

**ASN policy concerning the
decommissioning and delicensing of
basic nuclear installations (BNIs) in France**

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"Warning: this document is a translation of the French version,
which is the only official version and should be referred to in the event of any doubt."

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1. CONTEXT AND SUBJECT OF THE DOCUMENT

At the end of their operating life, and in the same way as all industrial facilities, nuclear installations undergo a process of decommissioning prior to the possible release of the site on which they are located, or reuse of the site for another activity.

Within the framework created by the Act on transparency and security in the nuclear field [1], the Planning act on the sustainable management of radioactive materials and waste [2] and the resulting texts, the purpose of this document is to clarify ASN policy and expectations with regard to the following in particular:

- the various decommissioning strategies that could be implemented by the licensees;
- the conditions in which the end of the operating period and decommissioning must take place;
- the final status of the nuclear facilities following decommissioning and delicensing;
- information of the public.

2. DECOMMISSIONING AND DECOMMISSIONING STRATEGIES

2.1. Decommissioning and delicensing of basic nuclear installations (BNIs)

The general term of decommissioning covers all the activities – both technical and administrative – carried out following the shutdown of a facility, in order to reach a predetermined final state. These activities, which can take several decades in the case of complex nuclear facilities (nuclear reactor, spent fuel reprocessing plant), can in particular comprise equipment disassembly operations, clean-out of premises and soils, demolition of civil engineering structures, reprocessing, packaging, removal and disposal of waste (whether or not radioactive).

Pursuant to article 29-V of the Act [1], all of these operations must be performed in such a way as to prevent or adequately mitigate the risks or hazards relative to public health and safety and protection of the environment. Following decommissioning, and in certain conditions, a nuclear facility can be delicensed. The facility is then no longer subject to the legal and administrative controls applicable to BNIs. Delicensing allows lifting of some¹ or all of the regulatory controls to which a BNI is subject.

2.2. The different decommissioning strategies

In the document presenting the decommissioning of facilities utilising radioactive substances, [4], the International Atomic Energy Agency (IAEA) defined three decommissioning strategies for nuclear facilities following their final shutdown:

- *deferred dismantling*: the parts of the facility containing radioactive substances are kept in or placed in a safe state (safe enclosure) for several decades before the decommissioning operations begin (the “conventional” parts of the facility can be dismantled as of shutdown of the facility);
- *entombment*: the parts of the facility containing radioactive substances are placed in a reinforced containment structure for a period that is long enough to attain a level of radiological activity low enough to allow release of the site (the “conventional” parts of the facility may be dismantled as of shutdown of the facility);
- *immediate dismantling*: in this case, dismantling of the entire facility is started as of the end of operations, with no transitional period, even if the dismantling operations themselves, owing to their complexity, can last for a very long time.

¹ Usage restrictions may be put into place (see § 4.2)

Many factors influence the decision to opt for one or other of the decommissioning strategies: national regulations, socio-economic factors, financing of the operations, availability of waste disposal solutions, dismantling techniques, qualified personnel, exposure of the personnel and the public to ionising radiation resulting from dismantling operations, etc. International practices therefore differ from one country to another.

ASN today recommends that the licensees of France's BNIs adopt immediate dismantling strategies. The arguments underpinning this position are explained below. Any other choice must be backed up by a sound argument on the part of the licensee.

It should also be noted that increasing numbers of countries have opted for immediate dismantling, such as the United States, Sweden, Germany and Spain. Other countries have adopted a very similar strategy, involving dismantling over a short period of about 5 to 10 safe enclosure (Japan and South Korea). Other countries have different approaches depending on the facilities, such as Finland, which is employing immediate dismantling for its first pressurised water reactor, while a safe enclosure period of 30 years is being envisaged for the first boiling water reactor. This is also the case in the United Kingdom, where certain installations have undergone immediate dismantling but where, with regard to the gas cooled reactors, safe enclosure of about 100 years was chosen. International organisations such as IAEA [4] or the OECD's Nuclear energy Agency [6] present the immediate dismantling strategy as preferable, when the conditions for its implementation are met.

2.3. In France, the conditions for immediate dismantling are met

One of the main arguments for recommending an immediate dismantling strategy is to prevent or mitigate the burden that will be borne by **future generations** concerning the management of radioactive waste and consequently concerning the dismantling of the nuclear facilities. Over and above this consideration, other factors must be taken into account.

2.3.1. Political and socio-economic factors

The French regulations concerning nuclear facilities have since 1990 included provisions for decommissioning². In 2006 and 2007, Act [1] and decree [3] explained the regulatory procedures associated with the decommissioning and delicensing of BNIs. There is thus a **clear and transparent regulatory framework** for all the stakeholders (licensees, administration, public, associations, etc.), in which nuclear facility decommissioning operations can be authorised and then take place.

