FOR YOUR SAFETY

Actions in Case of Emergencies and Incidents Pursuant to Section 106(4) Radiation Protection Ordinance

JEN
Jülicher Entsorgungsgesellschaft
für Nuklearanlagen

JÜLICH
Forschungszentrum

From left to right:

Karsten Beneke, Vice-Chairman of the Board of Directors of Forschungszentrum Jülich.

Dipl.-Ing. Rudolf Printz, Chairman and Technical Director of Jülicher Entsorgungsgesellschaft für Nuklearanlagen mbH.

Prof. Dr.-Ing. Wolfgang Marquardt, Chairman of the Board of Directors of Forschungszentrum Jülich.

DEAR NEIGHBOURS OF FORSCHUNGSZENTRUM JÜLICH,

We are sending you this brochure to inform you of the preventive actions that Forschungszentrum Jülich and Jülicher Entsorgungsgesellschaft für Nuklearanlagen mbH (JEN) have taken together with the district of Düren for your safety. This disclosure of the emergency response plan for radiological emergencies to the general public is prescribed by law.

There are nuclear facilities located on the campus, including the two decommissioned research reactors FRJ-2 and AVR, which were taken out of service a number of years ago to adapt to demand and are currently being dismantled.

As a result, there are no longer any reactors in operation.

Operating and, in particular, dismantling nuclear facilities produces radioactive waste, which must be treated and disposed of in a safe and reliable manner. The radioactive waste that is produced must also be safely stored until it is delivered to a final storage facility. These tasks of waste disposal and interim storage have been handled by JEN since 2015, the company that also operates these facilities.

For decades, safety has been the primary concern in handling radioactive substances and waste. Protecting personnel, the environment, and the general public are of top priority.

Along with JEN's facilities mentioned above, some scientific institutes at Forschungszentrum Jülich also work with radioactive substances, which are used for example in brain research and environmental research. For instance, radioactive tracers are used to track metabolic processes in cells. These methods are used to gain important insights into the functioning of the human brain or of plants.

All the facilities containing radioactive substances are equipped with numerous safeguards that prevent these substances from escaping into the environment. To this end, the facilities are regularly inspected with regard to the application safety precautions and further developed and improved pursuant to the mandated technical requirements.

We conduct our research on behalf of society and are fully aware of our particular responsibility.

We satisfy this responsibility with our high scientific and operational standards, with our employees' competence and diligence, and with the stringency of our safety precautions.

Please contact us if you have any questions.

SAFETY

The construction and operation of facilities containing radioactive substances is subject to strict legal regulations. As part of the individual licensing procedures, all possible accidents that may occur were analysed and classified as manageable. The safety systems are monitored continually by independent experts to ensure they are always in good working order.

Our facilities are not only protected by solid structures, they are also equipped with a number of active and passive systems designed to make them even safer. In case of undesirable operational states, they activate automatically or set off an alarm.

Radioactive substances are used in various facilities managed by JEN and at Forschungszentrum Jülich's institutes for various purposes. Radioactive substances contain atoms in which the number of protons and neutrons is not in equilibrium. The atoms have a tendency to rectify this state by emitting alpha, beta, and gamma radiation until a stable nucleus remains. This may take one or several steps of radioactive decay.

Released radioactive substances can affect humans from inside and outside the body. In an exhaust air cloud, or on the ground, they cause external radiation exposure. If they enter the body through food or the air, they can accumulate – depending on their properties – in different organs of the body, where they cause internal radiation exposure.

The design, construction, operation, and dismantling of all facilities on the Jülich campus is therefore geared specifically towards having radioactive substances confined and contained at all times. Where necessary, additional protective, control, and alerting systems are also in place.

CONTINUOUS MONITORING OF THE ENVIRONMENT

Measuring instruments inside and outside the Jülich campus continuously monitor the atmosphere, soil, and water. Some of the measurement data are sent directly to the regulatory authority. In the many years of monitoring, the data have never given cause for concern.

In addition, an environmental measurement programme is also carried out. This is to demonstrate that no elevated levels of radioactive substances can be found in the environment and, in particular, in food. These activities are supported by measurements from the meteorological tower, which can help determine the direction in which airborne emissions move and the conditions under which they do so at any time.

