NUCLEAR ACCIDENTS

Proposals for national and international measures

Part II of the report from a committee appointed by the Government on 27 May 1986. Submitted on 13 February 1987

SUMMARY AND CONCLUSIONS

MINISTRY OF ENVIRONMENT
NORWAY

T-693

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Unofficial translation

1. THE BACKGROUND FOR APPOINTING THE COMMITTEE, AND ITS TERMS OF REFERENCE

The nuclear accident in Chernobyl had serious consequences for Norway. Extensive areas were contaminated by radioactive fall-out. Especially during the first days after the accident, neither the Norwegian authorities nor the general public really knew what had happened, or what effects the accident had caused. This made it necessary to undertake a thorough study of the course of the accident and of how the Norwegian authorities had handled the situation.

In the light of the above, on 27 May 1986 the Government appointed an inter-ministerial Committee of Senior Officials with the following terms of reference:

1. To prepare, by 1 October, a report to the Government on experiences in connection with the accident. The report was to describe how the discharges spread from the reactor to Scandinavia, the situation as regards contamination in different parts of the country, and the measures taken.

2. To submit, by December the following year, preliminary recommendations for monitoring routines and contingency plans to be used if similar accidents were to occur at other nuclear power plants. Topics to be considered included: warning and exchange of information at the national and international level, routines to measure the level of pollution in air, soil and water, measures to prevent exposure of the population to radiation, the legal basis for restrictions on the production and sale of agricultural products, including systems of compensation, and information to the public during and after the accident.

3. To prepare a proposal for how contamination from radioactive material can be incorporated into Nordic and other existing international agreements.

4. To advise on the Norwegian attitude towards the safety of nuclear installations in our neighbouring countries.

The following is a list of the members of the committee:

- Atle Fretheim, Deputy Director General, Ministry of Environment - Chairman
- Kari Selte, Head of Division, Ministry of Petroleum and Energy
- Nils Olav Stava, Head of Division, Ministry of Foreign Affairs
- Almar Sagelvmo, Director of Agriculture, Ministry of Agriculture
- Christian Lerche, Assistant Director General, Directorate of Public Health
- Tor Rolf Bryntesen, Director General, Directorate of Civil Defence and Emergency Planning
- Kari Bjørkbæk, Head of Division, Ministry of Fisheries

Advocate Erik Davidsen was the committee's secretary, assisted by Bente Kristiansen, executive officer at the Ministry of Environment.

The committee published the first part of its report on 5 November 1986, covering item 1 in the terms of reference. This report is printed in Norwegian Official Report 1986:24: Experience from the Nuclear Accident in Chernobyl.

II. SUMMARY

1. INTRODUCTION

The nuclear accident in Chernobyl had serious impacts in Norway. Large areas were contaminated by radioactive fall-out. Especially during the first days after the accident, a great deal of uncertainty prevailed about the accident and its effects. On 27 May 1986 the Government appointed a Committee of Senior Officials to prepare an account of the accident itself and to make recommendations for measures to prevent and deal with similar accidents in the future. The first part of the committee's report was published on 5 November 1986 (Norwegian Official Report 1986:24: Experience from the Nuclear Accident at Chernobyl). The present report describes the committee's proposals for measures to prevent and deal with similar accidents in the future.

The committee's evaluations and proposals are grouped into three main sections: 1. Safety and risk at nuclear power stations, 2. The Norwegian contingency organization for dealing with nuclear accidents, 3. Compensation issues and 4. International cooperation.

2. SAFETY AND RISK AT NUCLEAR POWER PLANTS

2.1 Number of nuclear power plants, development, plans

At the turn of the year 1985/86 there were 374 nuclear power plants in operation in the world. The plants are located in 26 countries and have a total power of approx. 250 GWe. 157 plants were under construction. A further 173 plants had been ordered or were planned. A number of the nuclear power plants which are in operation are near to Norway, in countries such as Sweden, the Soviet Union, Finland and Great Britain. In addition, there are an unknown number of military reactors on land, and on board ships and submarines.

Nuclear power plants provide about 15% of the world's electricity. In some countries, nuclear plants provide 60-70% of the electricity.

Prognoses prepared before the Chernobyl accident show that the world's nuclear power capacity is expected to be almost doubled by the year 2000. Some countries have adopted a hesitant attitude towards the further development of nuclear power. Sweden is considering winding up its nuclear power plants by the year 2010.

2.2 Nuclear power plants in our neighbouring countries

Sweden has 12 reactor plants. The nearest to Norway, about 250 km away, is Ringhalsverket, located south of Gothenburg, and consisting of 4 reactors. The other plants are located at Barsebäck near Malmø, Forsmark, north of Stockholm and Oskarshamn, south of Stockholm. These plants are about 400 km away from Norwegian soil.

Finland has 4 reactor plants in operation. Great Britain has 38 reactor plants in operation and 4 under construction.

The Soviet Union has 512 reactor plants in operation. 28 are of the same type as the reactor which suffered the accident at Chernobyl. The Soviet Union is building another 34 nuclear power plants. The nearest are located less than 200 km from Norway.

2.3 Safety at nuclear power plants

2.3.1 General remarks about conditions important for safety

The purpose of safety measures at nuclear power plants is to prevent the release of radioactive substances. This applies both during normal operation and in the event of an accident.

The greatest risk of accident is connected with the nuclear power plant itself, and to a lesser degree with other phases of the process, such as the handling of used fuel and storage of waste. This is because of the high concentrations of energy (high temperature and high pressure) combined with the creation of large quantities of radioactivity in the fuel during the energy production.

An assumption for a serious accident to a reactor is failure of the cooling system. This causes the fuel in the reactor core to become overheated and melt, and the physical barriers surrounding the fuel break down.

The authorities in the different countries decide what safety criteria the reactors have to comply with. These requirements are harmonized to a large degree in the OECD countries. The fundamental principle is to define the accident situations which a reactor must be able to withstand without this having an effect on the environment. In western countries the plants are usually dimensioned to withstand a rupture of one of the largest pipes carrying cooling water to the reactor tank. The dimension requirements do not, however, cover a rupture of the tank itself. Most of the plants in western countries are equipped with a safety container (reactor containment) to contain the radioactive substances if an accident should occur.

In the Soviet Union and Eastern Europe, an accident leading to loss of cooling, with subsequent melting of the reactor core, has until now been considered almost unthinkable. For this reason it has not been usual to build safety containers in the western meaning of the term around East-European reactors.

The accident at the nuclear power station on Three Mile Island in the USA in 1979 is a practical example of the importance of such a measure. The structure prevented extensive spreading of radioactive substances. The reactor in which the accident occurred at Chernobyl had no such safety container, and this was one of the main reasons for the serious consequences of the accident.