The planning and implementation of decommissioning programmes, which have the particularity of taking place over relatively long periods of time when compared with the service life of the facilities, require the mobilisation of significant funding. Act [2] sets out the procedures for **ensuring that the funds are in place and available** at the required time. The nuclear licensees must thus make a prudent assessment of the cost of decommissioning their BNIs and of managing the spent fuel and radioactive waste. On the basis of these cost assessments, the licensees must set up provisions, with coverage by a portfolio of assets dedicated to these costs. The licensees must regularly report to the public authorities regarding their compliance with these obligations, in particular by means of a three-yearly report describing the licensee's situation with regard to the technical and financial obligations mentioned above. A three-yearly report is also drafted for information of the public. In this context, and in accordance with its specified duties on the occasion of the review of the three-yearly reports, ASN ensures that the decommissioning strategy and the management of spent fuel and nuclear waste are consistent with nuclear safety. Pursuant to Act [2], it is in particular required to issue an opinion on the three-yearly reports to the administrative authority in charge of monitoring compliance with the above-mentioned provisions (General Directorate for Energy and Climate).

² Decree 90-78 of 19 January 1990 amending decree 63-1228 of 11 December 1963

The problem of the decommissioning of nuclear facilities is closely linked to that of radioactive waste management. The decommissioning of a nuclear facility implies the availability of management routes for the disposal of all the waste generated by the decommissioning operations, or at the very least its temporary storage. Equipment dismantling and the possible demolition of the buildings making up the nuclear facilities produces large quantities of mainly very low level (VLL) waste. Smaller quantities of short-lived (<31 years) low or intermediate level waste (LLW-ILW) can also be generated. For these two waste categories, most of which is produced during decommissioning, there are operational disposal routes in France. For some long-lived, low-level waste produced by decommissioning of the first generation of power reactors, there is as yet however no disposal solution. The same applies to long-lived high level waste³. With regard to these two categories of waste, Act [3] requires the availability of disposal routes. **Therefore in 2008, the French nuclear licensees have solutions for managing the majority of the waste generated by the decommissioning of nuclear facilities and, in the future, should have access to disposals routes allowing management of all this waste.**

2.3.2. Technical and operational factors

The decommissioning of nuclear facilities involves a certain number of technical issues, owing to the characteristics of these facilities: risks for the environment and health because of the presence of radioactive substances, complexity, size or “unique” nature of certain equipment items or facilities, risks induced by insufficiently comprehensive data on legacy facilities, etc.

Since the early 1980s, the decommissioning work carried out has enabled the licensees to acquire extensive experience feedback on decommissioning techniques and the management of this type of project. The facility delicensing operations since the early 2000s demonstrate the **technical feasibility** of decommissioning. ASN remains attentive to ensuring that the skills that can be called on today will remain available. Furthermore, the decommissioning currently in progress concerns all types of facilities: power or research reactors, laboratories, waste treatment facilities, spent fuel reprocessing plants, etc.

2.4. The drawbacks and risks of deferred dismantling

2.4.1. Political and socio-economic factors

With regard to political and socio-economic factors, if a deferred dismantling strategy is adopted, there then arises the question of the availability of the funds needed for dismantling at the requirement moment, even if current legislation in principle guarantees the availability of these funds. Similarly, there is also the question of the availability of the waste disposal routes (just because they are currently available does not necessarily mean that this will still be the case in a hundred years for example).

2.4.2. Technical and operational factors

Technical and operational factors also imply significant risks if a deferred dismantling strategy is adopted.

It is first of all clear that the uncertainties increase with the passage of time: loss of information about the construction and operating conditions of the facilities, loss of skills, aggravated by the retirement of staff familiar with the facility. The current decommissioning programmes, concerning facilities operated for about forty years, already frequently suffer from the uncertainties linked to the loss of those who were most familiar with the facilities.

³ Until such time as a disposal solution is found, this waste is stored in the BNIs

Deferred dismantling also raises the question of monitoring and maintaining the safety of the facilities. Technical problems can arise: management of the ageing of the civil engineering structures, obsolescence of equipment, in particular monitoring systems, etc.

Finally, the dosimetric gains due to the radioactive decay of certain radionuclides (especially ^{60}Co), which is the argument most often heard in support of deferred dismantling strategies, does not apply to all situations and depends on the type of residual contamination or activation⁴. In the end, this factor would not appear to be particularly decisive in the choice of a decommissioning strategy.

