

Convention on Nuclear Safety

9th National Report by Denmark, August 2022

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A. Introduction

With this report to the 9th Review Meeting Denmark presents an overview on the current Danish nuclear policy, the present legislation and measures relating to Nuclear Safety – in particular the emergency planning framework.

Denmark signed to the Convention on Nuclear Safety (hereafter "the Convention") on 20 September 1994, and the Convention entered into force for Denmark on 11 February 1999. The instrument of acceptance specified that "until further notice the Convention shall not apply to Greenland and the Faroe Islands."¹ On 26 September 2016, Denmark notified the Depository that it also accepted the Convention for Greenland.

In terms of the Convention neither Denmark nor Greenland, possess any nuclear installations.

Denmark has previously operated three research reactors. In September 2000, it was decided to decommission the three Danish research reactors, DR1, DR2 and DR3 (DR for Danish Reactor).

DR1 and the DR2 are fully decommissioned. DR3 is currently under decommissioning – in the second main phase, which, among other measures, includes removal of the reactor's inner parts and demolition of the reactor block. Cutting of and removal of the lead-lined steel tank and the outer steel/concrete shield is ongoing, and hereafter the reactor building will be cleared of fixtures, ventilation etc. and decontaminated as necessary before clearance measurements are made. Decommissioning of DR3 has been expected to last throughout 2022, but due to the pandemic-situation, the decommissioning period is prolonged. The currently expected time for finalization of decommissioning is 2026.

Detailed reporting on the decommissioning activities is done under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the Joint Convention).

Since last Review Meeting Denmark has hosted an Integrated Regulatory Review Service (IRRS) Mission. In this report, reference to recommendations, suggestions and good practices from IRRS Mission is given where appropriate.

This year Denmark hosted an ARTEMIS Mission, which was carried out from 2 May to 9 May 2022. In this report there is given no reference to recommendations, suggestions or good practices from ARTEMIS Mission, as they do not relate to the scope of this report.

Danish Emergency Management Agency (DEMA) and Danish Health Authority, Radiation Protection (DHARP) are the nuclear safety authorities and jointly constitutes the Regulatory Body, termed the Nuclear Regulatory Authorities.

¹ Greenland and the Faroe Islands are parts of the Unity of the Realm and has Self-Government Arrangements, which presently does not include nuclear safety though

Very generally, it can be outlined that DEMA handles tasks primarily regarding technical aspects and matters concerning the design and operation of facilities, while DHARP handles matters concerning radiation protection, including matters of design and operation closely related hereto.

As Denmark is a non nuclear Party to the Convention, this report primarily addresses emergency preparedness (besides legislative and organizational matters). As DEMA is the "main authority" for emergency preparedness, including nuclear emergency preparedness, this report focuses in particular on matters within DEMA's area, but relevant matters within DHARP's area are also included.

In addition to the Convention on Nuclear Safety, Denmark is a contracting party to the Convention on Early Notification of a Nuclear Accident, the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency and the Convention on Physical Protection of Nuclear Material and Nuclear Facilities and to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

In addition, Denmark has implemented Council Directives 2009/71/Euratom and 2014/87/Euratom on nuclear safety as well as council directive 2011/70/Euratom on radioactive waste management and Council directive 2013/59/Euratom on basic safety standards.

B. Summary

Current Danish legislation specifically governing nuclear safety dates back to 1962 and 1976. Notwithstanding the date, the legal framework is considered sufficient in the current circumstances; in 1985 the Danish parliament adopted a resolution instructing the government to organise the public energy planning under the premise that nuclear power will not be used. This resolution has not since been overturned and there are currently no indications that it will happen in the foreseeable future. Thus, there are and will still be no nuclear facilities in terms of the Convention in Denmark.

The IRRS Mission to Denmark (2021) presented a recommendation on legal framework; "The Government should review the legal framework for nuclear safety and, as appropriate, bring it in line with the IAEA safety standards, taking into account type of facilities present, planned or foreseen."

The reference to planned or foreseen facilities concerns a new upgraded storage facility, which will not fall under the Convention. Thus, no nuclear installations in terms of the Convention are - present, planned or foreseen in Denmark.

At the 7th Review Meeting, no challenges were identified for Denmark throughout the Country Group session.

Previously identified challenges and areas of focus have concerned exercises, international cooperation and recruiting and training of staff. The relevant authorities have expanded activities in these areas throughout recent years.

CONTEX exercises with international participation have successfully been carried out in 2014, 2016, 2018 and 2020. Due to the pandemic situation, the exercise in 2020 was carried out in a reduced format though. The 2022 exercise is currently being planned. CONTEX exercises are arranged and conducted by DEMA.

International cooperation has been an area of focus for the nuclear safety authorities in Denmark for a number of years. Especially the cooperation among the Nordic countries is a cornerstone, while also cooperation with neighboring countries and other countries in general has been expanded over a number of years. International cooperation is considered as an important measure to improve and maintain skills as a non-nuclear party to the Convention.

Recent recruitments show that candidates with relevant skills are available despite absence of specific academic education in Denmark relating to (and including safety of) nuclear installations². With supplementary education and training, the necessary qualifications have been achieved and can be maintained.

² as a result of the resolution adopted by the Danish Parliament in 1985 on the exclusion of nuclear power from the national energy mix

The subjects "Training and exercises" as well as "International cooperation" will be elaborated on in chapter C under reporting on Article 16 – Emergency Preparedness.

C. Compliance with articles 6 to 19

As Denmark is a non-nuclear party to the Convention not all obligations 6 to 19 are applicable. Thus, in this chapter there is primarily reported on applicable obligations. However, on some obligations that are not applicable reporting is done where appropriate taking into account the purpose of reporting.