2.3.2 Safety measures

Errors may occur in all parts of a nuclear plant, and for many reasons. Possible causes are structural defects, defects in production, poor maintenance, fire, earthquake and sabotage. A main principle when designing the plants is to ensure that certain errors can occur without this affecting important functions of the plant.

Safety measures may be of two kinds, accident-prevention measures and impact-reducing measures. Accident-prevention measures are intended to prevent an error from occurring, and if it should occur, to prevent a development leading to reduced cooling of the core. This involves both technical and administrative measures. The impact-reducing measures are intended to delay and prevent release of radioactive substances to the environment after a serious accident. These measures will also be very important when the reactor core melts. The safety container is especially important, combined with systems for reducing the pressure and temperature loads if an accident does occur.

The actual organization operating the plant plays a decisive role for safety as a whole. The western countries' safety requirements emphasize the interplay between humans and technology. The Chernobyl accident has underlined the importance of this interplay.

In the OECD countries, the work to ensure safety is organized in such a way that the efforts of the owner of the plant and the relevant licensing authority are integrated to form a continous process. The owner of the plant has a 'standing' obligation to improve safety. The authorities follow this up by requiring regular reports, conducting inspections, etc. which in turn create new requirements to improve safety.

It remains to be seen whether the Soviet Union will continue to adjust its requirements to comply more closely with those of the western countries, and participate in the cooperation within IAEA.

2.4 Risk of accident

Risk analyses are the tool used to assess the level of safety and level of risk involved in the operation of large nuclear power plants. These are theoretical analyses which calculate both the probability and consequences of critical events.

A large nuclear accident may have very serious consequences, but the probability of such an accident occurring is extremely small. Many people will in this case emphasize the consequence factor and experience the risk as being greater than indicated by the risk analyses.

It is always a matter of doubt whether the risk analysis includes all imaginable scenarios. In the accidents to nuclear power plants that have occurred to date where the safety aspect has been significant, the human factor has been extremely important. Wrong dispositions have often not only triggered off the accident, but have also been decisive for developments. The accident in Chernobyl is a relevant example.

The accident at Three Mile Island is the most serious that has occurred in a western country. Very little of the fissionable radioactive substances were released from the reactor core.

Experience from the operation of civilian reactors totals about 4000 years of reactor operation. Two serious accidents have occurred to date. The accident at Three Mile Island occurred after about a total of 1000 years of operation of light water reactors of the western type. Since this accident about 2000 years of reactor operation have been experienced without any similar nuclear accident

with this type of reactor. The accident in Chernobyl occurred after about a total of 100 years of operation of this type of reactor.

It is estimated that a nuclear accident will occur once per approximately ten thousand years of reactor operation. The greater part of the risk is connected to a small group of reactors with certain structural defects from the point of view of safety, for example no safety container, and/or weaknesses in the quality of operation and maintenance. For this group of reactors, it is not improbable that another serious nuclear accident will occur before the end of the century. If such an accident occurs in a reactor where the containment is incapable of withstanding the loads to which it is exposed, there is a considerable risk that a substantial part of the radioactive substances in the core will be released. This will lead to serious local problems of contamination. There will also be a serious risk that the radioactive substances will be transported to other countries.

In spite of stringent safety precautions in western countries it is assumed in Sweden that there are still certain extremely improbable scenarios that could damage a nuclear power plant in such a way as to give releases of the same order of magnitude as experienced at Chernobyl. This so-called residual risk is not covered by the precautions. It is taken into account, however, in the work to ensure safety, by trying to identify risk-dominated scenarios as a basis for additional preventive measures.

One of the most important areas of 'residual risk' as far as nuclear power plants and the danger of radioactive discharges are concerned, is, in fact, the durability of the reactor tank and the resistance of the safety container.

2.5 Consequences of serious accidents to nuclear power plants in Norway's neighbouring countries

2.5.1 The consequences in Norway of accidents at Swedish nuclear power plants

In February 1986 the Swedish government made it a condition for continued operation of power plants that new systems should be installed to restrict discharges. This decision applied to the nuclear power plants in Forsmark, Oskarshamn and Ringhals, and the measures will be implemented by the end of 1988. Such a system has already been installed at the nuclear plant in Barsebäck. The main points in the government's guidelines are:

- If an accident occurs to the reactor, the container shall remain intact, and it shall be possible to attain a stable final state where the reactor core is kept cool and covered by water.
- The stable final state shall be achieved without the discharges to the environment exceeding 0.1% of the content of cesium in a reactor core of the size of Barsebäck, excluding inert gases.

The new measures are expected to imply that the Swedish reactor containment will be much more capable of withstanding the loads imposed by a serious accident. The radioactive substances released from the damaged reactor core can be confined in the containment.

An accident resulting in the release of 0.1% of the activity content is not considered to be capable of producing radiation doses in Norway making it necessary to evacuate any group of the population. The maximum individual

annual dose from the air and from ground deposits is unlikely to exceed 1 m Sv. The average, individual annual dose after the Chernobyl accident is estimated to be 0.3 - 0.4 m Sv.

More extensive accidents, involving release of about 30% of the total content of iodine and cesium in the reactor core have also been analysed. It is estimated that the probability of such accidents is in the region of 1 accident per 1-10 million years of reactor operation. Given unfavourable weather, it cannot be excluded that an accident of this extent could lead to a need for extensive contingency measures in Norway. It is unlikely that the radiation doses will be large enough to require quick evacuation, but it may be necessary to encourage the population to stay indoors for a certain period. It may be necessary to move certain exposed groups of persons. Extensive restrictions on the use of food from the affected areas must be expected.

Thus, if the worst happens, a serious accident at a Swedish nuclear power plant could have serious impacts on Norway, much more serious than was the case after the Chernobyl accident. However, the probability of such an accident occurring at a Swedish nuclear power plant is very small, and much less than at Soviet nuclear power plants.

2.5.2 The consequences for Norway of an accident at nuclear power plants in Finland, Great Britain or the Soviet Union

The standard of safety at the nuclear power plants in Finland is equally high as in other west-European nuclear power plants. The power and size of the largest reactors is about half that of the Swedish reactors. This means that the discharges in the event of a total accident will be correspondingly less. The Finnish reactors are located further away from Norway than the Swedish ones, and the consequences for Norway will probably be less than indicated for an accident at a Swedish plant.

In Great Britain, only the so-called AGR-reactors have a power comparable to the largest Swedish reactors. The British reactors are located more than 600 km from Norway, and the consequences for Norway must be assumed to be less than indicated for the worst case, i.e. total damage, at the Swedish nuclear power plants nearest to Norway.