3. PREPARATION FOR FINAL SHUTDOWN AND DECOMMISSIONING

The decommissioning of a nuclear facility is a major industrial project and ASN therefore recommends that the licensees anticipate the corresponding administrative and technical components as early as possible. The decommissioning plan which, in accordance with decree [3], is drafted as early as the creation of a nuclear facility, must be drawn up with this objective in mind.

3.1. Preparation for final shutdown

The specificities of the decommissioning phase, especially in terms of the nuclear safety and radiation protection risks, require that it take place within the framework of specific safety requirements, after authorisation has been issued by means of a decree. The regulation procedure for obtaining this authorisation makes provision for consultation of the stakeholders: general public, administrations concerned (national or European) and local information committee (see §6).

Consequently, no decommissioning operation may be undertaken before publication of the decree authorising final shutdown and decommissioning.

The operations performed between the closure of the facility and the issue of the final shutdown and decommissioning authorisation (“final shutdown preparation” phase), must comply with the provisions of the facility’s creation authorisation decree and its operating safety requirements.

The final shutdown preparation phase must allow optimum preparation of the facility for its decommissioning, taking full advantage of the presence of the operating personnel, with their extensive knowledge of the facility: operating history, incidents, familiarity with the premises and the various equipment items, etc. ASN considers that the final shutdown preparation phase should be limited to the performance of the following operations: tidying up the facility, preparing for decommissioning operations (creation of teams, production of radiological inventories, etc.), removal of as much as possible of the dangerous substances present in the facility, including operating waste, removal of some or all of the source term⁵.

3.2. Decommissioning

Decommissioning projects are often complex and involve a large number of modifications to the facility, with widely varying safety and/or radiation protection issues. In this context, the operations with the most significant safety or radiation protection implications have to be authorised by ASN. For the others, ASN recommends utilising a system of internal authorisations, monitored by itself, as provided for in article 27 of decree [3].

The risks present during the operation of the facility change as decommissioning progresses. Even if some can disappear rapidly, such as the risk of criticality, others, such as those linked to radiation

⁴ In the case of gas-cooled reactors, a waiting period of 80 to 120 years would be needed before manual dismantling could proceed (Source : NEA report [6])

⁵ Unloading of the core and removal of fuel from a reactor, or draining and rinsing of process systems in the case of a laboratory or plant for example

protection (gradual removal of containment barriers) or conventional safety (multiple contractor activities, falling loads, work at height, etc.) gradually become predominant. The same applies to fire or explosion risks (“hot spot” structural cutting techniques), as well as, for example, risks linked to human and organisational factors (different organisation from the operating phase, frequent use of contractors). During its inspections in facilities being decommissioned, ASN attaches particular importance to checking that the licensee correctly takes account of the risks specific to this phase in the lifetime of a BNI.

Pursuant to the provisions of Act [1], the safety of a facility is periodically reviewed, including when it is undergoing decommissioning. The frequency of these reviews is normally 10 years. A different frequency can however be specified in the final shutdown and decommissioning authorisation decree. With regard to the periodic safety reviews performed during the decommissioning phase, ASN’s aim is to ensure that:

- the level of safety of the facility remains acceptable up until delicensing, if necessary with implementation of compensatory measures proportionate to the risks;
- the safety measures adopted for performance of the decommissioning operations are compliant with the rules of professional good practice and the applicable regulations.

The periodic review approach must be carried out in the light of the overall analysis of the decommissioning project, the ultimate aim of which is delicensing of the nuclear facility after a limited period of time.

4. FINAL STATE OF FACILITIES AND DELICENSING

4.1. Objective of decommissioning, final state of facilities

The final state reached following decommissioning must be such as to prevent or adequately mitigate the risks or problems that could arise from the decommissioned facility and its site, in terms of public health and safety or the protection of nature and the environment, in particular in the light of the envisaged reuse of the site or the buildings. This objective must be set on the basis of the scientific and technical knowledge of the time.

In this context, **ASN recommends adopting clean-out and decommissioning practices designed to achieve a final state in which all dangerous substances, including those that are not radioactive, have been removed from the nuclear facility.** All the waste generated must therefore be removed from the facility following its decommissioning.

The situations in which a licensee cannot perform complete clean-out of its facility must be adequately justified in the decommissioning plan. Moreover, pursuant to article 20 of Act [2], the licensee shall set up financing for management of the waste resulting from the decommissioning operations, including if its disposal is postponed to a later date. It should be noted that this particular case, which entails postponing complete clean-out of a BNI or a site to a later date, does not correspond to the immediate dismantling strategy recommended by ASN.

In terms of the dosimetric impact of the facility and of its site after decommissioning, the objectives of the licensees are justified in the light of national and international best practices, in particular the guide issued by IAEA on this topic [5].