Article 6. Existing Nuclear Installations

Not applicable

Article 7. Legislative and Regulatory Framework

- *Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.*
- *The legislative and regulatory framework shall provide for:*
 - (i) the establishment of applicable national safety requirements and regulations;*
 - (ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a license;*
 - (iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;*
 - (iv) the enforcement of applicable regulations and of the terms of licenses, including suspension, modification or revocation.*

The legislative framework in Denmark governing nuclear safety (including matters of radiation protection and nuclear emergency preparedness relevant under the Convention) includes Act No. 170 of 16 May 1962 on Nuclear Installations, Government Order No. 278 of 27 June 1963 on Protective measures against Accidents at Nuclear installations, Act No. 244 of 12 May 1976 on Safety and Environmental conditions at nuclear installations etc., Consolidation Act No. 314 of 3 April 2017 on Emergency Management (with subsequent changes), and Act No. 23 of 15 January 2018 on ionizing radiation and radiation protection.

In addition to legislation, the overall responsible minister (Minister of Health) has issued Circular no. 9450 of 9 July 2020 on the application of regulatory control by the nuclear regulatory authorities regarding the nuclear safety of nuclear installation, etc., whereby the nuclear supervisory authorities are instructed in general on matters of supervision, reporting, etc.

Licensing and inspection of nuclear installations in Denmark is regulated according to the Act on Nuclear Installations, 1962, the Government Order on Protective measures against Accidents at Nuclear installations, 1963, and the Act on Ionising Radiation and Radiation Protection, 2018.

The Act on Safety and Environmental conditions at nuclear installations etc., 1976, was adopted by Parliament in preparation of the implementation of nuclear power in the national energy mix and the act was to enter into force before construction of a nuclear power plant. However, in 1985 the

Danish Parliament in practice decided that nuclear power should not be part of the Danish energy policy and thus not be a part of the national energy mix. This decision has not been overturned and consequently, only a part of the 1976 Act has entered into force.

The Act on Nuclear Installations, 1962, and the Government Order on Protective measures against Accidents at Nuclear installations, 1963, explicitly states that nuclear installations may only be constructed or commissioned upon approval from the minister responsible for nuclear safety.

An approval cannot be granted if the safety of the installation or other vital interests is questioned. Before a license can be issued, the applicant must present a safety report for scrutiny by the nuclear regulatory authorities; DEMA and DHARP – jointly constituting the Regulatory Body.

The safety report must comprehensively address all safety relevant issues related to the installation. As such, it must include information on operational procedures as well as protective measures. If the safety report and documentation does not give rise to questions about safety, the nuclear regulatory authorities may recommend to the responsible minister that an approval may be given.

An approval can be revoked should matters that give rise to questions on safety occur during construction as well as during operation.

Because of the Parliaments adoption of the resolution in 1985 instructing the government to organise the public energy planning without nuclear power, no nuclear power plants will or can be licensed in the Kingdom of Denmark unless this resolution is overturned.

Under these circumstances, existing legislation has been considered sufficient as there are and foreseeably will not be any nuclear facilities in terms of the Convention to regulate. However, should the resolution be overturned, the legal basis for nuclear installations (and safety hereof) must likely be replaced; Act No. 170 of 16 May 1962 on Nuclear Installations as well as Act No. 244 of 12 May 1976 on Safety and Environmental conditions at nuclear installations etc. must likely be replaced by new legislation. This will likely govern siting, construction, safety requirements, commissioning, operation, inspection, decommissioning and release of sites from regulatory control – i.e. an all-inclusive cradle to grave perspective legislation.

The IRRS Mission to Denmark in 2021 issued a recommendation on legislative matters; “the Government should review the legal framework for nuclear safety and, as appropriate, bring it in line with the IAEA safety standards, taking into account the types of facilities present, planned or foreseen.” (R2).

When the IRRS Mission refers to planned or foreseen facilities this concerns a new upgraded storage facility, which will not fall under the Convention. Thus, no nuclear installations in terms of the Convention are -present, planned or foreseen in Denmark.

The recommendation will be thoroughly considered in the follow-up on the outcome of the Mission.

Article 8. Regulatory Body

- 1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.*
- 2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.*

The nuclear regulatory authorities in Denmark and Greenland are DEMA and DHARP, who are jointly responsible for regulatory oversight of nuclear safety activities and constitute the Regulatory Body. As nuclear regulatory authorities, DEMA and DHARP are also jointly responsible for regulatory oversight of nuclear safety in relation to the decommissioning of the former research reactors.

DEMA is an agency under the Ministry of Defence, while DHARP is an agency under the Ministry of Health. In addition, DEMA is the general nuclear emergency preparedness authority. DEMA is also the competent authority for nuclear security and for (some) matters of safeguards in Greenland, while DHARP is the competent authority for radiation safety and radiation protection in general.

As of nuclear safety matters, the activities of Danish Decommissioning are regulated by DEMA and DHARP jointly. This includes setting the safety requirements and execution of inspections.