In the Soviet Union, only the two newest pressurized water reactors are equipped with safety containers. The four pressurized water reactors on the Kola peninsular, each of 440 MWe, have no safety container. An accident to the core of a reactor on Kola would cause very large releases of radioactive substances. The probability of releases from a reactor on Kola must be considered to be much greater than from western reactor plants. The reactors on Kola are located less than 200 km from Norway. Radioactive discharges could reach Finnmark before Norway has been warned by the Soviet authorities. Finnmark and Troms could experience large doses of radiation.

However, the large reactors in Leningrad and Lithuania are the source of the potentially largest discharges and most serious radioactive contamination in Norway as a whole. The distance between Norway and these reactors is about 800 km (as against 1600 km to Chernobyl). An accident here would result in much larger quantities of radioactivity in Norway than experienced during the Chernobyl accident. Doses from a passing radioactive cloud would probably not

be enough reason to evacuate the population. But extensive contingency measures cannot be excluded.

2.6 Safety at Norwegian plants

At the request of the Committee of Senior Officials, safety at the two Norwegian research reactors at Kjeller and in Halden was evaluated by experts. The plants are owned and operated by the Institute of Energy Technology (Institutt for Energiteknikk - IFE). The Nuclear Energy Safety Authority (Statens atomtilsyn - SAT) is responsible for inspection and control, partly in collaboration with the National Institute of Radiation Hygiene (Statens institutt for strålehygiene - SIS).

The reactors at Kjeller and in Halden are small in relation to a nuclear power plant. The amount of fuel in the reactors is respectively 0.15% and 0.5% of the amount in the Chernobyl reactor, and the thermal power is less than 0.1% and 1% respectively. This means that the amount of radioactive substances which can be released in the event of an accident will be correspondingly less.

The most serious accident which could possibly occur at the Halden reactor would be a rupture of the main circulation pipe for cooling water. Such an accident has been analysed in detail. The analysis has shown that a number of fuel elements would be damaged and that radioactive substances would be released into the reactor hall. Discharges to the environment would be small, and of short duration. Under normal weather conditions the radioactive discharge would be diluted and carried away in the course of 4-6 hours. Calculations show that the collective radiation dose to the population in the event of the worst possible accident is in the order of 5 manSv. By comparision, the fall-out over Norway from the the Chernobyl accident will result in a dose of about 1000 manSv for the first year. The radiation dose received by personnel on duty during such an accident is expected to remain under the stipulated annual limit for occupational exposure.

According to the evaluation of the safety of the reactor at Kjeller, the most serious accident would be damage to the primary cooling circuit, which would mean that the tank would be emptied of heavy water in a very short time. In certain circumstances radioactive substances might be released and leak out into the environment. However, the danger to the population in the immediate vicinity would come from direct radiation from radioative substances in the plant, and it might be necessary to evacuate people from within a radius of 400-500 m of the plant.

Special contingency plans have been prepared for the plants at Kjeller and in Halden. Experience from the operation of both plants is good. No accidents of a serious nature have taken place. When equipment has failed or the operators have made an error, the technical protection and administrative control systems have worked as planned.

The Nuclear Energy Safety Authority has undertaken a detailed analysis which shows that conditions of the kind which triggered off the accident at Chernobyl are impossible at the Norwegian plants.

2.7 Evaluations

Safety at nuclear power plants is not only a matter of the functional capability of technical safety systems, but is just as much a question of the quality of the operating and safety organization which runs the plant. The efforts to ensure safety should go on continually at each plant in every country's nuclear energy programme and in international cooperation.

Efforts to ensure safety and proper contingency measures should be intensified, particularly by focusing attention on the consequences which might result from a serious accident in the worst case.

If today's prognoses of future development are followed, the number of nuclear power plants in Europe and in the rest of the world will increase. This implies that, if the total level of risk is not to increase, the technological measures intended to ensure safety must be improved.

The consequences of a lack of attention to safety were demonstrated by the accident in Chernobyl. A common feature of all accidents is the important part played by the human factor, that is to say, the operators. Grave human error has been both the immediate cause of accidents, and has had a decisive influence on the course of events and on further developments. On the other hand, experience has shown that if the personnel are proficient, they are able to intervene and stabilize a critical situation.

As far as possible, important dispositions during the first critical phase of an accident must be made automatic. This relieves the operator of participating actively during the first phase. Today, extensive automatization has been introduced at most western nuclear power plants.

Experience from accidents at western nuclear power plants has shown that an accident to the reactor will occur in several phases and will develop over many hours or many days. Thus, to some extent, it is possible to intervene and direct the course of an accident. It is also possible to take countermeasures to reduce the extent of the accident.

An accident taking the same course, and of the same size, as the one that happened at Chernobyl is extremely unlikely in plants of the type found in the West. The rapid and intensive increase of power that took place in the reactor core in the Chernobyl plant cannot occur in western plants. Furthermore, the control and shut-down systems are designed in a way which in practice prevents the operators from making such serious errors as preceded the accident at Chernobyl.

Experience from Chernobyl has given no grounds for any specific changes to western plants. The structural criteria for the safety containers should be re-assessed, however, in order to ensure safe and improved resistance under direct exposure to extreme loads.

Further measures should be introduced to develop and improve the systems of communication between man and machine, e.g. by using advanced information technology/computer technology. This is a field where IFE has done a great deal of development work through the international 'OECD Halden Reactor Project'.

It is a matter of concern that the plants in the Soviet Union do not satisfy the safety requirements applying in the West, and that there are several such plants quite close to Norwegian territory.

The Three-Mile Island accident in the USA in 1979 led to even greater efforts to ensure safety and adequate contingency measures in the West. Considering the disastrous consequences of the Chernobyl accident for the Soviet society, this accident ought to be an eye-opener in connection with the work on safety measures in Eastern Europe. The Soviet Union has already stated that the weaknesses brought to light by the accident will be improved at all similar plants. Western countries should ask for regular reports on Soviet efforts to improve the safety of the country's nuclear reactors.

A rational attitude towards the risk connected with nuclear energy must be based on a clear recognition that a serious nuclear accident may occur again. The question is what risk is acceptable. Such a decision must include weighing the risk connected with nuclear power plants against the risk from other technologies, and especially the technologies judged to be alternatives to nuclear energy.

It is important for Norway, which has no nuclear power plants herself, to be able to obtain up-to-date knowledge about the efforts of other countries to ensure safety by technological means, and their modes of thinking. Norway will then be able to judge for herself the risk represented by other countries' plants in a larger regional perspective. This is necessary out of consideration for Norwegian interests, and so that Norway can contribute actively towards the long-term objective of coordinating and accelerating international developments with regard to technological ways of ensuring safety.