All possible actions have been taken for the Jülich campus to guarantee protection of the surroundings. The necessary precautions have also been taken to protect against a negative impact on the environment in case of accidents, such as fires, explosions, or technical failures. Forschungszentrum Jülich has a safety control centre for the Jülich campus that is always staffed and can summon any required emergency services immediately. These include the Radiation Emergency Response Services and Forschungszentrum Jülich's own Works Fire Brigade, which is specially trained to fight fires involving radioactive substances.

The purpose of the meteorological tower – which is 124 metres high and thus the highest structure at Forschungszentrum Jülich – is to monitor the area.

As far as their resources allow, the Works Fire Brigade, Radiation Emergency Response Services, and Medical Service are also available to respond to other emergencies in the region.

Numerous structural, operational, and other safety features mean that in all probability, any substantial negative impact on the environment has been ruled out. However, prudence requires us to be prepared for all eventualities. Therefore the competent authority, namely the district of Düren, developed an emergency response plan in cooperation with Forschungszentrum Jülich over 30 years ago, which now also includes JEN and is regularly updated. This leaflet will give you information on the key features of this plan.

EMERGENCY RESPONSE PLAN

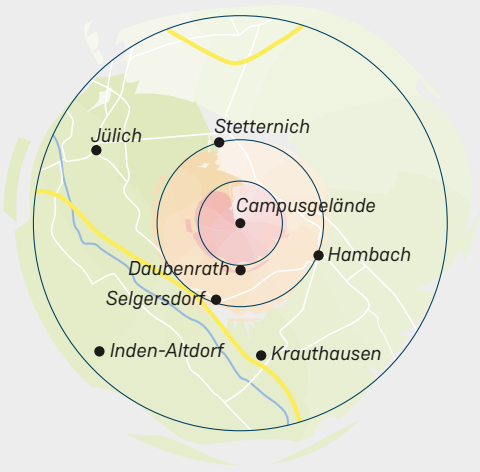
The emergency response plan guarantees that, in an emergency, you will be given the information you need in good time, and that all measures designed for your protection will be triggered quickly and effectively. The plan's most important features are:

Alerting system and cooperation of the authorities

In case of an accident, the safety control centre of Forschungszentrum Jülich will be alerted first. All emergency services on campus will be deployed, including the Works Fire Brigade and the various measurement teams and task forces. Their job is to quickly and effectively limit the impact of the accident, and, if possible, to restore safety. The employees on the Jülich campus and the authorities will also be informed immediately.

The district of Düren will then, if necessary, convene a crisis management group, which will take the necessary measures without delay: the general public will be informed and warned as early as possible and to the extent necessary; traffic routes will be blocked for the emergency services.

Any additional measures depend on the severity of the accident and the amount of radiation released. The direction of the wind and other weather conditions also play a decisive role in this. Forschungszentrum Jülich therefore continuously monitors and stores data on the current wind and weather conditions.



Danger Zones

For the purpose of emergency response planning, three zones have been defined around the campus:

First Zone
The first zone covers the area within a radius of 1 kilometre around a central point on the campus of Forschungszentrum Jülich. This includes only the campus itself, and the northern parts of the village of Daubenrath.

Second Zone
The second zone covers an area within a radius of 2 kilometres around the central point. This includes the first zone and the villages of Stetternich, Hambach, and Selgersdorf, as well as the rest of Daubenrath.

Third Zone
The third zone covers a radius of 5 kilometres. This area stretches to the town centre of Jülich and to the villages of Inden-Altdorf and Niederzier-Krauthausen to the south.

The latter two zones are subdivided into twelve segments of 30° each. This enables the emergency services to respond with different measures in the different segments, for example according to the wind direction and the distance.