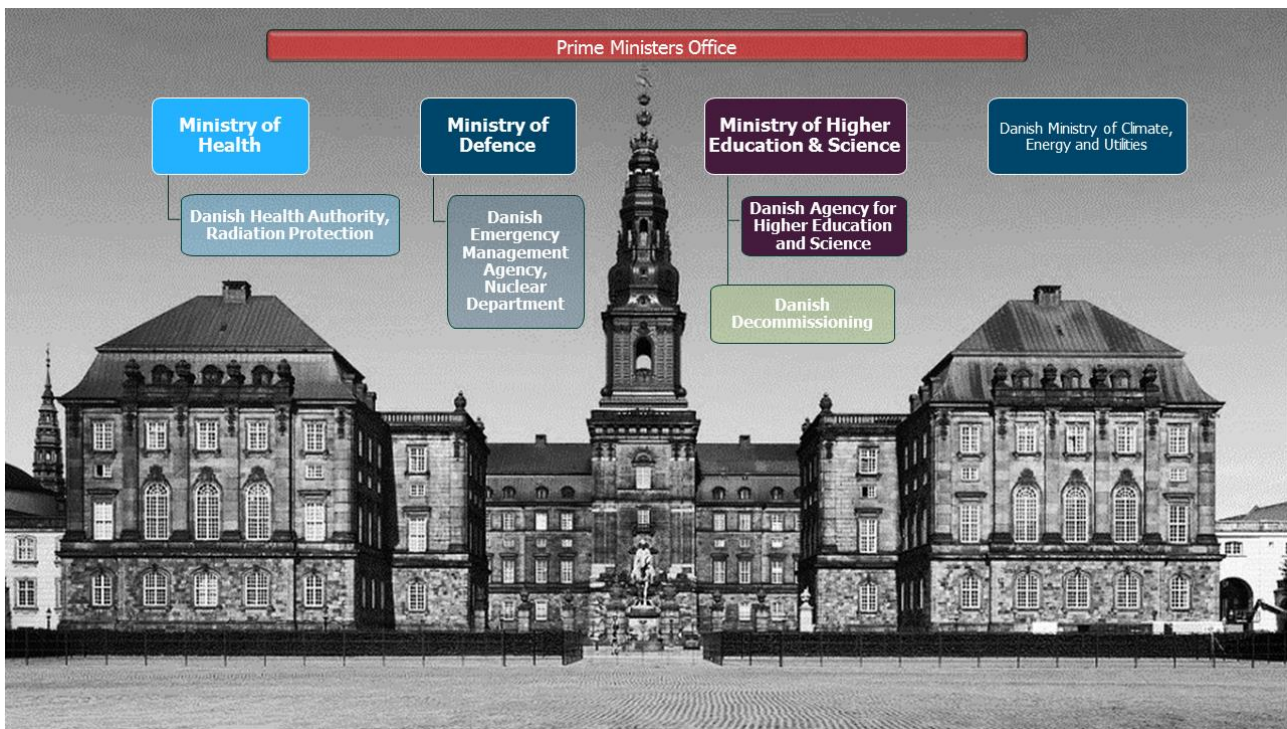


Figure 1; Structure of authorities part of the nuclear safety organisation © DEMA

The legislative, regulatory and administrative setup in the Danish regulatory system for nuclear safety is deemed adequate for the present situation in Denmark and in compliance with the obligations of the Convention on Nuclear Safety. No additional steps are required in Denmark for implementation of the obligations under this Convention under the current circumstances.

With the Danish Parliament's decision to exclude nuclear power from the energy mix, no agency (authority, board or similar) is engaged in the promotion or utilization of nuclear power, and thereby the separation of the functions of the nuclear regulatory authorities is implicitly ensured. Energy policy is generally a matter for the Danish Ministry of Climate, Energy and Utilities or the agencies below.

As for recruiting and training of staff recent postings and fillings of vacant positions have shown that candidates with relevant skills are available despite absence of specific academic education in Denmark relating to (and including safety of) nuclear installations³. With supplementary education and training through national education activities, educational offers through IAEA, EU and through bilateral educational activities, the necessary qualifications is achieved and can be maintained.

³ as a result of the resolution adopted by the Danish Parliament in 1985 on the exclusion of nuclear power from the national energy mix

Article 9. Responsibility of the licence holder

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

Licensing and inspection of nuclear installations is regulated according to the Act on Nuclear Installations, 1962 and the Government Order on Protective measures against Accidents at Nuclear installations (1963) which explicitly states that nuclear installations may be constructed or operated only upon approval respectively license from the minister responsible for nuclear safety (Minister of Health).

As part of processing an application for the construction of a nuclear installation, an applicant must present a preliminary safety report for scrutiny by the nuclear regulatory authorities, DEMA and DHARP, who on basis of the preliminary report will make a recommendation to the minister on whether or not to approve construction. Before a license to operate a nuclear facility subsequently can be granted the applicant must present to DEMA and DHARP a final safety report on basis of which DEMA and DHARP will make recommendation to the minister on the question of license to operate. The safety reports must in a comprehensive way address all safety relevant issues related to the installation and it shall include information on operational procedures as well as protective measures. Approval as well as issuance of a license may be conditional, revocable and limited in time. Approval nor license will granted if the safety of the installation or other vital interests is questioned.

During construction as well as operation, the licensee and facility is subject to inspection from the nuclear regulatory authorities. The nuclear regulatory authorities shall in this regard be granted unconditional access and can inspect documentation, other documents as well as any part of a facility at all times – also without notice. The nuclear regulatory authorities can impose any such order on the licensee that the nuclear regulatory authorities deems necessary to ensure safe operation, and (any of) DEMA and DHARP can demand operations stopped for shorter or longer periods for safety reasons.

The nuclear regulatory authorities have issued Operational Limits and Conditions for the responsible license holder, Danish Decommissioning, to ensure safe operation and decommissioning of the former Danish research reactors and associated facilities.

Danish Decommissioning, an institution under Ministry of Higher Education and Science, is responsible for the decommissioning of the three former research reactors, as well as associated hot cell and fuel fabrication facilities. Danish Decommissioning also receives, handles and stores radioactive waste from users of radioactive substances (e.g. industry, hospitals and universities) in Denmark.

As mentioned above the Danish Parliament in 1985 adopted a resolution instructing the government to organise the public energy planning without inclusion of nuclear power.

