources (Piedmont, Lombardy, Emilia Romagna, Lazio, Campania, Puglia, Basilicata, Sicily).

Qualitative criteria were used for this analysis, namely the inclusion within the analysis of plans whose main objective was sectoral environmental protection.

Therefore essentially no incoherence emerged from "horizontal" coherence verifications, between Programme objectives and territorial Plans and programmes for regions taken into consideration.

24. What does internal coherence analysis consist of?

The following 5 assessment levels were used to conduct internal coherence analysis:

- Full coherence: whenever there is substantial coherence between Programme orientation and foreseen lines of action;
- Partial coherence: when coherence between Programme orientation and foreseen lines of action is only partially or, in the case of potential ones, not definable in advance;
- Not applicable: when a line of action is deemed to be not applicable and/or beyond the space of action with reference to the objective under consideration;
- Not regarded/considered: when the reference line of action has not been regarded in the Programme (lack of information);
- Incoherence: the Programme line of action and objective pursue contrasting purposes.

Internal coherence assessment was carried out by dividing the National Programme into its two main themes: the management of radioactive waste and the management of spent fuel. In each case, different strategies foreseen in the Programme were listed, with relative lines of action. Lastly, the aforementioned lines of action were compared with expected Programme objectives, by assessing coherence.

Analysis results indicate substantial coherence of Programme actions and objectives, for the energy sector, where the management of radioactive waste and spent fuel is established by the decommissioning strategy of Nuclear Power Stations and nuclear fuel cycle installations, as well as the non-energy sector, where the waste management strategy is implemented using procedures defined within the scope of the Integrated Service.

25. What are the lines of action for radioactive waste management?

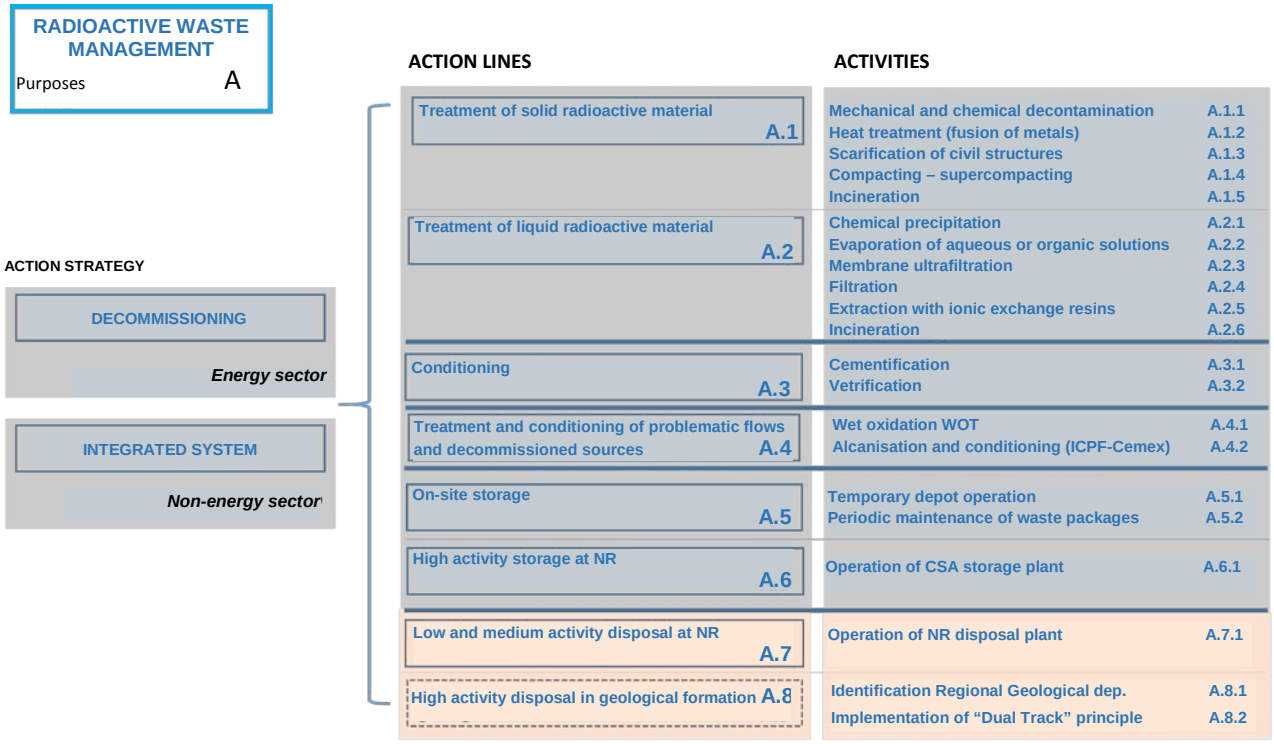


Table 5 - Lines of action for radioactive waste management

Radioactive waste management refers to all technical-administrative and operative actions which must be carried out with reference to radioactive waste management, during the entire life cycle, specifically from production to definitive disposal.

- **Characterisation**: This is the first phase of radioactive waste management. It consists of a series of analyses/measurements to determine chemical/physical/radiological waste characteristics and to classify said waste, for the definition of successive treatment and conditioning phases required for storage followed by definitive disposal.

– **Treatment**: Treatment consists of a series of operations which modify the physical form and/or chemical composition, with the aim of reducing volume and transforming waste into a more suitable physical/chemical form for the successive conditioning phase. Treatment varies according to liquid or solid waste.

– **Conditioning**: The main objective of the waste conditioning process is to transform radioactive residue resulting from treatment processes, into a solid product packaged in special containers, with the greatest possible reduction in volume.

– **Storage**: Waste is safely stored in temporary depots (generally at the site of origin, or at an authorised depot), and is then definitively transferred to a disposal repository. During storage, waste is already confined from the external environment, thus guaranteeing operator and population safety.

– **Disposal**: Disposal occurs in definitive repositories which must confine waste from the environment for extremely long periods (hundreds of years for low to medium activity waste, thousands of years for high activity waste).

26. What are the lines of action for spent fuel management?

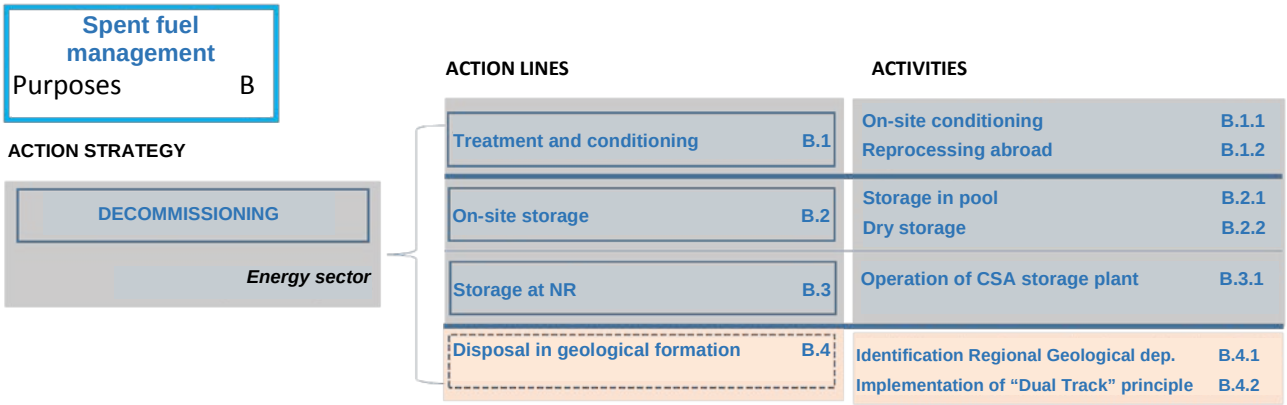


Table 6 - Lines of action for spent fuel management

– **Treatment**: Treatment of spent nuclear fuel consists of reprocessing, which enables the separation of materials making up the residue (highly radioactive), from materials which can be re-used in the production cycle of nuclear fuel. Reprocessing results in a reduction of volume.

– **Conditioning**: Conditioning is the packaging of irradiated fuel elements/bars/pieces, through recovery from storage areas and successive repositioning in specific metal, high integrity metal containers called *casks.* The structural characteristics of *casks* ensure that fuel is shielded and confined under normal circumstances and during foreseeable accidents, for the entire duration of handling (shipment and storage, *dual purpose cask").*

– **Temporary storage**: Irradiated fuel elements are temporarily stored while waiting for definitive disposal in a geological repository. Storage may occur on-site (in pools or dry) or at the National Repository in a long-term temporary depot.

– **Disposal**: Occurs in a geological repository, in line with indications set forth in Directive 2011/70/Euratom. For the permanent accommodation of high activity waste, the "'*dual track*"' method, as referred to in Europe, is applied, namely active participation in feasibility analyses for a repository to be built abroad and shared by several countries and at the same time, research into a solution at a national level.

27. What is the objective of the Environmental Report?

The Environmental Report requires the identification of environmental components which may be negatively or positively affected due to the implementation of NP actions.

Therefore, potential disruptive factors are characterised and possible effects are assessed, with an estimation of the degree of generated interference and the type of change brought about for each component.

28. What are fields of potential influence for the NP and disruptive factors?

According to specifications set forth in ISPRA[1] Guidelines, the field of potential influence, based on which SEA environmental assessments are drafted, must include areas interested by potential effects produced by

[1] Operative indications for evaluation and the drafting of Strategic Environmental Assessment documents - Guidelines 124/2015

the Plan/Programme, based on a conservative estimate which is coherent with the level of planning content definition.

An analysis of radiological and conventional disruptive factors is necessary to define the National Programme's field of potential influence.

