

Swedish emergency preparedness for nuclear energy accidents



**RÄDDNINGSG
VERKET**

**Swedish emergency
preparedness for nuclear
energy accidents**

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This booklet includes the following

A description of the Swedish emergency preparedness for protection measures during a nuclear energy accident.

Responsibility 2

What are nuclear energy accidents?

Accidents in nuclear power plants, in installations for nuclear fuel and waste, during the transport of spent nuclear fuel, on vessels driven by nuclear reactors, with satellites powered by nuclear reactors or batteries containing radioactive substances (radioactive substances are those that emit radiation)

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Who makes up the emergency preparedness organisation?

The county administrative boards, municipalities, and authorities responsible for nuclear energy, radiation protection, agriculture, fisheries, foodstuffs etc.

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Reading tips

If you want to know who is responsible for what, then read 'Responsibility' on page 2.

If you want to follow what happens once the alarm has been raised then read 'During an accident' on page 21.

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Keep this booklet by your telephone directory

Responsibility

Preparedness means being prepared for the unexpected...

...and being able to minimise the consequences of an accident. This booklet describes the Swedish emergency preparedness for protection measures during a nuclear energy accident. If a nuclear energy accident occurs in Sweden or abroad the emergency preparedness organisation will protect people and the environment.

The emergency preparedness organisation covers the whole country

The emergency preparedness organisation is a national network, including municipalities, county councils, county administrative boards, central authorities, and the government.

During a nuclear energy accident it is the county administrative boards that are responsible for the protection of the public.

Central authorities such as the Swedish Nuclear Power Inspectorate, the Swedish Radiation Protection Institute, the Swedish Board of Agriculture, the Swedish National Food Administration, and the Swedish National Board of Health and Welfare, and the *municipal fire & rescue services*, the *medical services*, the *police* and the *coastguard* also contribute to the running of the organisation.

The *Swedish Rescue Services Agency* is responsible for co-ordinating planning and supervision of the emergency preparedness organisation.

Emergency preparedness work includes planning in advance of the need to take various protective measures, operations for the acute period of emergency situations, and subsequent operations to minimise the consequences of accidents.

Operations to minimise consequences may be required both in the short and long-terms. Radioactive fallout from an accident can, in the worst case, entail problems over a number of years for crop husbandry, animal breeding, horticulture, reindeer food, hunting and fishing. In which case the municipalities, county administrative boards and authorities are required to run operations over a longer period of time after an accident, especially for the control and inspection of foodstuffs.

The county administrative boards issue warnings and information

In the event of a nuclear energy accident the relevant county administrative board receives information at a very early stage and so can therefore respond immediately. The county administrative board shall then:

- *Quickly warn and inform the public*
- *Prevent injury and damage to people, animals and the environment*

Who is responsible for what?

Within the organisation for emergency preparedness for nuclear energy accidents:

- Emergency preparedness planning
- Measures to be taken in the acute phase for the protection of the public, e.g. warning and information

*The county
administrative board*

- The measuring of radiation within the municipality
- Care of those evacuated

The municipality

- Technical analyses
- Assessment of the contents and duration of the release

*Swedish Nuclear
Power Inspectorate*

- Advice to the authorities on radiation and decontamination
- Co-ordination of national resources for taking measurements
- Dose calculations
- Information to the media and the public

*Swedish Radiation
Protection Institute*

- Weather and dispersion prognoses

*Swedish Meteorological and
Hydrological Institute*

- Mitigation of the effects to agriculture
- Limiting the quantity of radioactive substances in agricultural produce
- Protection of animals

*Swedish Board of
Agriculture*

- Limit values for the quantity of radioactive substances in foodstuffs
- Advice on foodstuffs

*Swedish National
Food Administration*

- Advice on medical matters

*Swedish National Board of
Health and Welfare*

- Care of the injured

The county council

- Evacuation

The police

- All safety measures within the limits of a nuclear power plant

- Co-ordination and supervision of emergency preparedness

Swedish Rescue Services Agency

What is it that is dangerous?

The most serious consequence of a nuclear energy accident is when there is a release of radioactive substances, dispersed by the wind, that settle on the ground and in the water. They remain there and can injure, through exposure to radiation, people and the environment. Radioactive substances can also be transmitted through the food chain from the land (e.g. grazing animals, crops) to the food we eat. It is the radiation from radioactive substances that is dangerous.

Mankind has, however, always been exposed to radiation. There is natural radiation all around us, which comes from the ground, from space, and also from the radioactive substances in our own bodies. Each year, therefore, we all receive a dose of radiation. Radiation can cause acute injuries and subsequent injuries, such as cancer for example. It is only when the dose of radiation becomes sufficiently large that we can receive acute injuries requiring emergency medical treatment. Large doses primarily damage blood-producing organs (e.g. bone marrow), the intestines and the central nervous system. (The symptoms from serious injuries present within a short time – from hours up to months – after exposure, in comparison to cancer, which can develop years or even decades later.) A large dose is one that is several hundred to a thousand times larger than the yearly, natural dose of radiation. (See diagram on doses on page 13.)

Radioactive substances can irradiate a per-

son externally – so called external irradiation (see diagram on page 9) – when they are carried by the wind, in the form of a cloud from the accident site, to later fall to the ground.

It is therefore important to know from which direction the wind is blowing. Then you can go indoors and avoid being outdoors on the route of the cloud as it passes. It is also important to know where radioactive fallout settles.