Consequently, there are no nuclear installations in the terms of the Convention in the Kingdom of Denmark and from this perspective, the Act on Nuclear Installations, 1962, and the Government Order on Protective measures against Accidents at Nuclear installations, 1963, have not been revised. If Danish energy planning were to change and include nuclear power, licensing of a nuclear power plant must be expected to require a change in the legal basis.

(c) General Safety Considerations

Article 10. Priority to Safety

Not applicable.

Article 11. Financial and Human Resources

Not applicable.

Article 12. Human Factors

Not applicable.

Article 13. Quality assurance

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

The obligations under Article 13 apply to nuclear installations. There are no nuclear installations in the terms of the Convention in the Kingdom of Denmark.

However, the decommissioning activities related to the former three research reactors under the responsibility of Danish Decommissioning are similar to activities related to nuclear installations, and these activities are subject to a comprehensive system for quality assurance of health, safety and environment.

According to the provisions regulating the decommissioning activities by Danish Decommissioning, "A quality management system must be established and maintained that supports the operation and decommissioning of the nuclear installations in accordance with the conditions of the nuclear supervisory authorities as well as applicable laws and executive orders regarding radiation protection and nuclear safety. Likewise, the system must support that all essential matters concerning the operation and decommissioning of the nuclear facilities are registered and documented. The quality management system must be certified according to DS/EN ISO 9001." The provisions are issued by the nuclear regulatory authorities.

This quality assurance system is audited by the certifying bodies, supervised, and also audited by DEMA and DHARP as well as other authorities responsible for the non-nuclear part of the activities at the Danish Decommissioning.

Article 14. Assessment and verification of safety

Each Contracting Party shall take the appropriate steps to ensure:

- (i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessment shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;*
- (ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.*

The obligations under Article 14 apply to nuclear installations. There are no nuclear installations in the terms of the Convention in the Kingdom of Denmark.

As reported on Article 9 the legal basis in the existing legislation requires any applicant to present safety reports to the nuclear regulatory authorities as part of processing an application for the construction of a nuclear facility as well as a license to operate a nuclear facility. The safety reports must in a comprehensive way address all safety relevant issues related to the installation and it shall include information on operational procedures as well as protective measures.

The decommissioning activities related to the former three research reactors are the responsibility of Danish Decommissioning and the safety of the facilities is regularly supervised by inspections and assessments carried out by DEMA and DHARP. As part of the Operational Limits and Conditions the responsible Danish Decommissioning must, as licensee, prepare safety assessments and maintain documentation of thereof. Scrutiny hereof is part of the nuclear regulatory authorities' oversight.

Article 15. Radiation Protection

Each Contracting Party shall take the appropriate steps to ensure that in all operational status the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

The obligations under Article 15 apply to nuclear installations. There are no nuclear installations in the terms of the Convention in the Kingdom of Denmark.

Matters of radiation protection are addressed in Act No. 23 of 15 January 2018 on ionizing radiation and radiation protection, which is under the auspices of the Ministry of Health and DHARP. Provisions on justification and optimization as well as dose limits, dose constraints and

reference levels for the protection of workers and members of the public are in accordance with the recommendations of the International Commission on Radiological protection (ICRP) and the Council Directive 2013/59/Euratom (EU-BSS).

Matters of radiation protection in Greenland is under the auspices of the Government of Greenland, Ministry of Health, and such matters are addressed by Act No. 33 of 9 December 2015 on ionizing radiation and radiation protection.

Article 16. Emergency preparedness

1. ...
2. ...
3. *Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.*

While there are no nuclear installations in the terms of the convention in Denmark nor Greenland, a number of nuclear power plants are in operation in other countries in close vicinity of Denmark. Some of these within approximately 100 km from Danish borders.

The present nuclear power plants in the vicinity of Denmark are all of western design equipped with filtered containments, but in the context of nuclear emergency preparedness planning, the risk of a filter bypass from such installations cannot be disregarded. Terrorist activities may contribute to this risk. Thus, an accident on a nuclear power plant in the vicinity of Denmark will potentially have serious and widespread consequences in Denmark.

In addition, nuclear powered vessels pass through waters close to Denmark as well as through waters close to Greenland. These pose a similar risk in case of release in connection with an accident.