3. NORWEGIAN CONTINGENCY PREPAREDNESS AGAINST NUCLEAR ACCIDENTS

3.1 Introduction

Norwegian contingency preparedness was not satisfactory during the Chernobyl accident. It cannot be excluded that accidents may occur in the future with a more widespread impact on Norway than experienced after the Chernobyl accident. This makes it imperative for Norway to improve the contingency preparedness against nuclear accidents.

3.2 Nuclear accidents, requirements as to Norwegian contingency preparedness

The Committee of Senior Officials was requested to submit proposals for preliminary contingency preparedness against 'accidents similar to' the nuclear accident in Chernobyl. The Committee has found it reasonable to interpret the term 'similar to' in its widest sense. 'Nuclear accident' is used as a common term for the types of accidents dealt with. This term covers accidents at nuclear power plants, at recovery plants for used fuel, to Norwegian research reactors, to nuclear-powered vessels and with nuclear weapons, as well as satellite crashes and other accidents involving nuclear material. The Committee has reviewed these kinds of accidents systematically, and the requirements which must be imposed for Norwegian contingency preparedness.

Thus, 'nuclear accident' is a comprehensive term, and it is possible to imagine accidents in Norway which may vary in extent and impact from the totally insignificant to one likening a disaster. In the case of serious accidents, widespread action and protective measures will be required.

3.3 The present state of contingency preparedness

Various contingency plans to meet nuclear accidents had been prepared before the Chernobyl accident. Moreover, the country had a system of emergency measures against injury from radiation in wartime, under the Civil Defence. We were not prepared, however, for fall-out from a serious nuclear accident abroad.

Norwegian preparedness against radioactive fall-out and other radiation accidents has been gradually reduced since the nuclear weapon tests, and the radioactive fall-out caused by these tests, ceased in the 1960s. However, the Civil Defence has continued to build up its warning system for radioactive fall-out in wartime. But the Civil Defence's instrument park is at present unsuitable for measuring the lower intensities resulting from nuclear accidents in peacetime.

A certain level of preparedness is maintained at IFE's plants at Kjeller and in Halden, and also to some extent at the National Institute of Radiation Hygiene (Statens institutt for strålehygiene - SIS). The universities have maintained a reserve contingency organization.

During the early 1960s, about 80 monitoring stations were established to monitor radioactivity in potable water, milk and other foods. SIS found that this equipment was unsuitable for use during the Chernobyl accident. After the accident, the health and agricultural authorities have procured equipment worth about NOK 2.7 million. This equipment has been used for follow up control of foods after the accident. Special measuring equipment has also been procured for SIS.

In May 1986 the Ministry of Environment allocated funds to the Norwegian Institute for Air Research (Norsk institutt for luftforskning - NILU) for 7 air monitoring stations. These instruments have made it possible for several of NILU's stations for monitoring SO_2 to also monitor and give warning of radioactive contamination in the air, as well as ground radiation in the vicinity of the monitoring stations.

Several of the universities and technical colleges carried out measurements in cooperation with SIS after the Chernobyl accident. This cooperation has resulted in the preparation of standard procedures and calibration techniques for existing equipment. This work has been of considerable value from the point of view of preparedness, and should be kept up.

The new equipment, and the experience that has been gained from the Chernobyl accident, has led to a considerble improvement of the available capacity to carry out measurements in an emergency.

In October 1986 the Government appointed a temporary contingency committee to be responsible for coordinating the authorities' efforts in the event of further nuclear accidents.

The Committee of Senior Officials holds the view that the level of preparedness against nuclear accidents should be improved, and that all efforts in this respect should take place in accordance with an overall plan. The most serious accidents would result in a need for protective measures which could resemble those which would be appropriate in time of war, although they would probably be less extensive and would apply to only parts of the country. An effective level of preparedness against such accidents in peacetime would also serve to strengthen the wartime emergency organization.

3.4 The proposal for a Governmental Action Control Group for nuclear accidents

If a serious nuclear accident did occur it might be necessary for the Government to make far-reaching decisions in order to protect life, health and other important interests. The Chernobyl accident showed the need for better coordination of possible necessary action by the authorities. There must be a flexible contingency organization through which the Government would be able to coordinate the many different measures required in different accident situations. The Commitee of Senior Officials recommends the establishment of a Governmental Action Control Group whose function would be to coordinate these efforts. The Action Control Group should be supplied with a staff, an advisory group and an information service. In the case of extensive accidents, the Action Control Group should be established at an Action Control Centre equipped with the necessary communications equipment and other aids.

The Group should consist of permanent representatives appointed by the following ministries:

- The Ministry of Justice
- The Ministry of Health and Social Affairs
- The Ministry of Environment.

In addition, the following ministries should appoint a representative to participate in the Action Control Group as needed:

- The Ministry of Petroleum and Energy
- The Ministry of Agriculture
- The Ministry of Fisheries
- The Ministry of Communications
- The Ministry of Trade
- The Ministry of Defence
- The Ministry of Foreign Affairs
- The Ministry of Local Government and Labour.

The Action Control Group should be responsible for collecting up-to-date information about the accident and its consequences, and should ensure that the necessary measures are taken to protect life, health and other important societal interests.

The Committee of Senior Officials considers it most suitable for the leader of the Action Control Group to come from the Ministry of Justice or one of its subordinate authorities, which should also provide the secretariat for the Group.

3.5 Monitoring and warning in the event of accidents

The Committee of Senior Officials thinks that Norway ought to have a separate warning and monitoring system for air-transmitted radioactive pollution. At the request of the Committee, a working group has prepared a proposal for a national monitoring plan. The report has been prepared in collaboration with all the important Norwegian institutions concerned.

When the Chernobyl accident occurred, the only monitoring stations for radioactivity in the air were at SIS at Østerås, outside Oslo and at IFE's plant at Kjeller, that is to say, in the Oslo district. Since the accident, it has been decided to

extend 9 of NILU's ordinary monitoring stations to make them capable of registering radioactive air pollution and report heightened values automatically. 7 stations have already been extended. Sweden, Finland and Denmark all have monitoring stations which can report on the drift of radioactive discharges. Monitoring of radioactive pollution in the air is a suitable area for Nordic cooperation. The Nordic countries should be regarded as one monitoring area. This cooperation has been started, and the objective should be a joint Nordic plan for monitoring and reporting radioactive air pollution.

The Committee proposes that monitorng systems are also established for fresh water and the marine environment.

3.6 Assessment of the situation and measures to be taken in the acute phase of an accident

When the Action Control Group has received notification of an accident, and the first information, the situation must be assessed and any necessary measures initiated. It is difficult to draw up any guidelines in this respect in advance. This question should be considered, however, as an important part of the continuous contingency planning. In the case of a serious accident, it is important that the Action Control Group quickly informs the media and the general public that the contingency organization has been mobilized, and tells individuals how to behave. The most relevant measures in the acute phase are instructions to stay indoors, or in the worst case, evacuation of vulnerable groups of the population and restrictions on the use of various foods. Similarly it may be relevant to keep domestic animals indoors, and to impose restrictions on grazing in exposed areas. Depending on the time of year an accident occurs, it may be relevant to impose widespread restrictions on the use and sale of foods. Decisions of this kind will have to be based on numerous and widespread measurements and analyses of radioactivity in the affected areas.