Disruptive factors are all elements directly or indirectly generated by plan actions which may cause reversible or irreversible changes to the environment or ecosystem equilibrium.

If no disruptive factors emerge from analyses, it is reasonable to deduce the absence of change to the surrounding environment and consequently, the absence of a field of potential influence requiring assessment.

Disruptive factors induced by single lines of action are summarised in the table below.

RADIOLOGICAL PROFILE
CONVENTIONAL PROFILE
RADIOLOGICAL AND CONVENTIONAL PROFILE

				DISRUPTIVE FACTORS																
				Secondary waste	Gaseous effluent	Liquid effluent	Solid waste	Liquid waste to be treated	Radioactive waste to be conditioned	Spent resins to be treated and conditioned	Spent filters	Irradiation presence of conditioned waste package	Irradiation at Cask	Irradiation at spent fuel	Noise generation	Consumption of water resource	Above ground volume	Ground consumption	Production of excavation earth	Moving of earth
ACTION LINES	Treatment and conditioning	A.1.1	Mechanical decontamination																	
			Chemical decontamination																	
		A.1.2	Fusion																	
		A.1.3	Discharge civil structures																	
		A.1.4	Supercompacting/compacting																	
		A.1.5	Incineration																	
		A.2.1	Precipitation																	
		A.2.2	Evaporation																	
		A.2.3 - A.2.4	Filtration/ultrafiltration																	
		A.2.5	Extraction with resins																	
		A.2.6	Incineration																	
		A.3.1	Cementification																	
		A.3.2	Vetrification																	
		A.4.1	Wet oxidation																	
		A.4.2	Alcanisation and conditioning (ICPF-Cemex)																	
	Storage	A.5	On-site storage																	
		A.6	High activity storage at NR -CSA																	
	Disposal	A.7	Low and medium activity disposal at NR - construction																	
			Low and medium activity disposal at NR - operation																	
			Low and medium activity disposal at NR - closure																	
		B.1	Conditioning/Treatment: On-site conditioning																	
		B.2	On-site fuel storage (in pool or dry)																	
		B.3	High activity storage at NR - CSA																	

Table 7 - Disruptive factors induced by single lines of action

29. What is the field of potential influence for each nuclear power plant in the energy sector?

Based on provisions set forth in Legislative Decree 230/95, operators of nuclear power plants as defined in Chapter VII (articles 36 and 37) are required to carry out a preventive analysis of spatial and temporal distribution of dispersed radioactive material as well as of potential risk of exposure of workers and the population, in potential cases of radiological emergency. Said assessment requires the drafting of a site-specific technical report containing "Technical Requirements of the External Emergency Plan". Also on the basis of the progressive resizing of radiological risk, the External Emergency Plan (EEP), drafted by competent Prefectures, indicates actions to be implemented for emergency management, with a classification of seriousness according to distance from accident site.

For energy sector plants, here below please find the distance within which radiological surveillance is required following the accident event.

Site	**Range of radiological surveillance**
Trino Power Plant	5 km
Caorso Power Plant	3 km
Latina Power Plant	3 km
Garigliano Power Plant	2 km
Saluggia Nuclear Area (SOGIN S.p.A. site and Avogadro depot)	5 km
Bosco Marengo plant	2 km
CR ENEA Casaccia – SOGIN S.p.A. site	6 km
ITREC plant, Rotondella	5 km

Table 8 - Range of radiological surveillance per site

Based on the aforementioned information, the hypothesis of non-negligible radiological consequences due to an accident event taken as a reference for each site, loses significance. For the purposes of this environmental assessment, the potential area of radiological influence will therefore coincide with the radiological monitoring area specified here above.

Conventional aspects

Disruptive factors potentially generated by treatment/conditioning and storage activities are described here below.

Noise generation - Noise generation is linked to hydropneumatic mechanical presses (compactors and super compactors) as well as ventilation systems active throughout the waste life cycle of facilities, in both cases limited to designated buildings. Therefore, the generation of said disruptive factors does not determine appreciable alterations to the zone's characteristic acoustic climate.

Given that everything is enclosed within industrial perimeters of examined sites, there are no areas of potential influence in terms of acoustic profile deriving from NP actions.

The release of liquid/gaseous effluents - The generation of such factors may result in alterations to the quality of receptor components, due to the emission of chemical compounds produced by treatment and conditioning activities of radioactive waste flows as well as reagents used in processes.

A project has been drawn up for the dismantling of four power stations (Trino, Caorso, Latina and Garigliano): Motion for Deactivation pursuant to art. 55 of Legislative Decree 230/95, which based on the nature of previous waste present as well as the estimation (qualitative and quantitative) waste which will

be produced during decommissioning, identifies the most suitable management actions for each identified radioactive flow. The Motion for Deactivation constitutes the project on which Environmental Impact Studies have been drafted which, based on detailed forecast analysis, have identified the most significant phases with reference to environmental interference and demolition activities on buildings declared to be free from radioactivity (decontaminated). During Environmental Impact Assessment, said hypothesis was deemed to be shareable with confirmation, in conventional terms, of the negligible effects of liquid and gaseous effluent emissions produced by treatment/conditioning activities and storage required for radioactive waste. In compliance with specific provisions set forth in the Environmental Impact Assessment decree, SOGIN S.p.A. has drawn up an Environmental Monitoring Plan for each power station undergoing decommissioning.

Radioactive waste management activities described in the Motion for Deactivation for Nuclear Power Stations are included in the NP's lines of action, described in chapter 4 of the Environmental Report. Therefore for Air and Water Environmental components it is possible to assimilate the field of potential influence with the area designated by the approved Environmental Monitoring Programme.

The same reasoning applies to plants for the management of specific flows: ICPF, CEMEX and WOT-SiCoMor, located in the former ENEA sites of Saluggia, Trisaia and the Trino Power Plant.

Water resource consumption - Water requirements for the completion of some treatment processes and the conditioning of radioactive waste is ensured by the water supply system previously used for supply and which continue to serve nuclear installations where such activities are carried out. These systems have been designed according to overall water requirements (industrial water, fire prevention water, service water) for the entire site at hand, without compromising the integrity of water sources subjected to draining or sourcing.

In the case of plants for the treatment and conditioning of specific flows (CEMEX, ICPF, WOT-SiCoMor), estimated water consumption has already been assessed in detail during the Environmental Impact Assessment Procedure, confirming the negligible environmental impact with reference to the quantity of water to be drained.

Therefore, with reference to the "water consumption" disruptive factor, in consideration of hydrogeological/hydraulic factors of interested water bodies as well as the limited volume of water sourcing, the natural water flow is capable of absorbing slight variations caused by treatment/conditioning activities, therefore it is not defined as an area of potential influence caused by NP actions.

Above ground volume - The construction of new above ground facilities may result in landscape disturbances caused by the physical volume of said structures. However, if the territory on which the nuclear site is located is not protected, in virtue of its particular industrial use, historical-cultural or natural characteristics, generated disruptions would not be significant and therefore there would be no need to define a field of potential influence for the landscape component. This is the case for the following energy sector plants: Latina, the IPU and OPEC plants inside the CR ENEA, Casaccia.

Different levels of landscape protection have been detected for the Trisaia, Caorso, Trino, Saluggia and Garigliano sites.

In order to guarantee compliance with radioprotection objectives constituting the foundation of the radioactive waste management process described in chapter 4 of the Environmental Report, they will be confined and positioned so as to reduce external waste handling to a minimum. In the case of the aforementioned power plants, treatment lines will be mostly constructed inside existing buildings, suitably adapted in terms of structure and installations. In this case landscape disruption is not generated, insofar as the building consistency of the industrial installation remains unchanged.

In contrast, in the case in which the complexity of treatment operations or need for additional on-site storage volumes results in the construction of new buildings, landscape disruption is foreseeable due to the new physical volume in the protected landscape. As mentioned here above, downstream of Environmental Impact Assessment procedures carried out in decommissioning projects, an Environmental Monitoring Plan has been drawn up which also includes a series of landscape monitoring points. Therefore, it is possible to assimilate the field of potential influence with the circumscribed area of the approved Environmental Monitoring Plan.

In the case of treatment plants for specific flows (CEMEX, ICPF, WOT-SiCoMor), new volumes have been subjected to specific landscape assessment. Mitigation projects were then developed around any detected potential impacts (approved by the Environment Ministry). Effects on the landscape are monitored within the Environmental Monitoring Projects active at the Saluggia, Trisaia and Trino sites.

With reference to radioactive waste management activities implemented in the Bosco Marengo plant, to date no new volume construction is foreseen and consequently, there is no field of potential influence for the Landscape component.

Under the conventional profile, the field of influence which may be affected by any NP actions is limited to nuclear sites where treatment and conditioning processes are foreseen (Eurex Plant, Saluggia, IPU Plant, Casaccia, Latina Plant, Garigliano Power Station and ITREC Plant, Rotondella), limited to components which may be disrupted (Atmosphere, Water Environment and landscape). For remaining energy sector plants (Bosco Marengo, OPEC I and OPEC II Depots, Casaccia, as well as Deposito Avogadro S.r.l.), in virtue of activities carried out - the storage of radioactive waste and/or irradiated fuel only, - the absence of potential disruptive factors of a conventional nature do not lead to the hypothesis of any kind of effect on the surrounding environment.

With reference to the “Atmosphere and Landscape” environmental component, for the visualisation of any disruptive effects on the surrounding environment, it is possible to assimilate the field of potential influence with the circumscribed Environmental Monitoring Project area as prepared by SOGIN S.p.A.