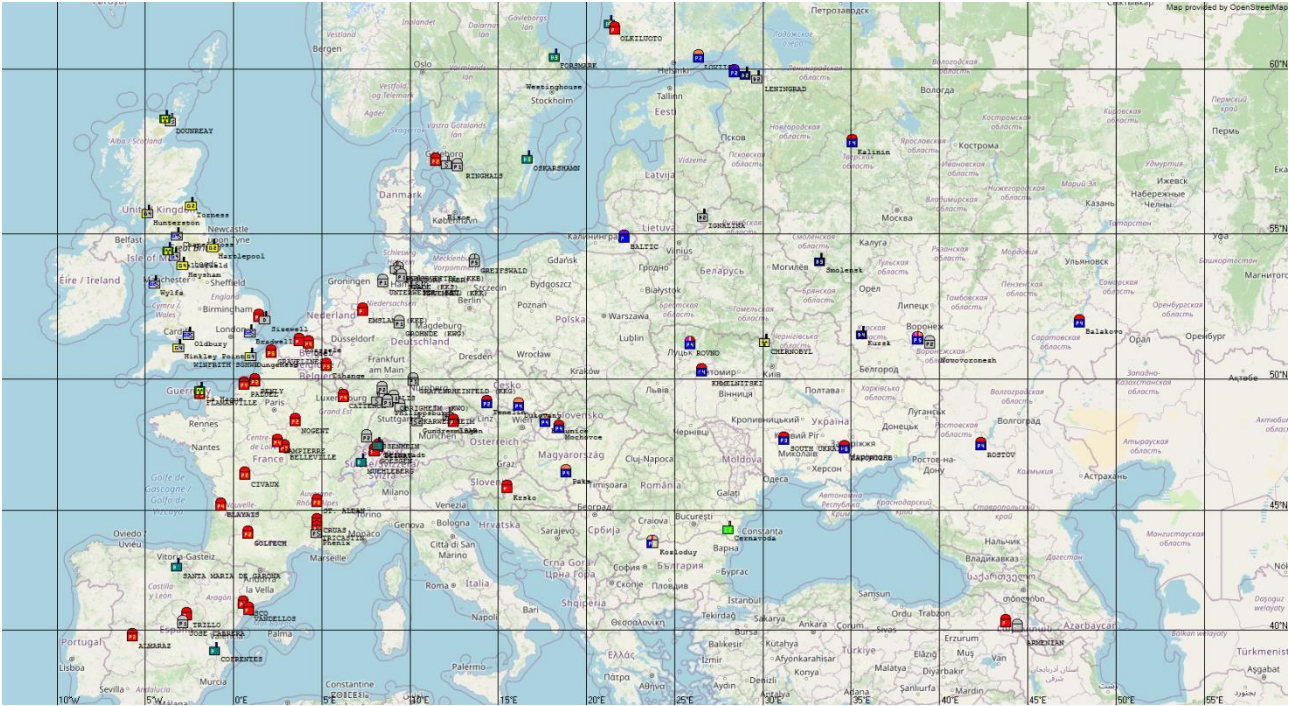


Figure 2; Nuclear Power Plants in vicinity of Denmark © DEMA

In the following, the (nuclear) emergency management system and the (nuclear) emergency preparedness system will be elaborated.

Objective

The Danish nuclear emergency preparedness system shall be able to respond adequately to a wide range of situations. These may range from a major accident that can lead to radioactive substances being widely dispersed and posing an immediate radiation hazard to an accident or event, which does not involve any radiation hazard, but may affect trade and movement of food and non-food commodities, cause economic instability and lead to general insecurity in the public. It was an important lesson learned from the national operations regarding the Fukushima nuclear accident, that nuclear accidents even very far from Denmark will require attention and measures by the emergency preparedness authorities as well as from other authorities.

The main objectives of the nuclear emergency preparedness and response system in Denmark and Greenland are:

- to maintain daily preparedness surveillance
- to implement protective measures immediately, if and as necessary
- to provide information to the public and the relevant authorities
- to guide public behaviour to avoid or reduce adverse effects

As there are no nuclear installations in terms of the Convention in Denmark nor in Greenland, emergencies will first and foremost originate from nuclear power plants located in vicinity to

Denmark or from accidents on nuclear powered vessels passing through waters close to Denmark or Greenland.

However, overall the aim of (nuclear) emergency planning is, rather than being oriented at a specific type of accident at a specific installation, to create a flexible organisation, which must be capable of handling various situations. Coordination measures and well-known procedures are key elements in the (nuclear) emergency planning.

Nuclear Preparedness Planning

Nuclear emergency preparedness planning is, in general, an area of responsibility for the Minister of Defence, while the tasks are widely carried out by DEMA in terms of planning and operations.

According to the Consolidation Act No. 314 of 3 April 2017 on Emergency Management (with subsequent changes), DEMA shall draw up a plan for the coordination and cooperation between the authorities responsible for maintaining and continuing the functions of society in the event of a nuclear accident. This National Nuclear Emergency Preparedness Plan shall be revised to the extent that circumstances makes it necessary, however, at least once every four years.

Also according to Consolidation Act on Emergency Management, every minister must within the respective area of responsibility plan for the maintenance and continuation of community functions in the event of major accidents and disasters, including nuclear accidents. This planning is beside the National Nuclear Emergency Preparedness Plan, and this is referred to as the "Sector responsibility principle". The plans must also be revised to the extent that circumstances makes it necessary, and at least every four years. The plans and revisions thereof are sent to DEMA for scrutiny.

The sector responsibility principle is fundamental for the Danish emergency preparedness regime, and wherever possible the Danish nuclear emergency system is based on organisations and preparedness arrangements that are already in force for other purposes. This means that regardless of the kind or nature of an accident or a catastrophe, the organisation of and coordination between various authorities will take place in the same single organisational set-up. Thus, decision-making and coordination between authorities will rely on familiar structures and procedures, which will facilitate robustness and effectiveness.

The National Nuclear Emergency Preparedness Plan, which aims to promote protection of the public in case of nuclear accidents or radiological emergencies, also sets out as an objective that the activities and coordination between authorities during a nuclear emergency shall build on existing mechanisms.

The last extensive revision of the national nuclear emergency preparedness plan had a specific focus on achieving a higher level of awareness and coordination among the various national authorities involved in nuclear emergency planning and response. This revision was done in 2018.

An extensive revision is undergoing in 2022 and this will include experiences from the pandemic situation, where a number of authorities carried out emergency tasks under difficult conditions and with a great need for coordination.

Organisation

DEMA is an agency under the Ministry of Defence and is the overall authority on Nuclear Emergency Preparedness, as well as overall authority on Civil Emergency Preparedness. The nuclear operative organisation is based in Nuclear Department in DEMO. The operative part of the DEMO overall is based in DEMO as well as in six regionally based rescue centres (operative centres part of DEMO with regular personnel and conscripts).