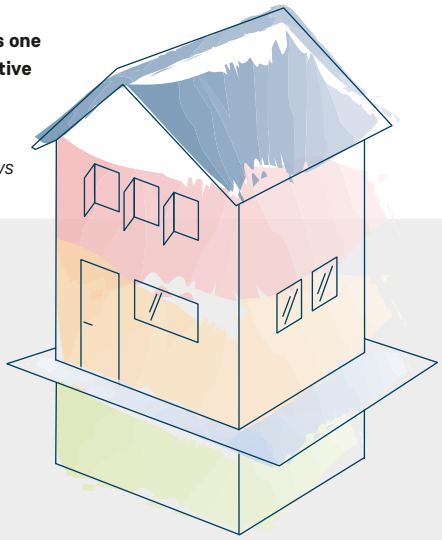
In an emergency, the general public will be informed and warned using mobile loudspeakers, the NINA warning app from the Federal Office of Civil Protection and Disaster Assistance, and by radio. Loudspeaker announcements may be short. You should therefore turn on your radio immediately and tune into a regional station. Please pass on all the information available to you, for example to relatives and neighbours. Avoid inquiries to the emergency services to keep lines free for emergency calls. The announcements will also provide information and instructions for your personal protection. The most important information is:

Staying in enclosed buildings is one of the simplest and most effective ways of protecting yourself

Insufficient protection if windows and doors are open

2 to 5 times better protected if windows and doors are closed

10 times better protected if in a basement or centrally located room within a house



Stay Indoors

When radioactive substances are released, it is important to protect yourself and others from the radiation emitted by these substances. One of the simplest and most effective ways is to seek protection in enclosed buildings. While a radioactive cloud is moving through the area, closing windows and doors can, to a large extent, prevent radioactive substances from entering. Walls, blankets and soil will also reduce the amount of radiation penetrating from outside. A centrally located room in the basement is therefore the safest place to go to.

This can considerably reduce the effects of radiation. In case of danger, it is therefore likely that you will be advised early to remain indoors and to close doors and windows.

If you are outside while radioactive substances are released or shortly afterwards, it is likely that radioactive particles will become attached to your clothes and exposed areas of your skin. Experts call this “contamination”. In such a case, take off your outer clothing and shoes inside the house and, if possible, collect them in plastic bags. Wash those parts of the body that were not covered. Protect your eyes while doing so!

In this kind of situation, tap water is generally safe to use and drink. Food that has been stored in the house, such as canned food, can also be consumed. However, you should avoid fresh food gathered in gardens or fields in the surrounding area after the incident.

Evacuation

The most severe measure in case of an accident is, without doubt, evacuation. In certain establishments, such as hospitals, this can cause significant problems. Such a measure would therefore only be taken after carefully weighing the risks, and if all other measures are insufficient.

Which areas are to be evacuated at what time will depend on the actual accident situation and on the weather conditions, and will be decided in Düren district’s crisis management group.

If the area where you live is evacuated, you must observe the following instructions:

- Listen for announcements by the police and fire brigade, and for radio announcements.
- Take only those items you will urgently need within the next two to three days, in particular, medicines prescribed by a doctor as well as money, keys, and ID cards.
- Depending on the situation, you may be asked to report to an emergency station set up specifically for this purpose in order to be tested for contamination and to receive medical attention. The location of any emergency station will also be announced.

NATIONAL AND INTERNATIONAL SUPPORT SYSTEM

The district authorities' protective measures are embedded in a comprehensive national and international system of precautions. This ensures that in case of danger, the local emergency services will receive all the assistance they need from the state of North Rhine-Westphalia and the Federal Government. The cooperation of the different authorities in emergency management and responsible behaviour on your part guarantees the best possible protection for you even in the hypothetical case of an incident such as described in this leaflet.

Information for the general public regarding the protective measures and recommendations for conduct in case of potential emergencies pursuant to Section 105 of the German Radiation Protection Act can be found on the following websites:

- on hazard prevention by the North Rhine-Westphalian Ministry of the Interior (in German): *www.im.nrw/themen/gefahrenabwehr*
- on nuclear accident management by the Federal Office for Radiation Protection (BfS): *www.bfs.de/DE/themen/ion/notfallschutz/notfallschutz_node.html*
- on emergency protection by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) (in German): *www.bmu.de/themen/atomenergie-strahlenschutz/strahlenschutz/notfallschutz/*
- on fundamentals of emergency protection outside facilities by the BMU (in German): *www.bmu.de/themen/atomenergie-strahlenschutz/strahlenschutz/notfallschutz/grundlagen-fuer-den-anlagenexternen-notfallschutz/*
- on emergency precautions by the Federal Office of Civil Protection and Disaster Assistance (BBK) (in German): *www.bbk.bund.de*

The most important keywords and terms are explained again below. The last page features an information sheet with a summary of the most important rules of conduct in the event of an accident involving radioactive substances.