As far as the measurement and control of foods is concerned, the measuring capacity has already been considerably increased since the Chernobyl accident. It is necessary, however, to further strengthen the control of foods. In addition to the need for measuring equipment, there is also a definite need to establish measuring procedures, calibration of equipment, development of expertise, and training. It is proposed that the National Institute of Radiation Hygiene is made responsible for administering and coordinating all the work connected with measurement and analysis.

3.7 Measures to protect export/import interests

It is evident from part 1 of the Committee's report that the Chernobyl accident had an impact on international trade in goods and services. Products that were directly affected were lamb and mutton, and reindeer meat. Other products may also be affected by export restrictions (even if the radioactivity does not exceed the stipulated action levels).

The most important export interest that can be affected indirectly is the tourist industry. During the Chernobyl accident, the product 'Norway' and the stamp of quality 'Norwegian' tended to be looked upon with some scepsis, and this had a negative effect on the tourist industry. Other groups of products where 'Norway' or 'Norwegian' is a distinctive feature of the marketing may also be vulnerable if a new accident were to occur. Measures to counteract problems of this kind include an objective and reliable contingency information organization, equipped to curb rumours and counteract erroneous information abroad.

Whether 'import interests' would suffer as a result of another accident depends on what restrictions, if any, were imposed by the Norwegian import authorities.

Information and contact with other countries are of vital importance to counteract problems connected with exports and imports after a nuclear accident. A contingency organization should be planned to protect Norwegian export and import interests in the event of another, serious nuclear accident. This organization should be connected to the Governmental Action Control Group for Nuclear Accidents.

In the event of an accident, information to other countries about Norway and Norwegian products should be communicated through the Ministry of Foreign Affairs. The affected authorities must provide the Ministry of Foreign Affairs with up-to-date and reliable information.

Norway should work to promote preparation of international, common procedures for stipulation of action levels for radioactive substances in foods, and for the introduction of uniform measures prevent unnecessary barriers to trade following a nuclear accident.

3.8 Contingency preparedness at the county level

Chapter 10 of part 1 of the Committee's report describes how the Chernobyl accident affected several counties, and how the communication between the counties and the central authorities and other parts of the contingency preparedness system, and the coordination of their various efforts, had not functioned satisfactorily.

The Committee recommends that a special coordinating group is established in each county as part of the general contingency preparedness to meet a possible future nuclear accident. Such a group would be able to ensure that information on local conditions reaches the central Action Control Group. Experience from the Chernobyl accident shows, furthermore, that the county may need to contact the central Action Control Group for advice and assistance. A county coordinating committee would be an important intermediary for the communication of information from the governmental Action Control Group to the population and the media in the affected counties.

Coordinating committees should be established in the counties as soon as possible, to make it possible to prepare specific reporting routines for the temporary contingency preparedness system. A plan should be prepared for contingency preparedness in the counties. For the time being, it is considered natural for the County Governor to coordinate this work.

3.9 Emergency information system

The public, the media and other affected parties have the right to information if a nuclear accident occurs again. This assumes that the authorities themselves are fully informed about the situation. Problems connected with information to the public are discussed in the Report from the Hernes Committee (Norwegian Official Report 1986:19) 'Information Crises'. The Committee of Senior Officials agrees with the Hernes Committee that the information system did not function adequately after the Chernobyl accident. In the opinion of the Committee of Senior Officials, this was because the authorities were not prepared for such an accident beforehand.

If a nuclear accident were to occur, several authorities and expert agencies would have responsibilities and functions, and would communicate information on behalf of the state. But there would be a large number of target groups: The general public, and many different authorities and institutions.

It is impossible to stop radioactive radiation, and the facts connected with an accident to a nuclear power station are complicated. This makes information particularly problematic. There is an additional difficulty because the language used by the experts usually makes the media and the public feel that the information is diffuse and full of reservations.

The main purpose of an emergency information system must be to make sure that the affected parties are told how they should behave, and that unnecessary anxiety and uncertainty are avoided. The experts are not always the best informers. 'The public' is a very heterogeneous target group, and information has to be generalized in order to reach as many as possible. This means that any future system of contingency preparedness against nuclear accidents should include professional information personnel, in addition to the authorities and experts concerned.

If the information about a serious nuclear accident is to fulfil its intention, the following basic requirements should be met:

a) necessary technical equipment
b) suitable staff
c) a system for searching for information
d) an external system for spread of information.

The Committee of Senior Officials has discussed these requirements in detail. The Prime Minister's Office is considering establishing a general emergency information service for use in a crisis. It should be possible to use this service also in the event of a serious nuclear accident.

3.10 Plan for procuring equipment etc.

The special institutions concerned have reported a need for equipment and resources if contingency preparedness is to be adequately developed. The Committee of Senior Officials thinks that, as far as equipment is concerned, the contingency preparedness system should be fully developed by 1990. Various items of equipment are given first priority. This particular equipment should be procured immediately. The provisional aim should be to also procure the equipment given second priority. However, this should be assessed in more detail, and the equipment bought as more concrete experience is gained about the organization of the contingency preparedness. In this way, the purchase of equipment can be adjusted to the future contingency preparedness planning which will obviously follow in the wake of this report.

The Committee of Senior Officials emphasizes that the responsibility for the preparedness to take the necessary measurements should be distributed between the different institutions concerned which would be mobilized in the event of an accident. In the light of this, the proposal for the equipment needed by the different institutions also implies a proposal for distribution of responsibility for the different parts of this sector of the preparedness.

The Committee's proposal for a priority programme for procurement of measuring equipment is divided into the following 8 sectors:

1) Monitoring of radioactivity in the air, calculation of drift and spreading
2) Control of foods
3) Monitoring of radioactivity in the marine environment
4) Monitoring of the freshwater environment
5) Monitoring of gamma background radiation
6) Medical contingency preparedness
7) Analysis capacity at SIS
8) Control of meat, animals, etc.

The total cost of all the equipment considered in the plan is rather more than NOK 40 million (1986-kroner). The plan shows that equipment amounting to approx. NOK 14 mill. should be bought immediately.

3.11 Personnel resources, development of expertise

The Committee of Senior Officials thinks that, in principle, no posts should be established for the specific purpose of dealing with nuclear accidents. Another accident is so improbable that it would not be expedient to reserve extensive personnel resources for this purpose alone. The main principle of the contingency preparedness should be that resources are mobilized if an accident does occur, and that, to the extent necessary, other tasks are set aside for the duration of the accident. It will be necessary, however, to arrange exercises, training and a certain amount of continuous activity to ensure that the contingency preparedness system would operate effectively in the event of an accident. This makes it necessary to supplement the present personnel resources.