A number of governmental authorities in Denmark and Greenland are part of the nuclear emergency preparedness regime. In Denmark the following should be mentioned – beside DEMO; the Danish National Police, DHARP (Danish Health Authority, Radiation Protection), the Danish Veterinary and Food Administration, the Danish Agricultural Agency, Danish Fisheries Agency, the Danish Environmental Protection Agency and the Danish Meteorological Institute. In Greenland the following should be mentioned; the Ministry of Health, the Ministry of Fisheries, Hunting and Agriculture, the Ministry of Nature and Environment. They all act according to the sector responsibility principle.

Operative activities in each of the authorities involved will most likely be coordinated within the "National Operational Staff" (NOST) which is the coordinating body at the central level in case of major accidents and catastrophes – in principle regardless of the kind or nature of an accident or catastrophe. NOST is led and hosted by the Danish National Police. A number of key authorities are permanent members of NOST and will thusly participate in emergency management operations on a regular basis. Furthermore, NOST may summon ad hoc members from public as well as private organizations, if needed be.

In case of a nuclear accident that will or can affect Denmark, NOST will convene to ensure coordination of activities and implementation of protective measures. NOST will also prepare information to the government; this will include general information about the accident as well as specific information needed in connection with decision-making. In addition, information to the public will be coordinated within NOST (through a supporting staff; the Central Operational Communications Staff). Formally measures as well as communication to the public is a sole responsibility for authorities individually though.

DEMO (Nuclear Department) is National Competent Authority as of nuclear safety and nuclear emergency preparedness (see below) and will in this capacity activate the nuclear emergency response system in the event of a nuclear accident, where, due to the nature and possible spread of the accident, a possible need for the implementation of measures and communication about this from various authorities must be foreseen, whereby there is a need to ensure coordination among these. Even if it is considered unlikely that an accident would cause significant radioactive contamination in Denmark, it may be decided to activate the emergency response system or selected functions herein to enhance and assess the available information and to inform other

authorities and the public. Such measures may include the rapid staffing of emergency capacities as well as ensuring that relevant information is available to the relevant authorities as well as to the public. Information to the public will be distributed in cooperation with the national media.

In case of an emergency where time is limited and protective measures should be implemented "immediately" DEMA can initiate implementation of certain protective measures "on behalf" of DHARP. This is based on prior understanding and agreement (predefined criteria) between DEMA and DHARP; DEMA can initiate the implementation of indoor protection and/or evacuation if dispersion calculations indicate risk of dispersion and consequent health risk under circumstances where protective measures must be implemented prior to DHARP assessment and NOST convening.

The Competent Authority

In terms of the Convention on Nuclear Safety, DEMA is the national competent authority. DEMA is also the national competent authority in terms of the Convention on Early Notification of a Nuclear Accident, in terms of the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency and in terms of the Convention on Physical Protection of Nuclear Material and Nuclear Facilities.

As mentioned above DEMA and DHARP are the nuclear safety authorities and jointly constitute the Regulatory Body.

Early Warning

Early warning in case of a nuclear accident is based on international agreements with IAEA (USIE) and EU (ECURIE), exchange of information and on bilateral agreements, which Denmark has concluded with various states: Sweden, Germany, Finland, Netherlands, UK and Northern Ireland, Poland, Russia and Lithuania.

Early warning is received by DEMA as National Contact Point (under Convention as well as bilateral agreements.)

Radiation Monitoring and Radiological Measuring

DEMA manage an online system for automatic monitoring of radioactivity. The system covers Denmark (11 stations) and Greenland (3 stations), and it is designed primarily to detect (verify) a release from a Nuclear Power Plant beyond the vicinity of Denmark and Greenland. The system is in operation 24/7 and provides monitoring data, including gamma spectra. Each station is equipped with a 2-inch NaI detector with automatic nuclide identification as well as a GM detector. Every 10 minutes the stations upload data to a central server. Data from the monitoring stations is collected automatically in DEMA. An automatic warning system will alert the Nuclear Duty Officer in DEMA (Nuclear Department) of any increase in gamma radiation that might be attributed to causes other than natural variations. Radiation monitoring data from neighbouring states is also available online based on the EURDEP monitoring network operated by the EU.

Two air-filter stations are also a part of the monitoring system. The filters are collected and examined for radioactive content once every week.

DEMA has a variety of equipment and competences for radiological measurement in the field. This includes hand-held as well as mobile and stationary instruments, which can be used for both nuclear and radiological incidents. There is a system in place to report measurement results to a central operational staff, or reach back capacity. The instruments specifically include:

- Approximately 60 hand-held GM tubes dose rate meters that can be operated by conscripts and/or volunteers.
- 6 dose rate meters with CsI detectors and build in GPS and logging function.
- 12 hand-held radionuclide identification instruments with 2-inch NaI detectors.
- Two High Resolution Ge-Detectors for in-situ measurements and advanced nuclide identification
- Two car borne systems with 4 L and 3-inch NaI detectors that can be deployed in lightly or severely contaminated areas. The systems can send data in real time to a reach back capacity.
- Two airborne systems with 2x4 L NaI detectors that can be mounted in a pod on a military Fennec helicopter.

Mobile monitoring teams from the regional rescue centres can be alerted and dispatched within a few minutes. For more sophisticated measurements DEMA can, in cooperation with other authorities and experts, provide expert monitoring teams if required.

Improvements and strengthening activities have been carried out as for equipment and competences within radiological measurement and Nuclear Field Investigation Teams (NFIT).

Special Operational Resources

Since 2014, DEMA has developed Nuclear Field Investigation Teams (NFIT). NFIT's can map radiation with a particular focus on identifying "hotspots" while radiation levels in this context is decided by designated experts by a specific assessment of the situation. Moreover, the NFIT's are a part of DEMA's HAZMAT concept, as all HAZMAT-specialists also must be NFIT-trained.