The following table contains distances within which the Environmental Monitoring Plan control points furthest away from SOGIN S.p.A. sites have been positioned.

Site	EMP Atmosphere	EMP Landscape
Trino Power Plant	2 km	2 km
Caorso Power Plant	2 km	2.4 km
Latina Power Plant	0.3 km	n.a.*
Garigliano Power Plant	0.8 km	3.7 km
EUREX Plant, Saluggia	2 km	2 km
CR ENEA Casaccia- IPU Plant	0.8 km	n.a.*
ITREC plant, Rotondella	0.5 km	1 km
*not applicable as environment not subject to landscape protection		

Table 9 - Area of control points of atmosphere and landscape EMP’s with reference to site

With reference to the “Water Environment” component, the distance of EMP monitoring points is substantially circumscribed to a few hundred metres away from the industrial drainage of SOGIN S.p.A. plants, upstream and downstream from receiving water bodies. The only exception to the aforementioned configuration is the SOGIN S.p.A. site of Casaccia - IPU Plant, for which no specific monitoring network has been defined, insofar as treatment and conditioning activities foreseen at the site do not generate any liquid effluent.

In order to contain a single field of potential influence, as a precautionary measure for each energy sector nuclear plant, the most extended areas identified among those defined for a nuclear accident event have

been used, within the context of the External Emergency Plan, also corresponding to the EMP monitoring points.

Site	Range of radiological surveillance	EMP Atmosphere	EMP Landscape	Field of potential NP influence
Trino Power Plant	5 km	2 km	2 km	**5 km**
Caorso Power Plant	3 km	2 km	2.4 km	**3 km**
Latina Power Plant	3 km	0.3 km	n.a.	**3 km**
Garigliano Power Plant	2 km	0.8 km	3.7 km	**3.7 km**
Saluggia Nuclear Area (SOGIN S.p.A. site and Avogadro depot)	5 km	2 km	2 km	**5 km**
Bosco Marengo plant	2 km	-	-	**2 km**
RC ENEA Casaccia – SOGIN S.p.A. site	6 km	0.8 km	n.a.	**6 km**
ITREC plant, Rotondella	5 km	0.5 km	1 km	**5 km**

Table 10 - Comparison of radiological surveillance range and EMP's

30. What are the potential effects on environmental components relative to energy sector plants?

	Disruptive factors	Potential environmental effects	Directly involved environmental component	
Radiological Aspects	Gaseous effluent emission	alteration of natural background due to the emission of artificial radionuclides	Atmosphere	
	Liquid effluent emission	alteration of natural background due to the emission of artificial radionuclides	Water environment	→ Apart from Sogin Casaccia and Bosco Marengo sites because no liquid effluent has been produced; Storage action line excluded
	Irradiation	variation of natural background radiation due to direct irradiation from nuclear waste requiring treatment and conditioning	Ionising radiation	→ Treatment and conditioning action line excluded

	Disruptive factor	Potential environmental effects	Directly involved environmental component	
Conventional Aspects	Gaseous effluent emission	variation in air quality	Atmosphere	→ Storage action line excluded
	Liquid effluent emission	variation in receptive water body quality	Water environment	→ Apart from Sogin Casaccia and Bosco Marengo sites because no liquid effluent has been produced; Storage action line excluded
	Above ground volume	temporary modification of characteristics representative of the territory and environment	Landscape	→ Excluding Sogin Casaccia, Latina plant and Bosco Marengo sites as the environmental landscapes are not protected

Table 11 – Direct effects on environmental components (Energy sector)

The generation of disruptive factors determines *direct effects* on the Atmosphere, Landscape, Water Environment and Ionising Radiation components, and may also generate *indirect effects* on Public Health and Biodiversity components.

With reference to the Public Health component, in October 2015 the Higher Health Institute published the results of an epidemiological study conducted on a resident population in Municipalities where nuclear installations once operated. For the entire period spanning from 1980 to 2008, the health of the population residing in municipalities once home to nuclear installations is generally comparable to those of the general public of the entire Region.

Based on the aforementioned, the definition of a field of potential influence for the Public Health component has not been deemed feasible.

With reference to the Biodiversity component, given the type of disruptive factors at hand, it was deemed precautionary to assimilate the NP field of potential influence with the same as the one identified in aforementioned Emergency Plans.

	Disruptive factors	Potential environmental effects	Directly involved environmental component		
Radiological Aspects	Gaseous effluent emission	alteration of natural background due to the emission of artificial radionuclides	Atmosphere	→ Ionising radiation	→ Biodiversity
	Liquid effluent emission	alteration of natural background due to the emission of artificial radionuclides	Water environment	→ Ionising radiation	→ Biodiversity
	Irradiation	variation of natural background radiation due to direct irradiation from nuclear waste requiring treatment and conditioning	Ionising radiation		→ Biodiversity

	Disruptive factor	Potential environmental effects	Directly involved environmental component	
Conventional Aspects	Gaseous effluent emission	variation in air quality	Atmosphere	→ Biodiversity
	Liquid effluent emission	variation in receptive water body quality	Water environment	→ Biodiversity
	Above ground volume	temporary modification of characteristics representative of the territory and environment	Landscape	

Table 12 – Indirect effects on environmental components (Energy Sector)

31. What is the field of potential influence for each nuclear power plant in the non-energy sector?

Integrated Service

With reference to the management of previous waste and waste which will be produced by the non-energy sector, the only operator authorised to carry out treatment/conditioning and storage is Nucleco S.p.A.. Other operators of the Integrated Service (Campoverde S.r.l. and Protex S.p.A.) limit their own management activities to pre-packaging for volume reduction and storage for decay (storage periods of less than 100 days).

The Environmental Report exclusively considers the field of potential influence with reference to the Nucleco S.p.A. site.

For the Nucleco S.p.A. site, located inside the RC ENEA, Casaccia, with reference to NP actions (treatment, conditioning activities and the storage of conditioned waste), potential disruptive factors which may determine effects on the surrounding environment (both under a radiological and conventional profile) are the same as those identified for energy sector plants.

Radiological aspects

With reference to possible alterations to the natural surrounding environment due to the emission of artificial radionuclides following the controlled release of radioactive effluents (liquid and gaseous), as well as any changes to radioactivity in the surrounding environment due to direct irradiation caused by the

presence of conditioned radioactive waste: as specified in the previous paragraph, in the case of these structures too, the normal management of radioactive waste does not determine any significant disruption to the surrounding environment.

Therefore it is not possible to define a field of potential influence following the application of NP lines of action. However, similarly to what has been proposed for energy cycle plants, for this category of plant it has also been deemed precautionary to equate the field of potential influence with the area defined in the "External Emergency Plan for Research Centres of ENEA", which, as for the SOGIN S.p.A. site in Casaccia, corresponds to an area of approximately 6 km in diameter.

With reference to the temporary depots within the context of the Integrated Service, such as those of Protex S.p.A. and Campoverde S.r.l., given the type of waste stored, no variations to the surrounding environment they depend on and caused by irradiation are foreseeable.

Lastly, the governing strategy developed for the management of nuclear clean-up at the Cemerad S.r.l. site does not include the construction of treatment/conditioning plants for casked waste currently stocked in Statte, only the characterisation of casks for the definition of most suitable nuclear shipment procedures to an authorised site, which will probably be identified within the context of the integrated Service.

Conventional aspects

Disruptive factors potentially generated by treatment/conditioning and storage activities are described here below.

Noise Generation - Noise generation is linked to the operation of extremely large-sized presses (compactors and super-compactors) and ventilation systems active throughout the entire waste life cycle installation, in both cases confined to dedicated buildings. The generation of said disruptive factors does not determine appreciable alterations to the zone's characteristic acoustic climate.

Based on the aforementioned, with reference to noise, there is no field of potential influence deriving from PN actions insofar as everything is contained within industrial areas.

The release of liquid/gaseous effluents - The generation of such factors may result in alterations to the quality of receptor components, due to the emission of chemical compounds produced by treatment and conditioning activities of radioactive waste flows as well as reagents used in processes.

For currently operating plants, laws and regulations in force at the time of their construction did not establish the requirement for them to undergo environmental assessment, limiting controls to industrial effluent (liquid and gaseous) for the acquisition of relative emissions authorisations set forth in legislative Decree 152/06 as amended. For this reason at the Nucleco S.p.A. site, even though there is no active environmental monitoring network for the identification of any alterations in air and surface water quality of a conventional nature, chemical analyses conducted on industrial liquid and gaseous effluent have not identified any critical environmental issues over the years.

However, given the possibility of an accident event in the nuclear field, it is plausible to assume a field of potential influence, also for conventional aspects, of NP actions, circumscribed to the 6 km area which corresponds to the one identified with reference to radiological aspects.

Water resource consumption - The water requirement for solid and liquid radioactive waste treatment and conditioning processes is ensured by the water supply system which serves the entire RC ENEA and has

been in operation since the facility's construction. It consists of three deep wells which provide an annual total of approximately 1,000,000 m^3 to ensure the availability of water for drinking as well as industrial purposes.

The proportion of water used by Nucleco S.p.A. for its own industrial activities is estimated at around 0.1% (1,000 m^3/year) of the total supply.

Above ground volume - Based on information available to date, the construction of new buildings is not necessary. Furthermore, the landscape surrounding the Nucleco S.p.A. site is not under landscape protection.

Based on the aforementioned, for the landscape component there is no area of potential influence caused by NP actions.