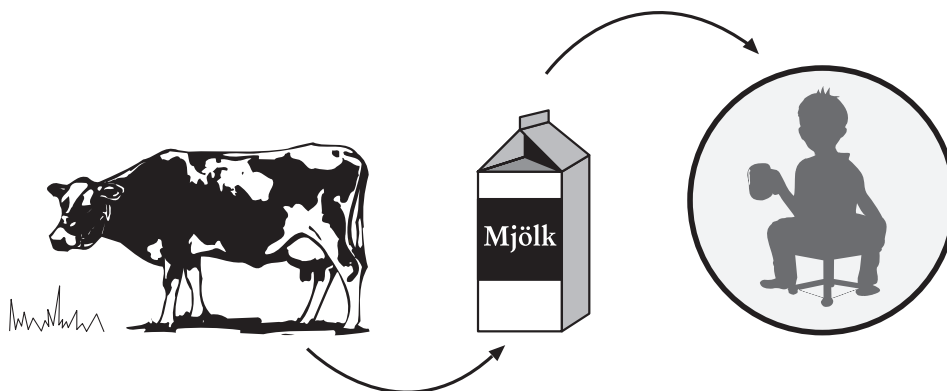
When radioactive fallout settles on the ground it can be absorbed by plants and animals. The radioactive substances can then be transmitted to humans via foodstuffs e.g. fruit, vegetables, fish, meat and milk.

When a person has absorbed radioactive substances they can irradiate that person internally – so called internal irradiation. Radioactive substances that people inhale (e.g. from the cloud) also result in internal irradiation.

The doses that Swedes are exposed to as a result of the Chernobyl disaster emanate, for the most part, from radioactive fallout that settled on the ground in Sweden. (For people that eat, for example, a lot of reindeer meat the dose they absorb from food can be higher than doses absorbed from fallout.)

For the sake of comparison it should be mentioned that radiation is only one of a number of causes of cancer, and a relatively small one at that.

Food chain example



If radioactive fallout settles on grass, which is later eaten by cows, some parts of the radioactive substances will be present in the milk. Then the radioactive substances are transmitted to people when they drink the milk.

Iodine and caesium

It is mainly the radioactive substances *iodine* and *caesium* that can irradiate a person if they are released during an accident at a nuclear power plant. Highly volatile radioactive gases, which are also released, give higher doses but only within the proximity of the nuclear power plant. Iodine and caesium are almost identical to certain substances that the body requires, so therefore the body absorbs them from foodstuffs and the air. There are, for example, both radioactive and non-radioactive forms of iodine. Both forms are absorbed by the thyroid gland. Radioactive iodine can enter the body in two ways: by breathing

in the iodine from the cloud, carrying the substances released from the nuclear power plant, and by eating foodstuffs containing it, e.g. milk, vegetables.

When radioactive iodine enters the thyroid gland it irradiates it. Very high doses can damage the gland.

In addition, there is a risk of cancer from radiation. The risk of the thyroid gland being damaged by radiation is greater in children than in adults. Iodine tablets reduce the risk of damage to the gland. (See text box on page 9.)

Where are the nuclear installations located?

Nuclear power plants are not the only type of nuclear installation. Apart from Swedish and foreign nuclear power plants, there are also, in our region and in Sweden, research reactors, nuclear fuel manufacturing plants, nuclear waste disposal plants, nuclear powered vessels, and satellites driven by nuclear reactors or batteries using radioactive substances; as well as nuclear weapons on land and onboard submarines and aircraft. (In addition, radioactive substances and equipment are used to produce radiation for research, medical treatment and certain industrial operations. Radioactive substances are transported by land, air and sea.)

The most serious consequences of accidents are when large amounts of radioactive substances are released, for example, from a nuclear power plant. The distance between one's own position and the accident site is of major importance. Radiation protection experts are of the opinion that a distance of 10km means that risk of injury is significantly reduced, even in a "worst case" scenario.

All Swedish nuclear power plants have built-in safety barriers, such as containment and filter installations. The filters are so constructed that they trap 99.9 percent of those radioactive substances that cause fallout. Therefore, the risk of a release of large amounts of radioactive substances from a Swedish nuclear power plant following an accident is very low.

Doses from a foreign accident

It is estimated that Swedes affected by a foreign accident could receive an extra dose in the first year roughly equivalent to the natural annual dose each Swede receives. In the absolute worst case – a large release of radioactive substances and unfavourable weather – those worst affected could receive an extra dose equivalent to 10 to 30 times the "nor-

mal" annual dose. It is not uncommon for people living in houses that emit radiation from radon to receive extra doses equivalent to five times the "normal" annual dose. It has also been found that people living in such houses can receive yearly doses equivalent to 25 times the "normal" annual dose.

Nuclear power plants in Sweden and our neighbouring countries



Your role

What can you do?

- Read this booklet and other information on emergency preparedness. Then you will know what resources are available to help you in the event of an accident. You will also find out what you can do yourself.
- Visit a nuclear power plant and the exhibitions there
- If you live near a nuclear power plant acquaint yourself with the information issued by the Swedish Rescue Services Agency, the Swedish Radiation Protection Institute, the Swedish Nuclear Power Inspectorate, the county administrative board, and the municipal safety committee.

This is how you can protect yourself

To reduce the dose you should

- Be at a good **distance** from the source of the radiation (the radioactive substances)
- Have a **shield** between yourself and the radiation source, for example, by being indoors
- Be in the contaminated area for as little **time** as possible

During an accident

- *Listen to the radio!* The county administrative board and the municipality issue information via the radio and TV, especially on Swedish Radio's local channel P4.
- When the county administrative board recommends that people stay indoors, you can assist by informing those that are outdoors to go inside.
- Help relatives, neighbours and friends – for example, during an evacuation.

Iodine tablets or not?

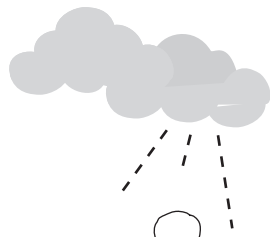
It is not necessary to take iodine tablets in Sweden if the accident occurred abroad. The amount of radioactive iodine in the air is comparatively low at long distances away from the accident site.

At a Swedish accident: You should take an iodine tablet only when requested to do so by the county administrative board – and only if there is a risk of a release of radioactive iodine and you are in the proximity of the release. To obtain the full effect of the tablet you ought to take it at the time suggested by the county administrative board. The tablet must have started to work before you breathe in any radioactive iodine.