NFIT-teams consist of 2-4 persons, dependent on the situation, all of which are NFIT trained. The NFIT-teams are available from all six regional operative emergency centres within DEMA. The NFIT-program includes 58 trained staff (June 2019). The NFIT-resource (alongside other resources) is listed as an IAEA RANET-capacity.

Decision Support System

DEMA uses the current version of the decision support system ARGOS 9.10 (Accident Reporting and Guiding Operational System).

ARGOS is used for dispersion calculations, consequence assessment and decision support following a nuclear, a radiological or a chemical emergency.

ARGOS can calculate atmospheric dispersion with three different models; URD; a short-range model, RIMPUFF; an intermediate model and, DERMA; a long-range model. The system calculates doses to the public, in the food chain and in the urban environment using real-time online weather data. ARGOS can also be used to present and analyse measurement data from car borne, airborne and handheld measurement systems.

DEMA holds the chair in the ARGOS user group and is active in the development and research relevant for ARGOS and related models and functionalities. Authorities from several countries also use ARGOS, e.g. Australia, Brazil, Canada, Ireland, Norway, Poland and Sweden.

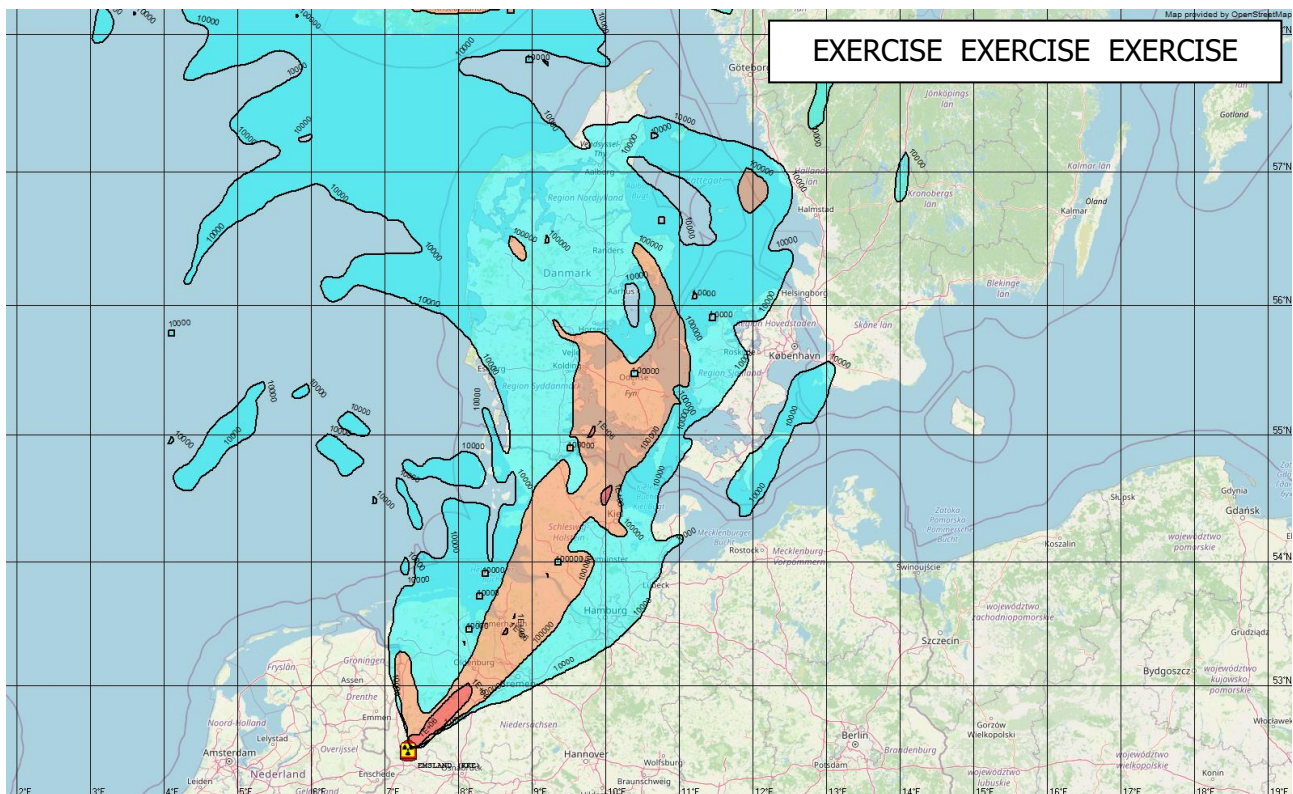


Figure 1; ARGOS dispersion calculation [NPP Emsland, DE] © DEMA

Protective Measures

According to a Government Order on Protective Measures against Accidents at Nuclear Installations, an emergency preparedness plan must be issued for all nuclear installations on Danish territory and for all Danish harbours, which receive nuclear powered ships. It also stipulates that in case of exposure from ionising radiation or other nuclear risks, preventive measures can be implemented, such as:

- Radiation monitoring etc., if necessary also on private property
- Notification of the public
- Areas cordoned off
- Evacuation/relocation and quartering
- Sheltering, including tight-fitting of windows and switching off ventilation

- Traffic regulations
- Restrictions on use of foodstuffs

The various authorities mentioned above can all implement protective measures within their area of responsibility. This can thus concern, for example, health measures, specific measures concerning food, crops (cultivation/harvest), farm animals and feed and fishing (area restrictions). Implementation of such protective measures will be coordinated (likely in NOST) and coordinated information will be ensured.

Training and Exercises

Training and exercises are fundamental parts of maintaining and developing competences in nuclear emergency preparedness and are also an efficient way to train and maintain bi- and multilateral agreements on assistance and notification.