32. What are the potential effects on environmental components relative to non-energy sector plants?

Potential environmental effects include disruption to the following environmental components:

	Disruptive factors	Potential environmental effects	Directly involved environmental component	
Radiological Aspects	Gaseous effluent emission	alteration of natural background due to the emission of artificial radionuclides	Atmosphere	
	Liquid effluent emission	alteration of natural background due to the emission of artificial radionuclides	Water environment	→ Storage action line excluded
	Irradiation	variation of natural background radiation due to direct irradiation from nuclear waste requiring treatment and conditioning	Ionising radiation	→ Storage action line excluded

	Disruptive factor	Potential environmental effects	Involved environmental component	
Conventional Aspects	Gaseous effluent emission	variation in air quality	Atmosphere	
	Liquid effluent emission	variation in receptive water body quality	Water environment	→ Storage action line excluded

Table 13 – Direct effects on environmental components (Non-energy sector)

With reference to the generation of disruptive factors which may determine direct effects on the quality of the "Atmosphere" and "Water Environment" and "Ionising Radiation" components, the same assessments remain valid for Integrated Service plants, regarding indirect effects on the "Public Health" and "Biodiversity" components described for energy sector installations.

	Disruptive factors	Potential environmental effects	Directly involved environmental component				
Radiological Aspects	Gaseous effluent emission	alteration of natural background due to the emission of artificial radionuclides	Atmosphere	→	Ionising radiation	→	Biodiversity
	Liquid effluent emission	alteration of natural background due to the emission of artificial radionuclides	Water environment	→	Ionising radiation	→	Biodiversity
	Irradiation	variation of natural background radiation due to direct irradiation from nuclear waste requiring treatment and conditioning	Ionising radiation			→	Biodiversity

	Disruptive factor	Potential environmental effects	Directly involved environmental component		
Conventional Aspects	Gaseous effluent emission	variation in air quality	Atmosphere	→	Biodiversity
	Liquid effluent emission	variation in receptive water body quality	Water environment	→	Biodiversity

Table 14 – Indirect effects on environmental components (Non-energy sector)

Nuclear Research

In Italy there are nuclear research centres operating in the fields of medical science, physics and radiochemistry. All radioactive waste produced by research activities is managed in compliance with procedures set forth in Legislative Decree 230/95.

To date, and with the exception of the RB3 reactor (Nuclear Engineering Laboratory of Montecuccolino, University of Bologna, nearing the conclusion of decommissioning activities, authorised in 2010), authorisation for deactivation has not been granted to any other plant.

With reference to the "Deactivation project for the Essor Nuclear Plant Complex and Joint Research Centre in ISPRA (VA)" the scoping phase has been completed, enabling the drafting of the study for the Environmental Impact Report.

Therefore a potential field of influence for research installations (JRC Ispra, CESNEF, LENA, TRIGA and TAPIRO, AGN 201) is not identified, and no environmental assessments are carried out.

33. What is the potential environmental impact linked to the shipment of radioactive waste and spent fuel?

As for National Repository siting, potential environmental implications linked to the shipment of radioactive waste has not been considered in the definition of field of study. In this case too, each shipment on national territory (essentially the conferral of medical waste to the Integrated Service, the shipment of radioactive waste to treatment plants, future conferral to the National Repository) is subject to prior evaluation, in terms of potential radiological risk, as well as authorisation from the Ministry of Economic Development, thus guaranteeing maximum safety for the population and environment, in compliance with regulations and procedures in force.

Furthermore, under a conventional profile, the environmental impact of shipments linked to radioactive waste management is not currently assessable insofar as it is not possible to compare the number of overall annual shipments with national shipment network traffic estimates.

The shipment of spent radioactive fuel, part road and part rail, is possible only in compliance with specific safety measures. Accident risk is assessed in advance, and deemed highly unlikely, considering the overall quantity of precautions in place and suitable consideration of foreseeable eventualities.

Such shipments are subject to the issuing of ISPRA (Institute for Environmental Protection and Research) nuclear safety certification, as well as railway safety authorisation from the Ministry of Infrastructures and Transport. Each shipment can only begin after the issuing of all documentation by all competent bodies, as established in relative laws and regulations in force.

Based on the aforementioned, with reference to the radiological profile, the shipment of containers by road and rail as well as any temporary stops along the way do not constitute a danger for the population insofar as materials and container construction procedures guarantee the absence of any health risk for the population.

34. What is the potential environmental impact generated by the National Repository?

Currently it is not possible to refer to the physical place where the National Repository will be built. Therefore the issue cannot be taken into consideration in defining the National Programme field of potential influence. However in view of this fact, it is still possible to carry out some environmental analyses which are already definable, for Programme actions, without burdening the study with hypothetical, in-depth analyses, pointless in the absence of certain siting information.

Therefore it is not possible to assess the significance of impact on environmental components, although this will occur during the Environmental Impact Assessment Procedure (pursuant to Legislative Decree 31/2010 and Legislative Decree 152/2006 as amended). It is appropriate to remember that the application validated by ISPRA Technical Guide 29 will ensure the selection of a site which will constitute a natural barrier, capable of isolating radioactive waste from the atmosphere, in conjunction with planned engineered barriers, and therefore protecting the population, environment and heritage for the necessary period (Safety Assessment).

In particular, with reference to the long-term temporary storage of high activity material which will occur at the National Repository, it is also important to note, as highlighted in the illustrative report associated with Technical Guide 29, "*a site deemed appropriate for the siting of a surface disposal plant for low and medium activity radioactive waste, based on the application of selection criteria for chemical-physical, natural and anthropic criteria of the territory, such as those identified in the Technical Guide, may also be deemed appropriate for the siting of a long-term storage depot*".

Radiological Aspects

Disruptive factors potentially generated by National Repository operation may essentially consist in variations to the natural surroundings due to irradiation, as well as a dose variation for the population. In each case such eventualities are excluded insofar as Technical Guide 29 contains a definition of radioprotection objectives for the population under normal evolutionary operation conditions of the repository system, both during operation and later stages, based on compliance with non-relevance criteria established in national legislation.

For **accident conditions**, radioprotection objectives will be established so that any radiological impact on the population deriving from the aforementioned situations does not require the adoption of any

protective intervention from said population, even in the face of the most serious foreseeable accident scenarios, in line with a repository structure such as the one at hand.

Furthermore, as already specified, siting criteria defined in Technical Guide 29 have been drawn up for the selection of areas with geological, geomorphologic, hydrological, hydrogeological and geochemical characteristics which, in conjunction with engineered structures, guarantee the safety and confinement of radioactive waste.

The absence of radiological impacts must also be assessed in light of evolutionary scenarios of systems deemed credible and based on different depot time frames (short and long term), using specific safety analysis procedures.

Conventional Aspects

Ground consumption - With reference to the change of ground use, which will necessarily occur, it is likely that the application of siting criteria will lead to the selection of a site of scarce anthropisation and use at the time of selection, thus determining its transformation for service use. Furthermore, the site will not be located in natural protected areas and will not interfere with important natural resources or sites of historical and archaeological interest.

With reference to the removal of soil upon the refilling of aquifers, deriving from water-proofing consequent to National Repository construction, in light of the application of criteria, the site will not interfere with important underground water resources and it is foreseeable that water-proofing will cause insignificant impact.

Liquid and gaseous effluents, noise generation, water resource consumption, the production of excavated earth, earth moving - The application of criteria prevents disruption which may be caused by such potential impacts to naturalistic components, insofar as the presence of protected areas, habitats, plant and animal species of high conservation value is excluded in advance.

Above ground volume - Once loaded, the repository will be covered by an artificial hill made from inert and low permeability materials which constitutes additional protection while also ensuring visual harmonisation of the repository with the surrounding environment, covered by a lawn.

Therefore an insignificant impact is foreseeable for these components, especially in the final phase of the National Repository's life, without prejudice to suitable assessments and mitigations which may be defined within the context of the Environmental Impact Assessment Procedure, regarding construction and operation phases.

35. How is NP analysis structured?

With reference to two general strategies (decommissioning and integrated service) and relative lines of action (treatment and on-site storage of radioactive waste, dry storage and pool storage of irradiated fuel), expected environmental impacts are specified for each significant environmental component, in relation to impacts of activities (atmosphere, water environment, ionising radiation and biodiversity).

Said analysis does not take the following into consideration:

- potential environmental effects deriving from objective 4 of the NP (Siting, construction and operation of the National Repository), insofar as siting is currently in a preliminary phase.
- The potential environmental effects deriving from objectives 2, 8, 9, 10 of the NP, as their achievement does not determine direct repercussions on the state of the environment, in a strict sense.

These objectives will constitute the subject of expected NP environmental monitoring, albeit limited to the quantification of successively defined “Process Indicators”.