4.2. Delicensing of a decommissioned nuclear facility

The delicensing decision for a decommissioned BNI can only be issued if the final state targeted by the licensee has been reached and conforms to the objectives recalled in §3.1.

In any case, ASN considers that steps must be taken to retain a trace and record of the presence of a former BNI on the land concerned (information of successive owners).

Depending on the final state reached, public protection restrictions may be applied, according to the envisaged subsequent usage of the site and/or buildings. Pursuant to article 50 of decree [3], restrictions are established to:

- prevent or mitigate the effects of a radiological emergency situation;
- prevent the effects of radioactive or chemical contamination of the soil.

Depending on any residual risks presented by the decommissioned facility or its site, the public protection restriction may contain a certain number of usage restrictions (for example, industrial uses only) or precautionary measures (radiological measurements required in the event of excavation for instance, monitoring programme).

This type of restriction must be put into place so that it is effective before the delicensing of a BNI.

5. DECOMMISSIONING PLAN

In accordance with decree [3], all BNI licensees must draw up a decommissioning plan for this facility, at the time it is created. This plan is updated throughout the life of the facility. ASN considers that it should be a reference document for optimising preparation for and anticipation of the decommissioning of a nuclear facility.

The decommissioning plan presents the procedures envisaged for the decommissioning of the nuclear facility considered, as well as for the rehabilitation and monitoring of the site on which it is located. It mentions and justifies the **decommissioning strategy** adopted by the licensee for the facility concerned, in the light of the strategy adopted for all the BNIs of a given licensee. The decommissioning plan in particular specifies the envisaged time between final cessation of operation and the beginning of the decommissioning operations. It presents an evaluation of the cost of decommissioning of the BNI and, once it has been defined, justifies the envisaged final state for the facility following decommissioning.

6. INFORMATION OF THE PUBLIC AND THE WORKERS

6.1. Before decommissioning

In accordance with decree [3], the final shutdown and decommissioning authorisation applications are subject to a public inquiry, in the usual conditions laid out in the Environment Code. ASN considers that in the public inquiry files, over and above the technical aspects, the licensee must in particular clearly present:

- the decommissioning strategy adopted and the justification for this choice;
- the decommissioning stages, the calendar and the duration of the operations as a whole;
- the target final state and the envisaged future use of the facility and/or its site.

Furthermore, the authorisation procedure also makes provision for consultation of the local information committee (CLI). In order to facilitate the task of the CLIs, and in particular to enable them to issue an opinion on the subject in good conditions, ASN recommends that the licensees involve them actively in the final shutdown and decommissioning authorisation application procedure. Therefore, whenever possible, they should be given access to the files as far in advance of the public inquiry as possible.

Finally, ASN recommends that the health, safety and working conditions committee (CHSCT) of the facility also be involved as early as possible in the final shutdown and decommissioning authorisation application procedure.

6.2. During decommissioning

Throughout decommissioning and in particular when the operations take place over a long period of time, the licensee takes appropriate measures to inform the public of the progress of the decommissioning operations, in particular via the CLIs. In this respect, the annual report drawn up by the licensee pursuant to article 21 of Act [1] is of prime importance and must inform the public⁶:

- of the overall progress of the decommissioning project as compared with the forecast schedules (any project delays must be mentioned and explained);
- of the decommissioning activities carried out during the course of the year and any notable findings (end or beginning of a decommissioning phase for example);
- any changes to the decommissioning project, whether technical or organisational.

This report is also presented to the CHSCT, which issues an opinion on its contents.

6.3. In preparation for delicensing

The delicensing application file for a nuclear facility is consulted by the prefecture and the town halls concerned by the project, as well as by the local information committee. In this file, the licensee must in particular present the final state reached at the end of decommissioning, as well as the envisaged future use of the buildings and land.

When public protection restrictions are to be put into place (see 4.2), the procedure implemented includes holding of a public inquiry. The public is thus informed of the restriction implementation procedures: perimeter covered by the measures, restriction and/or surveillance put into place, soil contamination studies conducted, etc.

7. REFERENCES

- [1] Act 2006-686 of 13 June 2006 on transparency and security in the nuclear field
- [2] Programme Act n°2006-739 of 28 June 2006 on the sustainable management of radioactive materials and waste
- [3] Decree 2007-1557 of 2 November 2007 concerning BNIs and the supervision of the transport of radioactive materials with respect to nuclear safety
- [4] IAEA safety standard WS-R-5 “Decommissioning of facilities using radioactive material”
- [5] IAEA Safety guide WS-G-5.1 “Release of sites from regulatory control on termination of practices”
- [6] OECD/NEA report n° 6038 “Selecting strategies for the decommissioning of nuclear facilities”

⁶ In addition to the requirements of article 21 of Act [1]