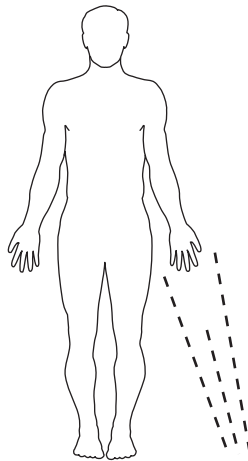
The tablet fills the thyroid gland with non-radioactive iodine so that it won't absorb any of the radioactive iodine. The tablet does not offer any other form of protection against radiation.

If radioactive iodine is absorbed by the thyroid gland it will irradiate the gland and cause damage. Iodine exists in both a gaseous and a solid form. Iodine can be absorbed from the air, or from milk and vegetables contaminated by fallout containing iodine. (Iodine tablets primarily offer protection against the inhalation of iodine. Protection in the other cases is provided by not eating suspected contaminated foodstuffs.)

External and internal irradiation

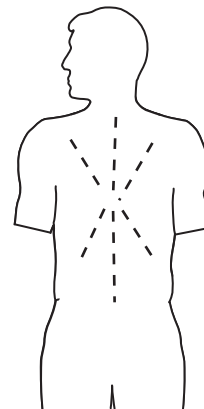


Radiation from fallout from the cloud carrying the radioactive substances (external irradiation)



Radiation from fallout on the ground (external irradiation)

Radiation from radioactive substances absorbed via inhalation or ingestion (internal irradiation)



Our role

This is how we help

County administrative boards – main responsibility

In the event of a nuclear energy accident every county administrative board is responsible for the safety of the public within its county.

Every county maintains an emergency preparedness organisation headed by an overall incident commander. If an accident affects several counties the government can designate overall responsibility for the fire & rescue services in those counties to *one* county administrative board or another authority.

In the four counties with nuclear power plants the emergency preparedness organisation is larger. As it is in Södermanland County where there is a reactor at Studsvik, and in Västerbotten County, which has the task of aiding other counties in the event of a nuclear energy accident.

County administrative boards

- *Train and exercise* many of the personnel that make up the regional emergency preparedness organisations
- *Warn and inform* the public in the event of an accident
- *Assign tasks* to the municipal fire & rescue services, the police, the Swedish Maritime Administration, the coastguard, Swedish Radio, SOS Alarm AB, and the many other bodies that assist in carrying out those operations that are required to protect the public
- Issue recommendations describing how the public can *protect themselves*
- Decide on the taking of *local measurements* of radiation
- Recommend or decide on measures to be taken within *agriculture* so as to reduce the risk of animals and foodstuffs being contaminated by radioactive substances
- Recommend or decide on measures to be taken in relation to *foodstuffs*
- Recommend or decide on measures to be taken for *decontamination* from the radioactive substances
- Make a decision in the counties with nuclear power plants –with advice from the Swedish Radiation Protection Institute – on the taking of iodine tablets, and – after consultation with the Swedish Radiation Protection Institute – on the possible evacuation of parts of the county. Evacuation is then later handled by the police.
- Inform the public of the *all clear* i.e. when protective measures are no longer required



PHOTO: TOMMY LINDBLOM

The resources of the community, for example, the police and the fire & rescue service, work in co-operation to protect the public.

Municipalities – measuring and information

The municipal environment and public health departments and the fire & rescue services have hand-held instruments for taking radiation measurements in the municipality. You can also obtain information on the level of radiation in your area.

Every municipality has two to four measuring points (more in municipalities close to nuclear power plants) for use in the event of an accident involving a release of radioactive substances. The points are at exact fixed locations and carefully selected, for example, football pitches and other open spaces. In total there are about 800 measuring points across the country. The municipalities report the measurements taken to the county administrative board, which in turn submits them to the Swedish Radiation Protection Institute. There they are used for the assessment of the radiation situation around the country.

In order to detect even small amounts of radioactive substances on the ground as a result of fallout, one must know how much radiation the ground normally emits. (There are natural radioactive substances present in our everyday surroundings.) Therefore, the municipalities regularly take measurements a couple of times a year. The instruments are also tested and personnel are exercised in field conditions.

The municipalities in the proximity of nuclear power plants are responsible for assembly stations, transport and temporary accommodation for those requiring it after evacuation.

Radiation is part of our environment

Radioactive substances exist naturally and so therefore we are all exposed to radiation. In addition, mankind has taken control of radiation and uses it, among other things, for medical treatment and industry.

Radon in domestic premises is the source of radiation that makes up the largest part of the annual dose for us in Sweden. The next largest part comes from *medical treatment and checks*. After which comes *natural back-*

ground radiation, which is the radiation that comes from space, the sun, the bedrock, and the radioactive substances that exist naturally in our bodies. In last place is the radiation that comes from *other sources of radiation*, such as fallout from nuclear weapons tests, the Chernobyl accident, and normal discharges from Swedish and foreign nuclear power plants.

County councils – medical care

Medical personnel employed by the county council at hospitals etc. would in the event of an accident treat anyone injured as a result of it.

Swedish Nuclear Power Inspectorate, Swedish Radiation Protection Institute and other authorities

The Swedish Nuclear Power Inspectorate, the Swedish Radiation Protection Institute and other authorities all assist the county administrative boards.

- The Swedish Nuclear Power Inspectorate carries out technical analyses of possible accidents. They also assess *whether* a release of radioactive substances is likely, and if so *when* it is expected to occur, and what *amount* of radioactive substances will be involved in the release, and how *long* the release can be expected to go on.
- The Swedish Radiation Protection Institute manages nationwide radiation protection preparedness and co-ordinates advice from the central authorities. They estimate likely fallout, control the nationwide measuring resources, analyse what effects will result from the radiation from an accident, state the accident consequences for people and the environment, and give advice on measures that can be taken to reduce the effects of the radiation.
- The emergency preparedness organisation of the Swedish Radiation Protection Institute includes a medical expert group, with doctors supplying the base data for the advice and information that is issued by the Swedish National Board of Health and Welfare on medical matters.
- The Swedish Meteorological and Hydrological Institute makes weather prognoses and estimates the dispersion of radioactive substances from an accident.
- The Swedish Board of Agriculture and the Swedish National Food Administration make decisions on protective measures within their respective fields of activity, and inform and give advice on, for example, grazing animals and foodstuffs.