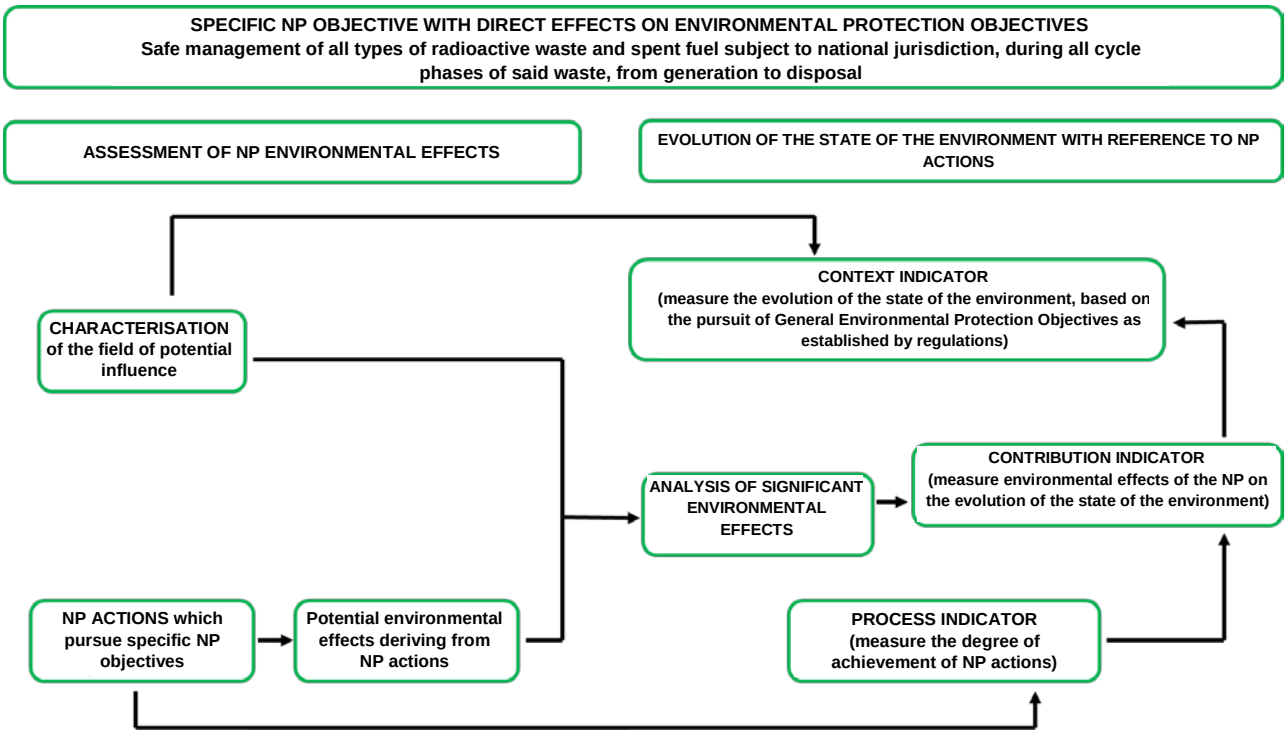


Figure 9 - National Programme assessment path

Expected environmental effects of the NP and both lines of action have been divided into short, medium and long term:

	Short term	**Medium term**	**Long term**
Decommissioning	Facility operation for the treatment and conditioning of previous radioactive waste as well as of waste deriving from the safe maintenance and waste produced during the *decommissioning* of nuclear sites, as well as the operation of on-site temporary depots, until full loading	The safe storage at on-site depots of treated and conditioned radioactive waste and spent fuel, pending National Repository availability (brown field) Dismantling of aforementioned depot structures.	Conferral of radioactive waste and spent fuel to the National Repository, with the release of sites free from radiological constraints *(*green field*)*
Integrated Service	Operation of radioactive waste treatment, conditioning and storage plants	NA insofar as management cycle closure is not foreseen	NA insofar as management cycle closure is not foreseen

Table 15 - Environmental effects based on National Programme progress

Environmental effects are measured as an increase or decrease of potential environmental disruptions with reference to temporal phases preceding assessed action, and are defined as follows:

ABSENT	The disruptive factor, despite being identifiable, does not produce any change/disruption to the external environment, therefore analysed environmental characteristics remain unchanged within the reference time frame, despite the progress of activities
INSIGNIFICANT	The change/disruption is within the variable of the system at hand and therefore no significant change is caused to the environment, within the reference time frame for the action in progress.
POSITIVE	Upon the conclusion of activities in progress, site release free from radiological constraints will be possible, with the definition of a positive evolutionary tendency of the overall state of the environment, even in the sense of the recovery of own specific original characteristics.

Table 16 - Environmental effects with reference to time frames

36. How can the evolution of the environmental state be measured in relation to progress of NP activities?

The following indicators are used to assess the evolution of the environmental state over time, with the progress of NP activities:

- *Process indicators*: measure the degree of completion of NP actions (for example: the number of waste packages produced by radioactive waste treatment and conditioning, the number of new treatment plants in operation, the number of new authorisations acquired);
- *Context indicators*: measure the evolution of the environmental state, based on the pursuit of General Environmental Protection Objectives (for example receptive water body capacity, climate conditions, the presence of protected areas)
- *Contribution indicators*: measure the environmental effects of the NP on the evolution of the state of the environment (for example: an increase/reduction of above ground volumes, measurement of released activities and comparison with maximum authorised limits).

37. Where has potential disruption to the environment been detected?

Potential environmental effects are analysed and assessed by correlating them to the territorial context defined for each nuclear plant, namely the site of implementation for both action strategies (decommissioning and integrated service), comparing them to the consequent evolution of the state of the environment.

In particular, with reference to natural incidence, potential incidence produced by the implementation of the aforementioned Strategies - NP lines of action, on the nuclear sites in Saluggia, the Research Centre (RC) ENEA Casaccia and ITREC - Rotondella (MT), are being methodologically analysed.

With reference to other plants being studied: for the four nuclear power stations, treatment/conditioning and temporary storage activities which will be implemented are part of a broader decommissioning project. Environmental assessment procedures to which Motions for Deactivation have been subjected, with reference to said plants, have confirmed the negligibility of impacts produced, also pursuant to the Habitat Directive.

- Environmental characterisation of the NP field of potential influence confirms the absence of protected areas and Nature 2000 sites in the vicinity of the Bosco Marengo plant.
- At Integrated Service temporary depots (Protex S.p.A. and Campoverde S.r.l.), the Cemerad S.r.l. depot and nuclear research centres, no radioactive waste treatment is carried out. The ER has confirmed the absence of potential environmental disruptions in the surrounding areas of said plants, both radiological and conventional in nature. Consequently interference generated by NP actions on protected areas and Nature 2000 sites was not investigated.

Table 25 here below systematically displays potential environmental effects for each site along with foreseen NP action strategies.

38. Has naturalistic impact assessment of the National Repository been carried out?

Siting, construction and operation activities of the National Repository and Protection Plan are not analysable in their current state in terms of potential naturalistic impact insofar as the infrastructure is yet to be sited. However, as shown in par. 5.3 of the Environmental Report, the application validated by the ISPRA Technical Guide 29 will ensure the selection of a site which will constitute a natural barrier, capable of isolating radioactive waste from the atmosphere, in conjunction with planned engineered barriers, and

therefore protecting the population, environment and heritage for the necessary period (Safety Assessment). Criteria for National Repository siting contained in the Technical Guide must take into account the value of biodiversity (habitat and species) within territories under assessment[2]. Indeed the application of exclusion criteria CE11 prevents NR-TP siting in protected areas pursuant to the Habitat and Birds Directive, thus ensuring compliance with the principle of precaution on the basis of Environmental Assessments and Naturalistic Impact.

39. What is impact Assessment and how is applied to the NP?

With art. 6 paragraphs 3 and 4, the Habitat Directive introduced the preventive procedure of Impact Assessment, applicable to plans or projects which are not directly connected and necessary for the management of Nature 2000 sites.

The Directive proposes the articulation of assessment into four successive "levels" (phases): Screening, "suitable" assessment, assessment of alternative solutions, assessment in the absence of alternative solutions if there is any negative impact. Successive progression between various phases is not compulsory but consequential to information and results obtained.

The extensive variety of plan and programme types may require case per case adjustment, with reference to assessment methodologies of potential naturalistic impacts.

Impact Assessment applied to the National Programme (NP) requires significant adjustments to the analytical and assessment approach.

Indeed in the case at hand, the subject of assessment is a strategic orientation document which entrusts the following tasks with the task of achieving objectives specified by Directive 2011/70/Euratom:

- actions of an immaterial nature (for example: annual updating of the radioactive waste inventory, creation of a research and development programme for the safe management of radioactive waste and spent fuel) with slight chances of negative impact on naturalistic components;
- actions of a material nature but which are not currently siteable (NR disposal of low and medium activity waste, temporary long-term storage of high activity radioactive waste and spent fuel at the NR, geological repository siting);
- actions which have already been undertaken and which may have already produced effects, thus requiring monitoring and preventive assessment (decommissioning projects of Nuclear Power Stations, systems for the disposal of waste of medical origin);
- actions which require siting but with inadequate spatial resolution and project data for the analysis of the relationship with the habitat and species present on potentially compromised sites (plants for the treatment of solid radioactive wastes of former ENEA energy sector sites, new temporary on-site depots).

Therefore a study methodology has been developed for application within future Impact Studies. Details on the contents of this methodology can be found in Annex 3 of the Environmental Report

[2] Protected Natural Areas, Nature 2000 Network sites, habitats and animal species of conservation importance.

40. What are the conclusions of the methodological note on NP Impact Assessment?

The NP, as defined in EU (Directive 2011/70/Euratom) and national regulations, is a strategic document which does not provide for the possibility of a punctual definition of interactions between environmental interference produced by its Lines of action and sites protected under the Nature 2000 network.

In the case of Italy, a substantial part of the NP is centred around decommissioning activities of energy sector plants. Nuclear Power Station dismantling projects[3] have already obtained a favourable judgement of Environmental Compatibility. Within the field of said assessment procedure, the naturalistic impact of site-specific conservation activities of protected areas within the field of potential impact has been deemed non-significant. The analysis of this study has not been broken down into treatment, conditioning and stocking actions linked to the decommissioning of Trino, Caorso, Latina and Garigliano, so as not to repeat a previously conducted environmental assessment.

With reference to stocking activity for decay, operated by Protex S.p.A. and Campoverde S.r.l. within the scope of the Integrated Service, it is possible to immediately exclude any disruption to the habitat or species, given the absence of any generated environmental effects. The same conclusion can be drawn with reference to the Cemerad S.r.l. plant, the former FN Plant in Bosco Marengo and nuclear research plants.