Some consolidation of SIS and SAT is necessary. Experience from the Chenobyl accident has shown, moreover, that the Directorate of Public Health should have a special information officer. The establishment of a Governmental Action

Control Group, with its own secretariat, also requires personnel. For example, the Action Control Group would be responsible for the extensive work of planning the contingency preparedness in more detail. It is proposed that 7-10 posts are established for this purpose.

4. FINANCIAL COMPENSATION AFTER NUCLEAR ACCIDENTS

4.1 The need for systems of compensation

The Committee has considered to what degree present Norwegian law ensures compensation to an injured party for loss caused by a nuclear accident, and whether supplementary systems of compensation are needed.

Part 1 of the Committee's report shows that the Chernobyl accident had economic impacts in Norway. These were connected mainly to the authorities' restrictions on the sale of foods with a radioactive content exceeding the stipulated action levels.

It is possible that another nuclear accident might have quite other and more extensive impacts than the Chernobyl accident, also economic impacts. As a rule the persons who are affected will be quite coincidental, and the individual person will have little if any possibility of taking precautions against the effects of such an accident. The question is whether it is reasonable for the individual to bear the possible financial loss himself, or whether this loss should be distributed among the community as a whole through systems of compensation from the state, if there are no other existing compensation arrangements.

4.2 What are the existing possibilities of compensation?

The Chernobyl accident showed how easily foods can be affected by radioactive contamination from a nuclear accident. Various legislation gives the authorities the right to impose restrictions on the sale of such goods. These restrictions may be imposed without the affected persons' having the right to claim compensation from the authorities.

In certain cases the injured party may receive compensation for loss caused by a nuclear accident from the owner of the plant concerned or from the state in which the plant is located. The Act of 12 May 1972 relating to Nuclear Energy includes rules on the liability of a nuclear activity. The rules are based on the Paris Convention of 1960 and the Supplementary Convention of 1963 concerning civil liability for damage from nuclear activity. The Conventions regulate mutual compensation arrangements between the Contracting States. Norway has ratified both conventions.

The liability for compensation according to the Act and according to the Conventions is objective (independent of whether the person responsible is at fault). The liability rests with the owner of the nuclear plant, and is limited to a specific sum. The rules may be applied only if the plant concerned is located in a state that is party to the Convention (a Contracting State), and only to injurious effects in a state that is itself a Contracting State.

If the loss exceeds the sum for which the owner of the plant is liable, the state in which the plant is located has a supplementary liability. This liability also has an upper limit. In addition, the state in which the plant is located has a subsidiary liability to ensure that the owner of the plants fulfils his liability. In the case of very serious accidents, a country which has fulfilled its national responsibility may claim recourse from other Contracting States in accordance with a stipulated scale of distribution.

In the case of a specific accident, only one of the Contracting States will have jurisdiction over the claim for compensation. In practice this may imply that Norwegian injured parties must submit claims for compensation in another country. However, in such cases the Norwegian state can probably advance the compensation payment, intervene in the injured party's claim and claim compensation on behalf of the injured party.

Neither the Nuclear Energy Act nor the Conventions cover damage caused by an accident in a non-Contracting State (e.g. the Soviet Union). Possibly the Act gives the King the right to decide that it shall wholly or partially apply also in such cases. But the rules in the Nuclear Energy Act are not very suitable in such situations, and exceptions would have to be made from a number of the provisions.

The Nuclear Energy Act is based on the general legal principles for compensation. For example, it is necessary to establish a connection between the accident and the damage. Furthermore, the causal relations must be predictable. A claim can be made for compensation for all predictable financial loss within the specified limit.

The provisions do not apply to nuclear damage caused by war or suchlike, or by a serious natural disaster of an exceptional nature.

In principle, the general rules not regulated by law concerning the civil liability of dangerous companies may also apply to activities connected with nuclear energy. But the provisions in the Nuclear Energy Act will take precedence within the area regulated by the Act.

4.3 Possible future compensation arrangements

If the state is to accept liability for loss incurred as a result of the authorities' restrictions on production and sale of foods, it is natural to incorporate rules in this connection into the legislation giving the authority to impose such restrictions. This is a general issue, however, which should not be evaluated in isolation from the restrictions resulting from radioactive contamination. If it is desired to have special rules which apply to loss incurred as a result of radioactive pollution, this can be achieved in the form of a special Act, patterned, for example, on the Act relating to Compensation for Damage caused by Natural Disasters.

If the accident is connected with a state that is party to the Paris Convention and the Supplementary convention (a Contracting State), the injured party, in principle, is ensured the right to compensation.

If the accident occurs in a non-Contracting State, a possible solution might be for the Norwegian state to accept responsibility to pay compensaton in cases where it is impossible to claim compensation from the person who has caused the damage. The economic consequences may be very great, so such a compensation arrangement must be considered very carefully. If it is desirable to have extensive regulations for compensation arrangements also for accidents occurring in a non-Contracting State, the most reasonable solution seems to be to incorporate these into the Nuclear Energy Act. In such casesthe Norwegian state may have to bear a very serious economic loss, unless it is possible to have this loss refunded by the owner of the plant that has caused the damage or by the state in which the plant is located.

It is unlikely that insurance arrangements and voluntary arrangements within the different industries will provide suffificient coverage for serious accidents.

A suitable solution may be, however, to assess the compensation from the authorities in concreto and to pay the compensation in the form of an ex gratia payment when this is considered reasonable.

4.4 The recommendations of the Committee of Senior Officials

The Committee of Senior Officials does not recommend that special regulations are laid down for liability for damages by the state in the event of nuclear accidents, where the state in principle, is under no obligation to pay compensation. It is very difficult to forecast what damage may occur, the extent, and what measures will be possible and appropriate to counteract the damage. Any compensation arrangement should be adapted to the situation that arises.

In principle, the state should pay compensation for loss incurred as a result of the authorities' measurees to protect the health of the popultion. In the case of loss incurred in industries whose incomes are regulated by agreements with the state, it may be suitable to incorporate the arrangements for compensation into these agreements.

In the case of loss which is not caused by measures undertaken by the authorities, it is impossible to draw general conclusions. Basic considerations of justice tend to indicate that the state should pay an ex gratia payment in certain cases.

4.5 Certain views on Norway's position in regard to international law

Norway has ratified three conventions on compensation for nuclear damage. The Paris Conventions, the Supplementary Convention and the Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (1971) - but not the Vienna Convention (1963), which is based to a large extent on the same principles as the Paris Convention.