Normal annual dose

In Sweden every single person receives an annual dose of radiation of about 4 millisieverts.

The radiation comes from the following sources:

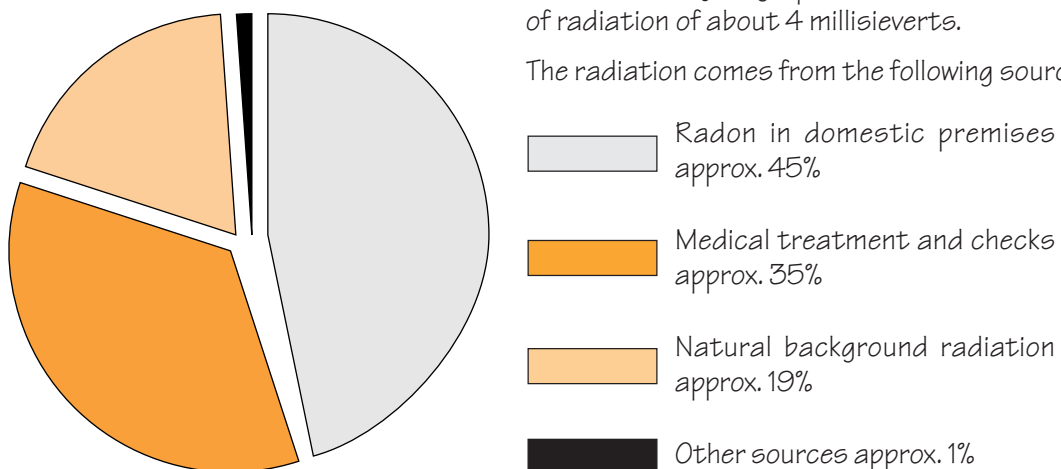




PHOTO: ANETTE NANTELL

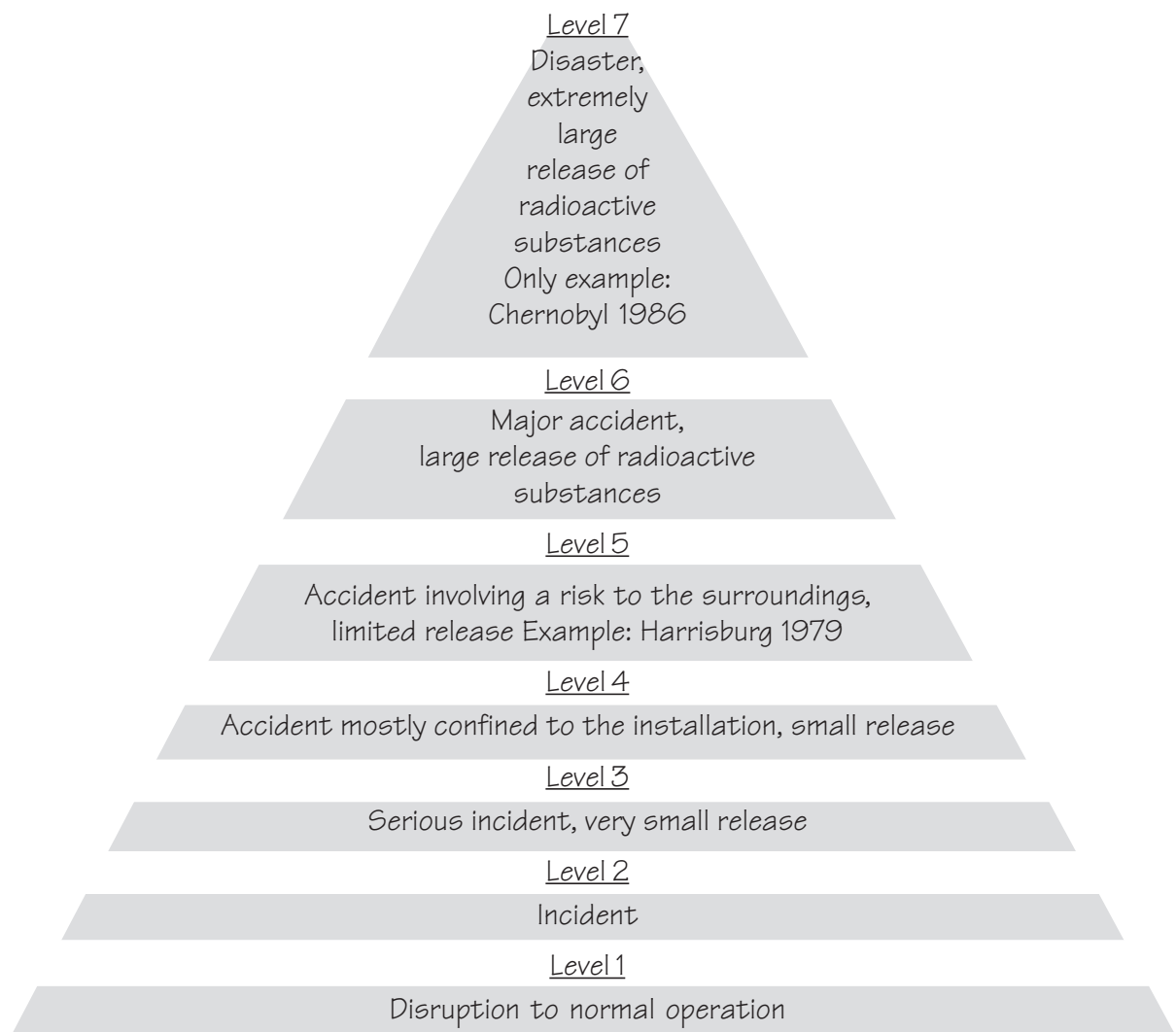
If you want information on emergency preparedness ring your county administrative board, your municipal offices, or one of the central authorities. You will find the relevant telephone numbers on page 26.