Based on the aforementioned, it can be concluded that the conservation objectives of Nature 2000 network sites have not been placed at risk by the implementation of NP Action Strategies, as it has already been established that they do not affect previous environmental procedures insofar as no environmental interference is generated (absence of disruptive factors - absence of protected sites). As specified in the European Union methodological guide[4], in these cases the lack of "significant impact" has been ascertained and therefore in-depth analysis, as established in points 3 and 4 of the Habitat Directive, is not necessary.

In line with the principle of precaution and based on technical details contained to date in the NP, for the Saluggia nuclear area, the R.C. in Casaccia and ITREC Plant, Rotondella, it is not possible to exclude impact on Sites of Community Interest (SIC) / Special Protection Areas (SPA) present within the field of potential influence defined in the Environmental Report. What emerges from this overview is that it will only be possible to determine the effective presence of naturalistic impact on Nature 2000 sites once the assessment is carried out on projects deriving from the engineering of NP action lines.

In any case it is important to note that radioactive waste and spent fuel management constitutes a binding national priority and which the NP is required to face by guaranteeing the highest safety and protection standards as well as the protection of man and the environment (for example by maximum limitation of waste shipment on national territory, siting the NR in compliance with the best, internationally recognised siting criteria, guaranteeing a widespread network for medical waste collection). For this reason, even if within the scope of the Strategic Environmental Assessment procedure to which the programme was subjected, it has not always been possible to establish with certainty[5] that planned activities do not compromise the integrity of protected sites, it can also be objectively noted that the NP protects important national interests linked to safety and public health, and that intrinsically it will produce substantial positive effects for the environment.

[3] Aspetti nucleari legati alla gestione della radioattività artificiale presente negli impianti ed aspetti convenzionali legati alla demolizione delle strutture e bonifiche finali di sito.

[4] European Commission, 2002 - *Assessment of Plans and Projects of significant impact on Nature 2000 network sites. Methodological guide to provisions set forth in article 6, paragraphs 3 and 4 of the "Habitat" Directive 92/43/EEC*.

[5] On this point please see provisions set forth in art. 6 par. 3 of Directive 92/43/EEC

Key	
ABSENT	
INSIGNIFICANT	
POSITIVE	
NON-CONSIDERABLE	-

ACTION STRATEGY	ACTION LINE	SITE	ENVIRONMENTAL COMPONENT														
			ATMOSPHERE			WATER ENVIRONMENT			LANDSCAPE			IONISING RADIATION			BIODIVERSITY		
			Short term	Medium term	Long term	Short term	Medium term	Long term	Short term	Medium term	Long term	Short term	Medium term	Long term	Short term	Medium term	Long term
DECOMMISSIONING	TREATMENT AND CONDITIONING OF RADIOACTIVE WASTE	TRINO, CAORSO, LATINA AND GARIGLIANO															
		SALUGGIA															
		CASACCIA				-	-	-	-	-	-						
		TRISAIA															
	ON-SITE STORAGE OF RADIOACTIVE WASTE	TRINO, CAORSO, LATINA AND GARIGLIANO				-	-	-									
		SALUGGIA				-	-	-									
		CASACCIA				-	-	-									
		TRISAIA				-	-	-									
		BOSCO MARENGO				-	-	-	-	-	-						
	DRY ON-SITE STORAGE OF IRRADIATED FUEL	CASACCIA				-	-	-	-	-	-						
		TRISAIA				-	-	-	-	-	-						

ACTION STRATEGY	ACTION LINE	SITE	ENVIRONMENTAL COMPONENT									
			ATMOSPHERE		WATER ENVIRONMENT		LANDSCAPE		IONISING RADIATION		BIODIVERSITY	
			stored energy fuel	removed energy fuel	stored energy fuel	removed energy fuel	stored energy fuel	removed energy fuel	stored energy fuel	removed energy fuel	stored energy fuel	removed energy fuel
DECOMMISSIONING	POOL ON-SITE STORAGE OF IRRADIATED FUEL	SALUGGIA (Avogadro)	-	-	-	-	-	-				
		TRISAIA	-	-	-	-	-	-				

ACTION STRATEGY	ACTION LINE	SITE	ENVIRONMENTAL COMPONENT				
			ATMOSPHERE	WATER ENVIRONMENT	LANDSCAPE	IONISING RADIATION	BIODIVERSITY
			Short term operation	Short term operation	-	Short term operation	Short term operation
INTEGRATED SERVICE	TREATMENT AND CONDITIONING OF RADIOACTIVE WASTE	NUCLECO			-		
	ON-SITE STORAGE OF RADIOACTIVE WASTE			-	-		

Table 17 - potential environmental effects for site and action strategies established by the NP

41. Why have the four power stations in Trino, Caorso, Latina and Garigliano been subjected to a single environmental effect assessment?

The four Italian power stations which are no longer in operation, despite being located in different territorial contexts and characterised by different industrial cycles (Garigliano and Caorso are both BWRs belonging to different generations) and previous radioactive waste as well as radioactive waste which will be produced by decommissioning activities that are not entirely homogeneous, they are nonetheless assimilable in terms of present or future NP actions (treatment, conditioning and on-site storage), as well as management strategies (decommissioning in two phases, brown field and green field).

Every single power plant decommissioning strategy also complies with specific provisions of Environmental Impact Assessment Decrees.

42. What is the assessment of NP environmental effects on the 4 power stations of Trino, Caorso, Latina and Garigliano?

Action lines A1, A2, A3, A4 – Treatment and conditioning of radioactive waste

Atmosphere and water environment

With reference to the atmosphere and water environment components, a gradual improvement of potential environmental effects over time has been recorded. This trend is correlated to the reduction of the quantity of waste requiring treatment and conditioning, with the progression of the decommissioning strategy, up to cessation of plant operation, once all radioactive waste is conditioned into suitable waste packages, ready for conferral to the National Repository and temporarily stored in on-site depots *(*brown fields). Therefore potential environmental effects defined for the component under examination can be considered to have concluded upon termination of conditioning and treatment activities, determining no variations in the state of the environment in the long term (green field).

Gaseous and liquid discharges produced by foreseen treatment and conditioning processes are controlled and recorded, and will be emitted into the environment in compliance with single “discharge formulas” with reference to radiological aspects, or “Single Environmental Authorisations”, with reference to conventional aspects.

Furthermore, environmental protection provisions will also keep the effects of NP actions under control, with reference to the evolution of the environmental context of each of the sites under examination.

ATMOSPHERE AND WATER ENVIRONMENT Liquid and gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

Landscape

With reference to NP actions, new treatment and conditioning plants will be located inside pre-existing buildings, except for in cases in which the safe management of treatment and conditioning processes requires the construction of volumes suitable for containing aforementioned plant structures.

In any case the construction of new volumes will not physically alter the landscape insofar as they will be located within an industrial site (plant area). Furthermore, the current quality level of the landscape-environment context will not be compromised insofar as disruption will be transitory and the construction of new plants will only be visible in close proximity.

Therefore for the landscape too, the evolutionary trend of the state of the environment is characterised by gradual improvement as decommissioning activities continue, until any potential disruption is nullified, following the dismantling of treatment plants (brown fields).

LANDSCAPE Physical volume	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

Ionising radiation

The potential environmental effect which may determine alterations to the natural environmental background due to the emission of artificial radionuclides is consequent to the emission of liquid and gaseous effluent during ordinary operation of treatment and conditioning plants. These effluents may only be emitted into the environment in compliance with discharge limits, based on radiological non-relevance criteria. Therefore the insignificance of consequent environmental effects is confirmed.

IONISING RADIATION Liquid and gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

Biodiversity

The 4 nuclear power plants are surrounded by a respect area within which all anthropic activity is forbidden, and therefore where favourable general conditions have been created for the colonisation of plant, flower and animal species.

With reference to foreseen decommissioning activities, artificial radioactivity released into the environment can be deemed to be minimal, if compared to discharge levels during plant operation. The consequent expected disturbance caused by the emission of artificial nuclides into the atmosphere can be deemed insignificant and in any case will not induce any assessable effects.

With reference to conventional aspects, the non-significance of the release of liquid and gaseous effluent into the atmosphere also enables the exclusion of potential indirect disturbance to the component under examination.

BIODIVERSITY Alteration of natural background due to the emission of artificial radionuclides	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

Action line A5 - On-site storage of radioactive waste

Possible disruptive factors generated by the operation of radioactive waste storage plants may determine environmental effects within the defined field of influence, limited to the progressive loading of conditioned waste packages inside temporary depots, the emission of gaseous effluents from the depot ventilation system and variation in the consistency of the nuclear site's physical volume. Said temporary depots will in all cases be constructed subject to specific approval of single projects, and authorised to operate only if characteristics guarantee safety and environmental compatibility.

Atmosphere

Gaseous effluent emitted into the environment via aforementioned forced ventilation systems fitted in temporary depots raise radiological issues only, limited to those depots containing previous radioactive waste and/or radioactive waste produced during the safe maintenance of plants, yet to undergo treatment and conditioning.

Furthermore, the quantity of gaseous effluent is considerably smaller than those emitted during treatment and conditioning which have already been deemed non-significant. Therefore, under normal depot operation conditions, the environmental effect which in the short and consequently medium term may determine alterations in the environmental background caused by the emission of artificial nuclides, is absent.

ATMOSPHERE Gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	absent
medium term (brown field)	absent
long term (green field)	absent

Ionising radiation

Treatment and conditioning activities linked to temporary depots and the consequent increase in conditioned waste packages may cause an increase in the irradiation dose to the extent that characteristic local natural background radiation may be affected.