TECHNICAL TERMS AND WHAT THEY MEAN

Radioactive substances
are the result of e.g. nuclear fission in reactors or production in particle accelerators. Their atoms are "unstable" and change in a series of steps until they become stable. During this process – referred to as "radioactive decay" – three types of radiation are emitted: alpha, beta, and gamma radiation. In the cells of the human body, radiation causes energy to be transmitted and may change atoms and molecules in such a way that they are no longer electrically neutral. Experts call this process "ionization" and also use the derived expression "ionizing radiation". When such changes occur in the nucleus of body cells, they can cause damage to your health.

Radioactivity
is the property of substances to decay and emit radiation. It is measured in becquerels (Bq). One Bq means that one nucleus decays per second. Radioactivity is present every-where in nature, even without any human influence. For example, a kilogram of soil contains enough radioactive potassium to cause between 40 and 1000 decays per second (depending on the potassium content), i.e. it has 40 to 1000 Bq/kg.

Contamination
happens when radioactive substances are deposited on surfaces, for example on clothes or on the skin, or when they mix with environmental media, such as soil, air or water.

Alpha radiation
means that particles are emitted, which consist of two protons and two neutrons each. These particles have only a short range, and the outermost layer of the skin shields us completely from this kind of radiation. It therefore presents a hazard only if radioactive substances enter the body.

Beta radiation
consists of tiny electrically charged particles (electrons) and is absorbed rapidly. Its impact on humans occurs when it comes in direct contact with the body, for example if the skin is contaminated or radioactive substances are ingested.

Gamma radiation
consists of electromagnetic waves, similar to X-rays. It is very penetrating and can have an effect on all inner organs even without direct contact, for example if it comes from a radio active cloud or from radioactive substances deposited on the ground.

Radiation dose
is the amount of radiation energy absorbed by human tissue taking into account its biological effects, as measured in sieverts (Sv). Doses that occur in practice are in the millisievert range (mSv), i.e. a thousandth of a sievert. The annual dose from natural background radiation in Germany is approx. 2 millisieverts.

INFORMATION SHEET

What to do in case of an accident with radioactive substances

Alerting

- The general public will be alerted and informed by means of police vehicles with loudspeakers, the NINA warning app, and by radio announcements. In the Düren district, the public will be informed on the local radio station Radio Rur (92.7 MHz) and, after sign-off, on Radio NRW broadcast on the same frequency.
- Do not call the emergency services unless absolutely necessary.
- Inform your neighbours and relatives.

Protection Inside Buildings

- Remain indoors if possible.
- Close windows and doors as tightly as possible.
- Switch off ventilation and air conditioning systems.
- If possible, do not light any open fire, e.g. a gas stove (oxygen consumption, exhaust gases).
- Go to centrally located rooms, preferably in the basement, and take your radio with you.

What Not to Eat

- Do not eat fresh vegetables from the garden.
- Do not drink milk directly from farms in the region.
- Do not drink water from open wells or from lakes, rivers, etc.

Evacuation

- Listen for announcements by the police and fire brigade, and for radio announcements.
- Pack an emergency bag containing what you and your family will need for the next two to three days. Remember to take important medicines, ID cards, keys, and cash.
- Prepare your home for your absence and lock the door. Turn off gas and water at the mains, extinguish any open fire and switch off electric devices.
- Follow the instructions of the emergency services.
- Tune in to a local radio station.

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You will find this brochure online at:
www.fz-juelich.de/info-bevoelkerung
www.jen-juelich.de/verantwortung/Informationsblatt

It will be distributed to all households within a 5-kilometre radius of the campus.

This information sheet will be updated to reflect any significant changes that impact the safety and protection of the general public, every 5 years at the latest.