Swedish Rescue Services Agency

The Swedish Rescue Services Agency co-ordinates and exercises supervision of activities within the field of emergency preparedness for nuclear energy accidents. Together with the Swedish Radiation Protection Institute and other authorities they train, among others, overall incident commanders at the county administrative boards and personnel in the municipal fire & rescue services.

INES – indicates how serious an accident is

To be able to quickly inform the public about the severity of a nuclear energy accident a scale has been developed, which is similar to the earthquake measuring Richter scale. The scale is called INES, which is an acronym for International Nuclear Event Scale.



A number of incidents at levels 1 and 2 are reported annually from all the world's reactors, which number about 450.

Municipal safety committees

Each municipality that contains a nuclear power plant has a municipal safety committee, made up of municipal politicians. They are, however, appointed by the government and so each committee is a state authority. The committees monitor and inspect the arrangements at nuclear power plants for safety and emergency preparedness for accidents. They inform the public about this role. You can contact your local safety committee directly if you have any questions, by, for example, ringing the committee's secretary who is often a municipal civil servant.

Chernobyl

In the 1986 accident in reactor four at the Chernobyl nuclear power plant 31 people died, mainly during the rescue operation. Fire fighters and personnel at the plant received acute radiation injuries. Over a thousand children in Ukraine, Belarus, and Russia developed cancer in the thyroid gland. However, it was possible to cure most of them. Just over 100,000 people were evacuated. Radioactive substances will be present for a long time within the extended surroundings of Chernobyl. No one in Sweden contracted acute injuries as a result of Chernobyl fallout. As a result of the accident the risk of dying from cancer has probably been increased across all of Europe (in Sweden by 0.003 % on average).

The cause of the accident was a combination of poor technical safety, shortcomings in training and administration, and human error. An experiment was conducted with the reactor – against regulations – with all the

vital safety systems disconnected. The consequence was that reactor power increased suddenly, which led to an explosion and a release of much of the radioactive substances. The reactor contained large amounts of graphite (coal), which was ignited during the accident. The reactor was not enclosed by a containment installation as western reactors are. Therefore the radioactive substances, released during the explosion and subsequent fire, escaped high up into the atmosphere. Then they were dispersed over long distances by the wind.

A containment installation is a “building within a building”. In a containment installation the radioactive substances can be contained. Apart from a containment installation Swedish reactors have an outer filter system, which can relieve the steam pressure from a damaged reactor, and absorb radioactive substances so that they don't escape out into the atmosphere.

Warnings from several sources

If an accident occurs anywhere in the world Sweden is able to find out at an early stage, due to agreements between countries to warn each other immediately in the event of an accident.

By the use of automatic measuring stations, we are able to find out whether or not radioactive substances have entered Sweden.



Alerting

International alerting systems

Sweden has, through the UN body the IAEA (International Atomic Energy Agency) and the EU, agreements with other countries on reciprocal warning and informing in the event of an accident. In addition, Sweden has direct agreements with its Nordic neighbours, and Russia and Germany on so-called, *early warning and exchanges of information*. The Swedish Rescue Services Agency is preparing agreements with other countries around the Baltic Sea. Swedish authorities have satellite connections with the Ignalina nuclear power plant in Lithuania. There is also an agreement on warning and exchanges of information with the authorities at the naval base in Murmansk, Russia.