Besides participation especially in exercises conducted by the IAEA and neighbouring countries DEMA has established a recurring exercise, CONTEX (CONTamination Exercise), which has expanded considerably in recent years with regard to participants from other countries.

CONTEX was first held in 2014 as an exercise for the national NFIT teams, and with participation from a few other countries. In 2016 and 2018 CONTEX was repeated with an increasing number of participants and participating countries. CONTEX 2020 was reduced in format and in participation due to the pandemic situation.

The National Report to 8th Review Meeting, July 2019, contains a comprehensive description of CONTEX 2018.

CONTEX 2022 will be conducted as a RANET exercise complete with a Host Nation Support Plan and an Assistance Action Plan. CONTEX 2022 will take place at training grounds near Finderup, just west of the city of Viborg in Central Jutland, Denmark.

The scenario for CONTEX 2022 will be a release of a radioactive cloud from a nuclear powered vessel situated in the inlet "Limfjorden" in the northern part of Jutland. The release leads to surface contamination in large areas of Jutland.

The task for the Field Assistance Teams (FAT) will be survey in the exercise area followed by mapping of hotspots, identification of nuclides and assessment of the surface contamination as well as clearance of areas without contamination and defining areas with contamination but below any health inflicting thresholds. Measurements with airborne equipment, reporting of data and presentation of data with GIS-tools is included in the activities.

Teams from Norway, Faeroe Islands, Finland, Germany and Denmark is expected to participate in CONTEX 2022 participate with NFIT teams and drones.

As a non-nuclear country Denmark give high priority to exercises, both national and international exercises. Participation in exercises is an opportunity to maintain the competences of the highly skilled professionals in general as well as to train specific competences. Exercises are also an

opportunity to exchange experiences and to take note of the technical and tactical development at emergency preparedness organizations in other countries.

International Cooperation

DEMA and DHARP is continuously strengthening cooperation in the areas of nuclear emergency preparedness area and (related) radiation protection nationally as well as internationally and with neighboring countries.

There is a strong tradition for close co-operation among the Nordic countries, and throughout the years, DEMA has been and continues to be an active player in Nordic cooperation.

The Nordic cooperation includes a number of Working Groups:

“Nordic Working Group of Emergency Preparedness” (NEP) is for authorities with responsibilities in radiological and nuclear emergency preparedness. The group exchanges information, experience and procedures within emergency planning and response. The group publishes “The Nordic Manual” (Co-operation, Exchange of Information and Assistance between Nordic Authorities in Nuclear or Radiological Incidents and Emergencies) and “Protective Measures in Early and Intermediate Phases of a Nuclear or Radiological Emergency”. Both papers are currently under revision and new versions are expected in 2020.

“Nordic Working Group for Public Communication” (NPC) is a forum for networking, sharing of information, discussions regarding issues of mutual interest and for sharing solutions on strategic and operative communication challenges. The Norwegian Radiation and Nuclear Safety Authority (DSA) currently chair this Working Group.

“Nordic Nuclear Safety Research” (NKS) is co-owned by DEMA and the other Nordic nuclear and radiological safety authorities. The Agency is active both in the owner group, board and as a user of research herein. NKS has an annual budget of approximately 8 million DKK and funds research within competence building, experience exchange and networking in nuclear and radiation safety with focus on reactor safety, including decommissioning, and emergency preparedness. This is achieved by joint activities of interest to the financing organizations and other end users resulting in scientific articles and technical reports. The results are used by the participating organizations in their competence building, decision-making processes and information activities. All NKS results are available free of charge not only for the NKS “family” but also internationally providing an international benefit of NKS work.

Within the Working Groups various activities and projects are carried out. Of these, the following NKS funded research projects – in which DEMA has participated in recently – should be mentioned:

- COMBMORC - Combined analysis of primary and scattered components in mobile gamma spectrometric data for detection of materials out of regulatory control (2021)

- SHIELDMORC 2020 - Shielding assessment by the use of net count rate ratios of Compton scattered photons measured by a gamma spectrometer. Obtaining a knowledge base for the NKS/SHIELDMORC project (2020)
- SOCHAOTIC – Source Characterization accounting for Meteorological Uncertainties (2020-2022)
- NUCSEM – Use of nuclear weapons towards a Nordic country: Scenarios, impact assessments and protective measure (2021)
- CRESCENT – Credible Release Scenarios for Nuclear-Powered Vessels operation in Nordic Waters (2021)
- RNSARBOOK – Nordic Handbook for Search and Rescue in a Maritime Radiological/Nuclear Emergency (2021)
- SHIELDMORC - Detection distances and methods to locate orphan gamma radiation sources in shielded building geometries by mobile gamma spectrometry (2019)
- SLIM - Source Localization by Inverse Methods (2019)
- AUTOMORC – Improvement of automatic methods for identification of radioactive material out of regulatory control (MORC) by mobile gamma spectrometric search (2018)
- AVESOME – Added Value of uncertainty Estimates of Source terms and Meteorology (2018)

Reports from all completed NKS projects are available on www.nks.org.

Denmark also has close bilateral cooperation with e.g. Germany and Sweden. This includes cooperation with national authorities, and also cooperation with local authorities responsible for emergency preparedness at NPPs.

Denmark has accepted the HERCA/WENRA approach for better cross-border coordination of protective actions during the early phase of a nuclear accident.

Article 17. Siting

Not applicable.

Article 18. Design and construction

Not applicable

Article 19. Operation

Not applicable

D. Conclusion

In conclusion – based on the above reporting under the applicable articles for a party having no nuclear installations on their territory – the Kingdom of Denmark is in full compliance with its obligations according to the Convention on Nuclear Safety.

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