However it is evident that inside their own industrial areas, the nuclear power stations are characterised by defined physical zoning, pursuant to laws and regulations, where Controlled Zone depots are located.

Due to the intrinsic nature of said zoning, the physical extension of the Controlled Zone may vary according to changes in conducted nuclear activities, for example during the loading of a depot.

The monitoring of gamma rate dose values in the air, conducted periodically and upon NP action implementation, will ensure the identification of any anomalies regarding natural environmental background radiation fluctuations, taking into account the requirement of radiological non-relevance and therefore the non-significance of environmental effects on the reference territory.

IONISING RADIATION Presence of conditioned waste packages	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	insignificant
long term (green field)	positive

Landscape

With reference to the landscape component, aspects defined for radioactive waste treatment installations are also applicable to this line of action.

The difference with the line of action analysed here above consists of the difference in the assessment of the degree of expected disturbance with the progression of decommissioning activities. In action line 1 (treatment and conditioning of radioactive waste), impact is limited to the medium term, in action line 2 (on-site storage), it remains even after the conclusion of treatment/conditioning activities, up to total conferral of conditioned waste packages to the National Repository.

LANDSCAPE Physical volume	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	insignificant
long term (green field)	positive

Biodiversity

Any disruption to the biodiversity component caused by the on-site storage of radioactive waste is linkable to any variation in the environmental gamma dose rate defined by the presence of waste.

Similarly to what has been analysed for the ionising radiation component, the environmental effect which in the short term and consequently in the medium and long term, could determine a variation of natural background radiation due to irradiation, is absent, insofar as within said natural local fluctuations.

BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**
short term (operation)	absent
medium term (brown field)	absent
long term (green field)	absent

43. What is the assessment of NP environmental effects on the SOGIN S.p.A. site in Saluggia?

Action lines A1, A2, A3, A4, A5 – Treatment, conditioning and storage of radioactive waste

NP actions to be carried out at the SOGIN S.p.A. site in Saluggia are analogous to those described for nuclear power stations.

In particular, foreseen activities regard the treatment and conditioning of radioactive waste and its storage in temporary depots. In this case too, to date not all plant structures necessary for the implementation of identified processes are actually present. Indeed some installations are currently being designed, whereas the Cemex plant is under construction.

Expected environmental effects for the completion of the entire cycles regarding radioactive waste management, according to advancement of safe management and decommissioning, have already been mentioned, described and analysed and therefore assessed in the previous paragraph, namely:

Action lines - Treatment and conditioning

ATMOSPHERE AND WATER ENVIRONMENT Liquid and gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

IONISING RADIATION Liquid and gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

LANDSCAPE Physical volume	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

BIODIVERSITY Alteration of natural background due to the emission of artificial radionuclides	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

Action lines- storage

ATMOSPHERE Gaseous effluent emission	
Evolution over time	**Environmental effect**
Short term (operation)	absent
medium term (brown field)	absent
long term (green field)	absent

IONISING RADIATION Presence of conditioned waste packages	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	insignificant
long term (green field)	positive

LANDSCAPE Physical volume	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	insignificant
long term (green field)	positive

BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**
Short term (operation)	absent
medium term (brown field)	absent
long term (green field)	absent

44. What is the assessment of NP environmental effects on Deposito Avogadro S.r.l. (Avogadro Depot)?

Action lines B2-B.2.1 - Storage in on-site pool of irradiated fuel

The Avogadro Depot has been inserted as one of the structures at the service of the energy sector as to date the only irradiated fuel placed in pool storage is linked to the energy production cycle, pending transfer abroad for scheduled reprocessing activities.

With reference to the current state of operation of the Avogadro Depot, radioprotection criteria adopted for the operation of such facilities are the same as those adopted for temporary depots of the radioactive waste site.

Once irradiated fuel has been alienated and the dismantling procedure has been defined, it will be necessary to forecast evolutionary effects over time.

Linee di azione – Stoccaggio in piscina (in sito) del combustibile esaurito

IONISING RADIATION Presence of spent fuel	
Evolution over time	**Environmental effect**
stored energy fuel	insignificant
removed energy fuel	positive

BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**
stored energy fuel	absent
removed energy fuel	absent

45. What is the assessment of NP environmental effects on the FN plant in Bosco Marengo?

Line of action A5 - On-site storage of radioactive waste

At the Bosco Marengo plant radioactive waste is to be stored inside pre-existing temporary depots.

Action lines - Storage

ATMOSPHERE Gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	absent
medium term (brown field)	absent
long term (green field)	absent

IONISING RADIATION Presence of conditioned waste packages	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	insignificant
long term (green field)	positive

BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**
short term (operation)	absent
medium term (brown field)	absent
long term (green field)	absent

46. What is the assessment of NP environmental effects on the IPU and OPEC plants in Casaccia?

Action lines A1, A2, A3, A4, A5 – Treatment, conditioning and storage of radioactive waste

At the SOGIN S.p.A. in Casaccia, radioactive waste is subjected to treatment, conditioning and storage activities to render it suitable for alienation at the National Repository.

The management of this waste does not foresee the emission of liquid radiological effluent; despite being produced in various planned processes, it will not be possible to manage them on site as effluent. Therefore liquid effluent will be transferred as waste to Nucleco S.p.A., where it will undergo treatment prior final release into the environment, in compliance with own discharge Formula.

For this reason environmental components potentially disrupted by the implementation of “treatment” and “conditioning” of the NP do not include the “Water Environment” component.

With reference to storage, specifications in previous paragraphs also apply to the case of the SOGIN S.p.A. site in Casaccia.

Action lines - Treatment and conditioning

ATMOSPHERE Gaseous effluent emission		IONISING RADIATION Gaseous effluent emission		BIODIVERSITY Alteration of natural background due to the emission of artificial radionuclides	
Evolution over time	**Environmental effect**	**Evolution over time**	**Environmental effect**	**Evolution over time**	**Environmental effect**
short term (operation)	insignificant	short term (operation)	insignificant	short term (operation)	insignificant
medium term (brown field)	positive	medium term (brown field)	positive	medium term (brown field)	positive
long term (green field)	absent	long term (green field)	absent	long term (green field)	absent

Action lines - Storage

ATMOSPHERE Gaseous effluent emission		IONISING RADIATION Presence of conditioned waste packages		BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**	**Evolution over time**	**Environmental effect**	**Evolution over time**	**Environmental effect**
short term (operation)	absent	short term (operation)	insignificant	short term (operation)	absent
medium term (brown field)	absent	medium term (brown field)	insignificant	medium term (brown field)	absent
long term (green field)	absent	long term (green field)	positive	long term (green field)	absent

Action lines B2-B.2.2 - Dry on-site storage of irradiated fuel

In the case of the SOGIN S.p.A. site in Casaccia, the major difference compared to other energy sector sites is the presence of irradiated fuel in dry storage, deriving from past activity, for which no reprocessing abroad is foreseen. The fuel will be repackaged in high integrity containers (casks) so that it can be transferred to the National Repository, pending disposal in a deep geological repository (Action line B4 of the NP).

With reference to on-site storage, considerations are analogous to those for on-site temporary deposits.

Action lines - Dry on-site storage of spent fuel

ATMOSPHERE Gaseous effluent emission		IONISING RADIATION Presence of spent fuel in cask		BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**	**Evolution over time**	**Environmental effect**	**Evolution over time**	**Environmental effect**
short term (operation)	absent	short term (operation)	insignificant	short term (operation)	absent
medium term (brown field)	absent	medium term (brown field)	insignificant	medium term (brown field)	absent
long term (green field)	absent	long term (green field)	positive	long term (green field)	absent

47. What is the assessment of NP environmental effects on the ITREC plant in Rotondella?

Action lines A1, A2, A3, A4, A5 – Treatment, conditioning and storage

The management of already present radioactive waste as well as radioactive waste which will be produced with the progression of safe maintenance and decommissioning at the ITREC site in Rotondella is the same as the one described inside the Saluggia nuclear area and for nuclear power stations for the Sogin S.p.A. site.

Therefore, previously conducted analyses are applicable here too, with the exception of the landscape component, insofar as activities for a new on-site temporary depot are currently in progress.

Action lines - Treatment and conditioning

ATMOSPHERE AND WATER ENVIRONMENT Liquid and gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

IONISING RADIATION Liquid and gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

LANDSCAPE Physical volume	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

BIODIVERSITY Alteration of natural background due to the emission of artificial radionuclides	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	positive
long term (green field)	absent

Action lines - Storage

ATMOSPHERE Gaseous effluent emission	
Evolution over time	**Environmental effect**
short term (operation)	absent
medium term (brown field)	absent
long term (green field)	absent

IONISING RADIATION Presence of conditioned waste packages	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	insignificant
long term (green field)	positive

LANDSCAPE Physical volume	
Evolution over time	**Environmental effect**
short term (operation)	insignificant
medium term (brown field)	insignificant
long term (green field)	positive

BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**
short term (operation)	absent
medium term (brown field)	absent
long term (green field)	absent

Action lines B2-B2.1 - B2-B.2.2 - Pool and dry on-site storage of irradiated fuel

Compared to other energy sector sites, the substantial difference for assessments carried out to date regards the presence of irradiated fuel still in storage at the ITREC plant pool. No reprocessing is foreseen for this fuel abroad, it will be packaged in casks to enable its dry storage inside a special area in the temporary on-site depot and successively sent to the National Repository, pending disposal in a geological repository (NP line of action B4).

The presence of irradiated fuel in the ITREC plant pool can be considered to be analogous with what has been described for the Avogadro Depot. The degree of disturbance over time is defined based on the presence or otherwise of fuel.