Nordic measuring stations

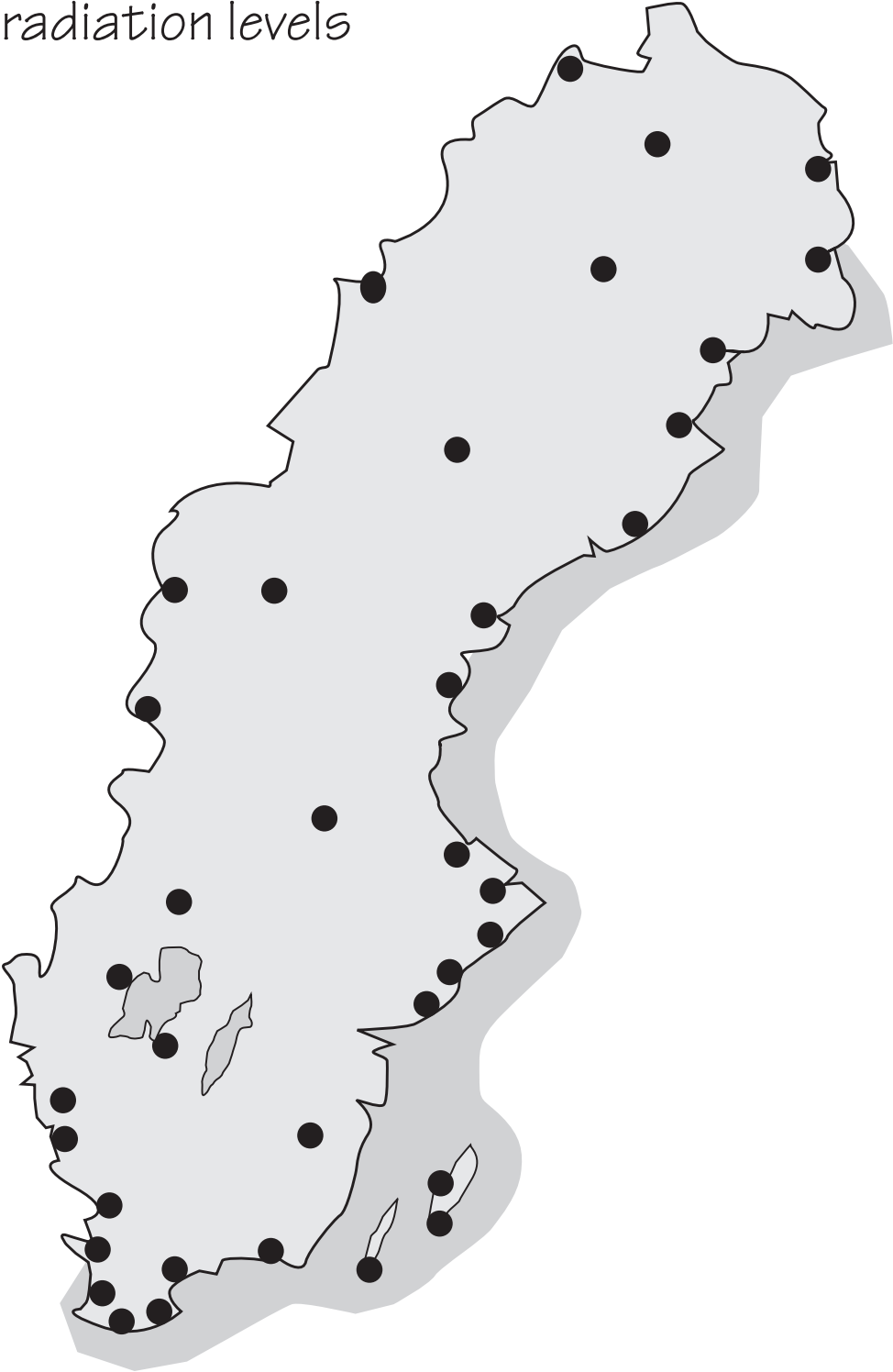
There are almost 40 automatic measuring stations in Sweden for the measuring of radiation levels. (See map on page 18.) They are run by the Swedish Radiation Protection Institute and are situated from Katterjåkk in the extreme north to Smygehuk in the extreme south. These stations automatically despatch an alert if the level of radiation increases. The alert goes to the duty officer at the Swedish Radiation Protection Institute. As a further resource there are laboratories prepared to take readings from, for example, foodstuffs. The Swedish Radiation Protection Institute regularly takes readings from milk from several dairies around the country in order to check if there are radioactive substances in the milk. In the event of an accident these measuring activities are increased.

In the other Nordic countries there are a further 300 automatic measuring stations, most of them in Finland. Since 1996 there has been an agreement in force between the Nordic countries on the exchange of measuring data from the permanent measuring stations.

The media are aware at a very early stage

Today's media is informed, at a very early stage of an incident, that something has happened and the news is spread quickly across many formats: radio, newspapers, TV, internet. *Radio* especially plays an important role. Swedish Radio's local channel P4 assists by transmitting information from the authorities, such as the *Important public announcements* which contain advice on the protective measures that can be taken.

Measuring stations in Sweden for the measuring of radiation levels



Exercises create proficiency

Training courses and emergency preparedness exercises are held several times per year.

Every year one of the nuclear power plant counties exercises its whole organisation in conjunction with the nuclear power plant's emergency preparedness group and central bodies, such as, the Swedish Radiation Protection Institute and the Swedish Nuclear Power Inspectorate. Occasionally specific parts of the organisation are also exercised, sometimes with and sometimes without prior warning.

Nordic exercises are held every few years. International exercises, for example, under the auspices of the OECD/NEA are also held regularly. (The OECD is an international Organisation for Economic Co-operation and Development. The NEA – Nuclear Energy Agency – is a semi-autonomous body within the OECD.)

Personnel working with information to and communication with the mass media and the public are exercised especially thoroughly. Journalists participate in the exercises to make them as realistic as possible.

Experience from the exercises is compiled and used for increasing competence amongst personnel and for increasing the effectiveness of the work of the emergency preparedness organisation.

Evaluations improve quality

Most large exercises are evaluated by an expert group appointed by the Swedish Rescue Services Agency. Lessons learned and conclusions are published in specific reports.



Exercises

The word "risk"

Worth thinking about if you call up and want information

- In connection with accidents the word *risk* occurs. And often experts and the public have different interpretations of it. Risk is sometimes used by the public to mean things that are dangerous (e.g. traffic), sometimes for probabilities (e.g. "there is a one percent risk"), and sometimes for consequences (e.g. "the risk is that you'll break your leg" or "the risk is that 100 people will be injured").
- Experts in risk assessments usually talk about risk as the *probability multiplied by the consequences*, the so-called expected value (e.g. that a certain amount of released radioactive substances leads to a certain amount of cancer cases).
- Other factors also influence the perception of risk, for example, how voluntary a risk is. People more readily accept a risk that one voluntarily exposes oneself to than a risk that someone else forces one to be exposed to.
- It is possible to state precisely how large a risk is for a particular person in a certain situation.

When the alarm is raised

If a nuclear energy accident occurs either in Sweden or abroad, this is what happens:

- Personnel within the emergency preparedness organisation are alerted via pre-prepared alerting systems.
- At an early stage the public are warned and informed by the county administrative board – primarily via radio transmissions.
- The county administrative board decides, with the help of experts from the central authorities, how people and the environment will be protected
- Municipal fire & rescue services and environment & public health departments, the medical services and police, amongst others, begin work in accordance with pre-prepared plans. Every municipality takes radiation measurements within its own area.
- The Swedish Nuclear Power Inspectorate assembles its emergency preparedness group, which includes nuclear technology experts.
- A central emergency preparedness organisation assembles at the Swedish Radiation Protection Institute. It includes radiation protection experts, doctors, nuclear technology experts, information officers, decontamination experts, and liaison personnel to other authorities. Experienced information officers are on scene to advise the county administrative boards as regards information, and also too answer questions, via a telephone information line, from the public and the mass media. A medical expert group is also part of the organisation so that together with the Swedish National Board of Health and Welfare it can provide medical advice to the medical services.
- The other authorities assemble their emergency preparedness groups and start work within their respective areas of activity, for example, protective measures for agriculture and for foodstuffs.