These Conventions are of limited importance, because few countries have signed the agreements and because the liability is fairly strongly restricted. It is correct that the limit for the sum for which the state is liable is to be raised. In the Nordic countries, the sum for which the owner of the plant is liable is also to be raised. Norway should try to get these limits raised even further. Norway should also make an effort to get other states to sign the Conventions. Further, Norway should consider taking the initiative for bilateral agreements on compensation.

5. INTERNATIONAL COOPERATION

5.1 Review of relevant international cooperation

The reactor accident in the Soviet Union affected a number of countries and international organizations. The measures that were considered and implemented in Norway were very much the same as was being done at the international level.

The Committee has reviewed the international cooperation in the field of nuclear safety, radioactive pollution, etc., particularly what happened after the Chernobyl accident. The report contains a special account of Nordic cooperation. Based on it evaluations in this connection, the Commitee has made more detailed proposals for further international cooperation.

A short time after the accident, the International Atomic Energy Agency, IAEA, decided to extend its safety programme because of the accident. It was further decided to prepare international agreements about notification of nuclear accidents and assistance during the accident itself. The agreements were finally prepared and adopted at IAEA's general meeting in September 1986, and were signed by more than 50 countries. Norway was the only country that ratified both agreements with binding effect. The Agreement on Notification entered into force on 27 October 1986.

The two Committees under the OECD's Nuclear Energy Agency (NEA) for safety and radiological protection, have also considered the Chernobyl accident and made recommendations for future action.

There are no international agreements which regulate the health impacts or hygienic effects of radiation from uncontrolled release of radioactive material or radiation. However, the professional aspects of these problems are being considered in several international bodies. Measures implemented in the World Health Organization, for example, are expected to result in recommendations as to how similar accidents shall be dealt with in the future in order to limit the effects on the population as far as possible.

Nordic cooperation has already been established in a number of fields connected with nuclear energy, safety, radiation hygiene, etc. This contact and cooperation has been further extended since the Cherobyl accident.

Three Nordic agreements relating to the localization and operation of nuclear power plants, and to assistance in the event of accidents, were signed some years ago. Furthermore, since the Chernobyl accident, bilateral agreements have been signed between Denmark and Sweden and between Sweden and Norway concerning information on the safety of nuclear plants in neighbouring countries and the hazard connected with such plants, and on notification and information if accidents occur. (Work has started on similar agreements between Norway and other neighbouring countries).

The Nordic Contact Body for Nuclear Energy Matters (Nordic kontaktorgan for atomenergi-spørsmål - NKA) is a body under the Nordic Council, and is responsible for the exchange of information between the Nordic authorities on matters concerning nuclear energy. Since the Chernobyl accident, NKA has reviewed its work and has started a project to establish a Nordic base for

measuring radioactivity.

It has also been decided to prepare a plan for a Nordic radio-ecological programme, a project to evaluate existing models for calculating air pollution exceeding the stipulated limits, and to evaluate the possibility of establishing an international reporting and monitoring system for radioactivity in the air.

5.2 The Committee's evaluations

Extensive Nordic and international cooperation occurs in the field of nuclear safety, radioactive pollution and radiation hygiene, and this has been greatly consolidated and modified since the Chernobyl accident. Plans are being prepared to further strengthen this cooperation.

5.2.1 International notification and information

As far as the reporting of nuclear accideents, and information in this respect are concerned, the IAEA agreement of 26 September 1986 concerning the notification of accidents is an important contribution to stronger international cooperation in the event of a nuclear accident. The agreement was brought about very quickly, and must be regarded as an example of good and effective international cooperation. From Norway's point of view the wording of the agreement must be considered satisfactory. To ensure the most effective implementation of the agreement, however, it must be followed up by further efforts, both in the individual countries and within IAEA. It must be assumed that all the 50 countries that participated in the preparation of the Convention will become party to it. Norway, in cooperation with the other Nordic countries, should press for as many countries as possible to sign the agreement as soon as possible.

The agreement states that it can be supplemented by bilaterial and/or regional notification agreements, if the partners find such agreements necessary. One reason for giving this further consideration is that the agreement does not make it an unconditional obligation for the member countries to notify affected neighbouring countries directly. It is sufficient to notify the IAEA. The Committee considers it desirable to receive notification directly, especially from the countries with nuclear power stations located close to Norway. In this connection, the Committee points to the agreement concerning notification and information in the event of accidents, signed by Sweden and Norway on 23 October 1986.

5.2.2 Assistance during accidents

The IAEA ageement concerning mutual assistance during nuclear accidents must also be said to be satisfactory for Norway. The existing Nordic agreement on assistance should be reviewed again, however, in the light of the contents of the new IAEA agreement and experience from the Chernobyl accident.

5.2.3 International cooperation in other fields

It is desirable that Norweglan authoritles are better informed about the safety and preparedness measures introduced in neighbouring countries with nuclear plants. Work on such matters has started between the Nordic countries, and Norway entered into an agreement with Sweden in this connection on 23 October

1986. Similar cooperation should be established with other neighbouring contries.

Cooperation with neighbouring countries on contingency preparedness should also be considered. The first relevant step is Nordic cooperation on monitoring of radioactive pollution. If Nordic cooperation in this field is successful, attention should be given to the possibility of extending this cooperation to include a wider area of Europe or parts of Europe.

The Committee emphasizes, however, that if Norway is to make an active and constructive contribution to the work, the follow-up of the cooperation on safety and preparedness will place clear demands on Norwegian expertise and resources.

6. SUMMARY OF THE PROPOSALS BY THE COMMITTEE OF SENIOR OFFICIALS

The Committee of Senior Officials submits the following proposals to improve safety, contingency preparedness, rules for compensation and international cooperation in connection with nuclear accidents.

I. Safety and risk with regard to nuclear accidents

1. The safety of nuclear plants must be as effective as possible.

2. The safety of nuclear plants is not solely a national responsibility, but an international one too.

3. International cooperation in all fields of nuclear energy is important. The positive results achieved by the IAEA agreements on early notification and assistance in the event of a nuclear accident should form the basis for continual development of the cooperation.

4. The international cooperation should lead to the definition of basic standards for the safety of nuclear power plants. Moreover, an effort must be made to make these international standards binding, and to ensure that the different countries comply with them. The basic standards should be re-evaluated and developed continually.

5. International research cooperation for the development of safer nuclear power technology and better knowledge about the consequences of nuclear accidents should be of central importance.

6. Norway needs to have bilateral agreements with neighbouring countries, in addition to the two IAEA agreements. These agreements must be more comprehensive than the agreements entered into as part of the IAEA cooperation (cf. the agreements between Norway and Sweden, dated 23 October 1986).