Expected disturbance of the Ionising Radiation component for irradiation caused by the presence of "stored fuel", also including packaging in casks, is assessed as non-significant, as no substantial disruption is determined compared to the current configuration. When irradiated fuel allocated in casks will be conferred to the site depot, pending National Repository availability, expected disturbance may be deemed positive insofar as irradiation will no longer be present and it will also be possible to proceed with dismantling the pool. It is important to note that necessary activities for the treatment and conditioning of radioactive waste deriving from said dismantling coincide with NP action lines which have been previously assessed for ITREC plant decommissioning.

Lastly, with reference to the biodiversity component, the same applies as for on-site storage action lines for radioactive waste, for pool storage.

Action lines - Storage in on-site pool of spent fuel

IONISING RADIATION Presence of spent fuel		BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**	**Evolution over time**	**Environmental effect**
stored energy fuel	insignificant	stored energy fuel	absent
removed energy fuel	positive	removed energy fuel	absent

With reference to the on-site storage of casks (line of action B.2.2.), aspects assessed for the radioactive waste storage in temporary on-site depots is also applicable for irradiated fuel.

48. What is the assessment of NP environmental effects on the Nucleco S.p.A. site?

Action strategy: Integrated Service

Analyses conducted to assess any environmental impacts determined by NP action lines (Treatment, Conditioning and Storage of radioactive waste) implemented on non-energy sector installations (Integrated Service), refer to activities which will be carried out at the Nucleco S.p.A. site (Located inside the RC ENEA Casaccia). Indeed the site is the only one in the non-energy sector where it has been possible to identify a potential area of influence (coinciding with the area defined in the External Emergency Plan of the ENEA Casaccia plant).

For the purposes of conducted environmental analyses, it is appropriate to highlight that the "NP strategy - Integrated Service", in pursuit of the objective of the safe management of radioactive waste of continuously produced medical and industrial waste, is characterised by the cyclical repetition of NP action lines. Indeed Nucleco S.p.A. plants, unlike energy sector ones whose operative life is linked to the duration of decommissioning at each nuclear site, work in accordance with single campaigns based on waste, which is punctually collected.

Therefore assessments pertaining to the degree of expected disturbance caused by the implementation of NP action lines, which correspond to those already analysed for the energy sector, are short term and regard the operation of treatment, conditioning and storage plants.

Action lines A1, A2, A3, A5 – Treatment, conditioning and storage of radioactive waste

The same analyses and assessments conducted for energy sector nuclear sites are confirmed for the identification of the degree of disruption in the environment surrounding the site, insofar as NP action lines are typically assimilable. The "Landscape" component constitutes the only exception, given that the area at hand is not the Nucleco S.p.A. (RC ENEA Casaccia) site with environmental/territorial/landscape constraints.

Action lines - Treatment and conditioning

ATMOSPHERE AND WATER ENVIRONMENT Liquid and gaseous effluent emission		IONISING RADIATION Liquid and gaseous effluent emission		BIODIVERSITY Alteration of natural background due to the emission of artificial radionuclides	
Evolution over time	**Environmental effect**	**Evolution over time**	**Environmental effect**	**Evolution over time**	**Environmental effect**
Short term operation	insignificant	Short term operation	insignificant	Short term operation	insignificant

Action lines - Storage

ATMOSPHERE Gaseous effluent emission		IONISING RADIATION Presence of conditioned waste packages		BIODIVERSITY Variation of natural environmental radiation background due to irradiation	
Evolution over time	**Environmental effect**	**Evolution over time**	**Environmental effect**	**Evolution over time**	**Environmental effect**
Short term operation	absent	Short term operation	insignificant	Short term operation	absent

49. What are the results of the overall assessment on the environmental effects of the NP?

A further organic assessment has been conducted to define overall environmental effects within the area affected by the NP, in addition to those caused by single actions. This has enabled the identification of a positive evolution over time of the surrounding environmental context of nuclear sites under examination, due to the progressive reduction of artificial radioactivity.

The degree of maximum assessed disruption, limited to the short term (plant operation), does not determine significant changes or disruptions to the external environment.

Therefore even on the basis of the hypothesis that different plants may be operated simultaneously at the same nuclear site, it can be assumed that even with the accumulation of each contribution, non-significant in all cases, the environmental effects will not determine any environmental critical situations, also in view of environmental assessments to which said activities are subjected in advance.

50. What are the differences between conventional and radiological analysis in the field of potential influence?

The operation of all nuclear practices is authorised by competent Bodies already during planning, both in radiological and conventional terms.

With reference to radiological aspects, overall project approval is based on management procedures to be implemented in order to guarantee radiological non-relevance, and the assessment of proposed construction techniques and processes.

With reference to conventional aspects, relative laws and regulations in force establish that the construction and operation of new radioactive waste treatment and storage plants must undergo Environmental Assessment procedures.

These plants will also be subjected to assessments for necessary construction authorisations, therefore relative projects will contain suitable documentation based on the territorial context of reference required

to obtain consequent authorisations, for example: geological-seismic, geological-hydrogeological compatibility and hydrological risk.

Emergency management at a nuclear site is characterised by substantially different aspects compared to management in a conventional context, due to the potential occurrence of an accident involving the release of radioactive substances into the surrounding environment.

Therefore nuclear accidents require complex internal and external organisation, involving both site personnel and External Authorities. The organisation and preparation of personnel designated for intervention in critical situations foresees all possible types of emergency, including those caused by external events (earthquake, floods, fire).

Conclusions

The Environmental Report examines strategies and action lines for the implementation of the National Programme and for radioactive waste and irradiated fuel management, in terms of potential environmental and economic impacts.

Therefore the Environmental Report also provides a preliminary assessment of potential disruptive factors generated by the National Repository and Technology Park, which will be analysed in detail once the infrastructure has actually been sited.

Furthermore, the entire Environmental Report operative procedure assesses the "coherence" of the National Programme, both internally, to verify correspondence of objectives and foreseen actions, and externally, broadening the analysis to objectives and criteria contained in national legislation as well as territorial planning and programming instruments.

Therefore ideally Phase 2 is concluded in this way, as defined by the international work group ENPLAN, namely the Phase for the elaboration and drafting of a Plan or Programme which follows Phase 1, Orientation and Preparation. Phase 3 consists of consultation for adoption and approval.

The purpose of the consultation instrument is to guarantee participation of stakeholders in the decision-making process and to ensure that the quality of decisions (process output) can be improved through contributions which emerge during consultation. Therefore, from the Århus Convention signed in 1998 and implemented in Italy with Law 108/2001, Italy has seen the affirmation of a procedure whose final objective is ensuring the right to transparency and participation through structured public debate on decisions regarding the environment.

The array of complex of issues within Strategic Environmental Assessment procedures, some habitual and some innovative - insofar as emerging from contexts which in other countries too, have provoked intense debate and lengthy decision-making processes - also includes radioactive waste management, where final repositories constitute a central element.

Therefore in Italy too a "mixed" decision-making process has been adopted for the siting of a National Repository, based on the application of technical-scientific criteria (criteria drawn up by ISPRA for the creation of the map of Potentially Suitable Areas) and manifestations of interest from local communities.

This process, governed by Legislative Decree 31/2010, shall proceed after the conclusion of the Strategic Environmental Assessment on the National Programme, benefiting from greater strength due to actual participation of stakeholders.

Fundamental Regulatory Framework (with active hypertext links)

- **LEGISLATIVE DECREE no. 230, 17th March 1995** Implementation of Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 2006/117/Euratom regarding ionising radiation, 2009/71/Euratom regarding the nuclear safety of nuclear plants and 2011/70/Euratom regarding the safe management of spent fuel and radioactive waste deriving from civil activities;
- **DIRECTIVE 2001/42/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL dated 27th June 2001** concerning the assessment of effects of specific plans and programmes on the environment;
- **DIRECTIVE 2003/4/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL dated 28th January 2003** on public access to environmental information and which abrogates Directive 90/313/EEC of the Council;
- **Directive 2003/35/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL dated 26th May 2003** which establishes public participation in the drafting of certain environmental plans and programmes and amends Council Directives 85/337/EEC and 96/61/CE regarding public participation and access to justice;
- **LEGISLATIVE DECREE no. 42, 22nd January 2004** Cultural and Landscape Heritage Code, pursuant to article 10 of Law 137, 6th July 2002;
- **Law no. 282, 16th December 2005** Ratification and execution of the Joint Convention regarding the safe management of spent fuel and radioactive waste, Vienna 5th September 1997;
- **LEGISLATIVE DECREE no. 152, 3rd April 2006** Environmental regulations;
- **LEGISLATIVE DECREE no. 31, 15th February 2010** Regulation of irradiated fuel and radioactive waste storage systems, as well as economic benefits, in accordance with art. 25 of applicable law no. 99, 23rd July 2009;
- **COUNCIL DIRECTIVE 2011/70/EURATOM, 19th July 2011** which establishes a community framework for the responsible and safe management of spent nuclear fuel and radioactive waste;
- **LEGISLATIVE DECREE 4th March 2014 no. 45** Implementation of DIRECTIVE 2011/70/EURATOM, which establishes a community framework for the responsible and safe management of spent nuclear fuel and radioactive waste;
- **TECHNICAL GUIDE no. 29 of ISPRA (2014)**, Siting criteria for a surface disposal plant for low to intermediate radioactive waste;
- **Ministry of Economic Development and Ministry of the Environment and the Protection of Land and Sea Decree, 7th August 2015,** Classification of radioactive waste pursuant to article 5 of Legislative Decree no. 45, 4th March 2014.