7-second tone



14-second
pause

7-second tone



The warning signal "Important announcement"

Information for nearby residents

Residents living in the proximity of the Swedish nuclear power plants have received information advising them what to do if the alarm is raised. They have also received iodine tablets. Farmers have received information on how to take care of their animals and crops in the event of an alarm. Evacuation plans exist for those that live within 15 km of the plants. In those areas sirens have been installed for outdoor warning. If the public needs to be warned, the sirens sound the alarm signal "important announcement". (The signal consists of a 7-second tone followed by a 14-second pause and another 7-second tone, and is repeated for two minutes.) All households in the immediate surroundings of the plants have also received special radios that can receive the warning and public information announcements.

Becquerel and sievert

The becquerel (Bq) unit is used to state the activity of a radioactive substance, i.e. the amount of disintegrations per second.

1 Bq = one disintegration per second.

The sievert unit (Sv) is used to state the dose equivalent. However, doses are often given in millisieverts (mSv), which is one thousandth of a sievert, or in microsieverts (µSv),

which are one millionth of a sievert.

A certain amount of activity, i.e. a certain amount of becquerels, can cause a certain dose.

The connection is complex. Therefore there is no easy way to convert from becquerels to sieverts.

Doses

6,000 millisieverts to the whole body will cause acute radiation sickness and is fatal.

3,000 millisieverts to the whole body entails a 50 percent risk of death.

1,000 millisieverts to the foetus in the third or fourth month entails a 40 percent risk of foetal damage.

The injuries mentioned above result after receiving a one-off dose.

20 millisieverts roughly means that the risk of dying from cancer within 50 years in-

creases from the average 20 percent to 20.1 percent.

3 millisieverts is the dose a patient receives during a stomach x-ray.

If you add up the doses that a Swede normally receives each year, they total about 4 millisieverts. (The largest part of which comes from radon.) See pie chart on page 13.

Discharges from nuclear power plants in Sweden could give each Swede a maximum annual dose of 0.1 millisieverts. (However, the average is considerably lower.)

If it happens today

How will you find out what you need to know?

Listen to the radio! Your county administrative board, which is responsible for public safety, will rapidly issue information announcements on what has happened and on what you need to do.

Where should you go?

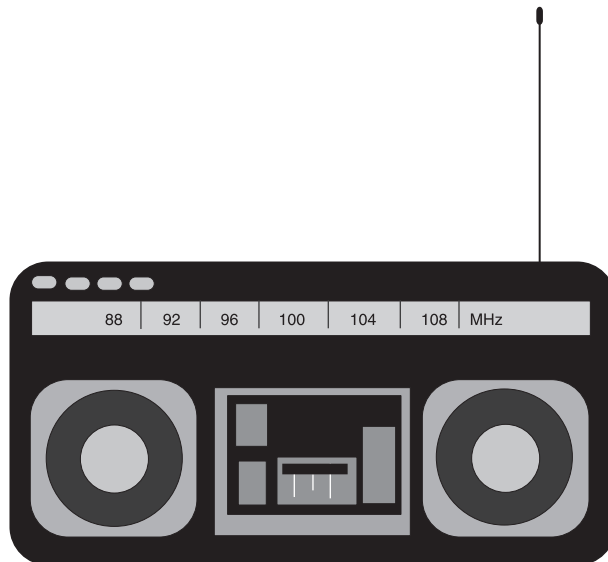
If the accident happens abroad:

An accident at a foreign nuclear power plant cannot, according to the experts, result in extremely large doses for people and animals in Sweden. (See text box on page 6.)

Evacuation will not be necessary before or during the release.

It may however be appropriate, for example, not to let animals graze, if there has been any fallout. These radioactive substances can be transmitted to milk and meat. The authorities may also decide on other measures for agriculture and horticulture.

It may be necessary to stay indoors for a while. This applies only in the worst case, i.e. when there has been a very large release of radioactive substances from the damaged reactor and the wind is blowing the release towards Sweden. It is only those people that are on the route of the wind blowing from the accident site that need to be indoors. They may need to remain indoors from between two to twenty four hours. It may also become necessary, later on in such a serious case, in areas where large amounts of fallout have settled on the ground, for people to move out for a while.



If the accident happens in Sweden:

If you find yourself near the accident site or on the route of the wind blowing from that direction, you may need to:

- Remain indoors
- Take iodine tablets – but only when requested to do so by your county administrative board!

All Swedish nuclear power plants are fitted with filter installations that make it possible to considerably reduce and to a certain extent steer the release of radioactive substances. During an accident masses of steam and gases can build up so that the pressure in the reactor containment installation (a thick concrete shield around the reactor) becomes extremely high. In which case the steam and gases need to be gradually released in order to reduce the pressure. The steam and gases include radioactive substances, and are guided out via the filter installation where most of them remain. The filter installation can hold a large amount of steam and gases before it is necessary to discharge them. Therefore, the opportunity exists to let people get indoors before the discharge. And during particularly large discharges there is the possibility to let people evacuate the area before the discharge, to be away during the discharge and to return home later.

If the accident occurs during the spring or summer it can be appropriate, for a limited period, not to let animals go out and graze, and not to sell milk from cows that have been grazing in the area where the fallout settled.