7. Present and future international agreements (both multilateral and bilateral) will result in large quantities of information coming to Norway. Norway must have an organization to receive and evaluate this information, which will also put Norway in a position to take an active part in the international cooperation on reactor safety, etc. In order to

take care of these functions it is necessary to strengthen the Nuclear Energy Safety Authority.

8. An active role in international cooperation on nuclear energy makes it necessary to maintain and develop the existing groups and expertise working on technological safety measures.

II. Norwegian contingency preparedness against nuclear accidents

1. Norwegian contingency preparedness to meet accidents at nuclear power plants in neigbouring countries, and other nuclear accidents, must be improved. The improvements should take place according to an overall plan. The plan should be based on the fact that, at worst, a possible nuclear accident may result in the need for much more extensive contingency measures than were required during the Chernobyl accident.

2. A Governmental Action Control Group should be established for nuclear accidents, so that the many ministries and institutions with duties connected with such accidents can coordinate their evaluations, decisions and efforts as effectively as possible in an accident situation.

3. The Ministry of Justice, the Ministry of Health and Social Affairs and the Ministry of Environment should each have a permanent representative in the Group. Eight other ministries should appoint representatives who can join the Group as required, depending on the nature of the accident and the decisions of the Action Control Group.

4. The Action Control Group should be responsible for collecting current information on the accident and its consequences, and should ensure that the necessary measures are taken to protect life, health and other important societal interests.

4.1 The Action Control Group should have a staff and an associated advisory group. It should also have its own information service.

5. The Committee proposes that a nation-wide reporting and monitoring system for radioactivity in the air is established, based on the monitoring stations operated by NILU. 2 additional stations are proposed over and above the 9 which it was decided to establish already after the Chernobyl accident.

5.1 The monitoring system can be, and should be, coordinated with similar systems in the other Nordic countries, so that the Nordic countries as such as regarded as one notification and monitoring area.

5.2 NILU, SIS, MI (Meteorological Institute), IFE and NGU (Norges Geologiske Undersøkelse - Norwegian Geological Survey) should be made responsible for obtaining information about the drift, spread and probable fall-out of radioactive substances. The cooperation should be based on the plans submitted to the Committee by these institutions.

6. A programme should be established to monitor radioactivity in water and in the marine environment.

7. Plans should be prepared for supplementary measurement of ground deposits, and radioactivity in the environment.

8. Extensive tasks will face the food control authorities in the event of a nuclear accident. The measurement capacity must be increased, over and above what has taken place since the Chernobyl accident.

8.1 A coordinating body should be appointed to be responsible for matters connected with the control of foods in the event of a nuclear accident. This should be connected to the Directorate of Public Health/Food Inspection Board.

9. Experience from the Chernobyl accident has shown that international trade in goods and services may be affected by a nuclear accident.

9.1 Therefore, an emergency organization to protect Norwegian export and import interests should be attached to the Governmental Control Group.

9.2 Norway should work to encourage the different countries to introduce harmonized measures which will prevent unnecessary barriers to trade in the event of a nuclear accident.

10. An emergency coordinating committee should be established in the counties as part of the contingency preparedness against nuclear accidents. A plan should be prepared for the counties' contingency preparedness. As part of the further efforts, consideration should be given to selecting one or more counties as trial counties. But provisional emergency coordinating committees, under the chairmanship of the County Governor, should be appointed immediately.

11. The Action Control Group should have an information service at its disposal. This information service should be attached to the general emergency information service for crisis situations, being considered at present by the Prime Minister's Office. The information service should be operated by professional information personnel in collaboration with the authorities and experts connected to the Action Control Group. The Committee's proposals for technical equipment, an information-search system and internal and external distribution of information should be considered in more detail.

12. The contingency preparedness to meet nuclear accidents must be created by means of exercises, courses and further planning and studies. An information campaign should be carried out once the system of contingency preparedness has been established.

13. The Governmental Action Control Group, with staff and advisors, must have suitable premises, an Action Control Centre, available in Oslo. The premises must be equipped with advanced communications and other equipment, so that a serious accident can be dealt with effectively. Consideration should be given to establishing alternative action control centres for accidents which are difficult to handle from Oslo.

14. A plan is proposed for procurement of measuring equipment etc. for the contingency preparedness organization. This equipment should be purchased as soon as possible, and at the latest by 1990. Some of the equipment should be bought immediately. The plan for procurement of equipment is based on the fact that several authorities and institutions ought to have better measuring equipment. The plan also implies a proposal for the distribution of the different tasks connected with the preparedness to carry out measurements and analyses in and emergency.

14.1 The cost framework for the total equipment required by the plan is about NOK 40 million. Measuring equipment worth NOK 14 million should be bought immediately. This first-purchased equipment will imply that Norway is reasonably well prepared for an accident similar to the Chernobyl accident. But more equipment would be required to achieve full preparedness.

15. Annual operating costs are estimated to amount to approx. NOK 4.5 million. It is proposed, in addition, that the ministries concerned establish a total of 7-10 positions, distributed as follows:

The Directorate of Public Health: 1 information officer
The Nuclear Energy Safety Authority: 1-2 posts
The National Institute of Radiation Hygiene: 3-4 posts
The Ministry of Justice/
Directorate of Civil Defence and Emergency Planning: 2-3 posts

16. The Committee of Senior Officials proposes that the Governmental Action Control Group is placed under the Ministry of Justice/Directorate for Civil Defence and Emergency Planning, and that this agency is also made responsible for planning and coordinating the further development of the contingency preparedness organization.

III. Compensation arrangements

1. Ex gratia compensation should be paid by the State for loss incurred as a result of the measures imposed by the authorities to protect people's health after a nuclear accident. In the case of losses incurred by industries whose income is regulated by special agreements with the State, consideration should be given to incorporating compensation arrangements into these agreements.

2. In the case of other losses, compensation should be paid by the State when this is found to be reasonable.

3. Norway should work to strengthen the international agreements relating to compensation for damage caused by nuclear activity, and in this connection should try to get more countries to sign these agreements.

4. Norway should consider taking the intiative for bilateral compensation agreements with neighbouring countries with activities which involve a possible risk of radioactive pollution in Norway.

IV. Other international cooperation

1. The IAEA agreement concerning notification of nuclear accidents should be followed up. Norway should work for quick and broad support for this agreement.

2. Norway should work for supplementary bilateral agreements which will ensure that Norway is notified and receives direct information in the event of a nuclear accident in a neighbouring country.

3. Norway should take the intiative to acquire better knowledge concerning the safety and contingency preparedness measures implemented in neighbouring countries with nuclear power plants which may cause serious nuclear accidents.

4. Nordic cooperation should be established for monitoring of radioactive pollution.

5. The need for more compehensive international cooperation on contigency preparedness measures should be evaluated.