If there is a large amount of fallout, it may be necessary to:

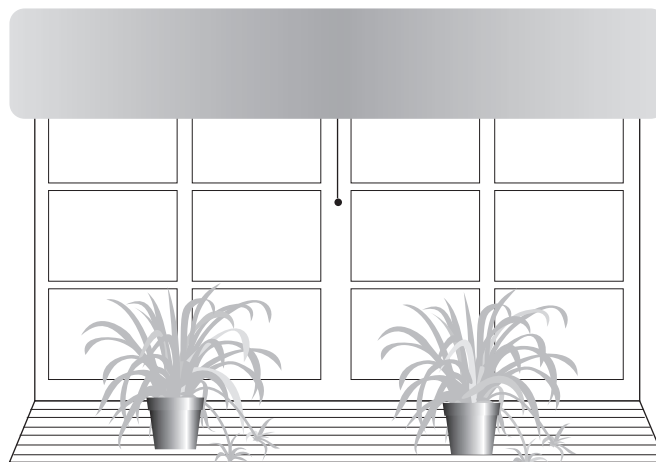
- Evacuate the area, i.e. leave the area for a short period of time

If there has been an *extremely* large amount of fallout the authorities can decide on

- Measures for agriculture (e.g. let land lie fallow), and decontamination of residential premises, streets, parks (e.g. cutting the grass and bushes, removing snow)

And in the absolute worst case:

- Evacuate the population from the area for a longer period of time.



How long have you got?

If the accident happens abroad:

Through the international systems that are in place for warning in the event of nuclear energy accidents we in Sweden will get to know at an early stage what has happened.

From the moment an accident occurs to a release of radioactive substances reaching Sweden takes a certain amount of time. When the Chernobyl accident happened it took almost 48 hours before the cloud of radioactive substances reached Sweden. (It is not definite that radioactive substances will reach Sweden, it all depends on which way the wind is blowing.)

If the accident happens in Sweden:

The Swedish nuclear power plants are duty bound to contact the Swedish Nuclear Power Inspectorate as soon as there are any indications of disturbances in normal operations, which could pose a threat to the safety of the surroundings of the plant –in other words long before any radioactive substances are released. The Swedish Nuclear Power Inspectorate has a duty officer available around the clock to receive such information.

The nuclear power plants have their own emergency preparedness groups, which include a duty engineer, who is responsible for raising the alarm in the event of any disruptions to safety. The Swedish Nuclear Power Inspectorate will also be warned. As will the relevant county administrative board and the other authorities included in the emergency preparedness organisation. County administrative boards in counties with nuclear power plants have a duty officer available around the clock ready to accept alarm calls.

At a very early stage of the incident the relevant county administrative board is able to issue warnings and information to the public.

The Swedish nuclear power plants can delay releases of radioactive substances (see page 24). This means that calculated from the start of the incident a release will be (except in extreme cases) delayed for some days.

Protective measures for the public

Protective measures that the authorities can decide on in the event of an accident:

- Staying indoors
- Restrictions on agriculture and foodstuffs
- The taking of iodine tablets
- Evacuation
- Decontamination of agricultural land and residential areas

Addresses and telephone numbers

Please do not hesitate to contact us at the Swedish Rescue Services Agency or any of the other authorities in the emergency preparedness organisation if you wish to know more. You can also find these addresses and telephone numbers in your local telephone directory.

| | | |
|--|---|--|
| Municipality | See telephone directory | |
| County administrative board | See telephone directory | www.lst.se |
| County council | See telephone directory | |
| Swedish Rescue Services Agency 651 80 Karlstad | tel. +46 54 13 50 00 fax +46 54 13 56 00 | www.srv.se |
| Swedish Radiation Protection Authority 171 16 Stockholm | tel. +46 8 729 71 00 fax +46 8 729 71 08 | www.ssi.se |
| Swedish Nuclear Power Inspectorate 106 58 Stockholm | tel. +46 8 698 84 00 fax +46 8 661 90 86 | www.ski.se |
| Swedish Board of Agriculture 551 82 Jönköping | tel. +46 36 15 50 00 fax +46 36 19 05 46 | www.sjv.se |
| Swedish National Food Administration Box 622 751 26 Uppsala | tel. +46 18 17 55 00 fax +46 18 10 58 48 | www.slv.se |
| Swedish National Board of Health and Welfare 106 30 Stockholm | tel. +46 8 555 530 00 fax +46 8 555 532 52 | www.sos.se |
| Swedish Meteorological and Hydrological Institute 601 76 Norrköping | tel. +46 11 495 80 00 fax +46 11 495 80 01 | www.smhi.se |
| Municipal safety committees: | | |
| Kävlinge | tel. +46 46 73 90 00 | |
| Oskarshamn | tel. +46 491 880 00 | |
| Varberg | tel. +46 340 880 00 | |
| Östhammar | tel. +46 173 860 00 | |
| Nyköping | tel. +46 155 24 80 00 | |

Up to date addresses and telephone numbers are published on the web sites.

For information in the event of a nuclear energy accident you can call your municipality or county administrative board

– but mainly listen to Swedish Radio's local channel P4!

If you call the emergency number 112

In the event of a nuclear energy accident (e.g. an accident at a nuclear power plant) you will be warned and informed by your county administrative board. But there are other types of accidents, e.g. during the transport of low-grade radioactive substances to hospitals. These types of substances are transported in packages marked with labels bearing the symbol to the right of this text. If you discover such a traffic accident you must call the emergency number 112, and be prepared to answer the following questions from the emergency services switchboard operator:



- What has happened?
- Where has the accident happened?
- What telephone number are you calling from?

These questions never delay the turn-out of ambulance, police or fire & rescue service vehicles. While you are talking to the operator, another operator will be alerting the emergency services personnel that are going to attend the accident.

When you have made the call, tell those injured that you have called 112 and that help is on its way. If you obtain any new information call 112 again. Meet the emergency services personnel and show them the way to the accident site if it is difficult to find.

Your notes

A series of horizontal dotted lines for writing notes.

Swedish emergency preparedness for nuclear energy accidents

This booklet describes the Swedish emergency preparedness for protection measures during a nuclear accident (e.g. an accident in a nuclear power plant)

It contains information on

- Who does what within the emergency preparedness organisation
- The location of the nuclear power plants
- Radiation and doses
- What would happen during an accident
- Who to contact if you have any questions on emergency preparedness

Swedish Rescue Services Agency, 651 80 Karlstad, Sweden
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