RADWASTE IN THE NETHERLANDS

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ABSTRACT

Information on radwaste management is extensively exchanged on an international level. This has not led to an uniform management system in the various countries. However a lot of parallels as well as comparable solutions can be noticed. Generally the total management system for a country is tailor-made. This is illustrated by describing the changes in the field of radioactive waste management in the Netherlands in the present decade. It is expected that within the next five years a new storage and treatment site will become operational which will be the beginning of the realization of a management policy reaching far in the 21st century.

INTRODUCTION

In March, 30 years ago, the Euratom Treaty was signed in Rome. This was one of the milestones in international cooperation in the nuclear field. Later that year another milestone was reached with the inaugural meeting of the IAEA in Vienna. These are just two examples of the many events that are indicative for the extensive exchange of information on the use of atomic energy and related topics.

One of these related topics is waste management. The many international contacts on this item has led to generally accepted basic principles, however it has not led to an uniform management system in the various countries. Yet, a lot of parallels can be noticed both in the kind of problems the various nations have to face, as well as in the kind of solutions that are worked out. The national waste management programs that are in or are put into operation are tailor-made and take into account the specific national needs, problems and circumstances.

Special features for the Netherlands are the high watertable, a high population density and a well developed environmental consciousness of the population. Following the historical developments will illustrate how the waste management program developed.

NUCLEAR POWER IN THE NETHERLANDS

In the sixties nuclear research started in the Netherlands. Research reactors were installed in Petten and Delft. At a modest scale nuclear power was introduced around 1970. In 1969 the BWR at Dodewaard (54 MWe) started operation, followed in 1973 by a PWR at Borsele (480 MWe).

In 1974 Government decided to propose expansion of the nuclear electricity production with another 3000 MWe; thus anticipating an expected increase in electricity consumption. The presence of the large natural gas resources in the Netherlands and the world-wide economic recession created however a situation in which it was not felt necessary to install in a short time additional power plants. So no further development of nuclear power took place. The two plants produced some 7% of the total electricity demand. In our neighbouring countries the development was very different: nowadays in the Federal Republic of Germany over 30% of the electricity is nuclear and in Belgium it is even over 60%.

In the seventies an extensive debate started amongst the public and in Parliament. This debate took more than ten years and seemed to be finished when in 1985 Government issued a policy-paper on electricity production in the nineties. This policy included the construction and commissioning of two till four large light water reactors before the end of this century. The Tsjernobyl-accident of April 1986 however refrained Government from any further decisive actions. A new debate in Parliament including the findings of the Tsjernobyl-assessment will be held in the beginning of 1988.

RADIOACTIVE WASTE PRODUCTION

Since there are just two nuclear power plants in operation the total amount of waste generated is relatively small. And therefore the volume of waste produced by the other users of radioactive materials in research, medicine and industry is relatively important and equals the volume of waste produced by the nuclear power plants. The total volume of untreated low-level waste is about 700 m^3 per year. After treatment some 400 m^3 of conditioned and packaged waste results. In addition to that another 400 m^3 of conditioned waste is produced by the solidification with cement of evaporator sludges, filter sludges and spent ion-exchange resins at the nuclear power plants. The total 800 m^3 of waste contains some 20.000 GBq of which 50% is H-3 and 30% is Co-60. Of the conditioned waste packages 90% have a surface doserate less than 0,5 mSv/hr and less than 2% is higher than 2 mSv/hr.

The spent fuel of the two nuclear power stations is sent to reprocessing facilities in France and the United Kingdom. Recently the French reprocessor has announced that the returning of the waste is aimed at to start in 1992. It is estimated that some 20 m^3 of highlevel waste, including the vitrified waste, and some 70 m^3 of conditioned lowlevel waste per production year will be returned.

The volume of radioactive waste expected to be produced in the next 100 year, with and without further expansion of nuclear power is indicated in Fig. 1.

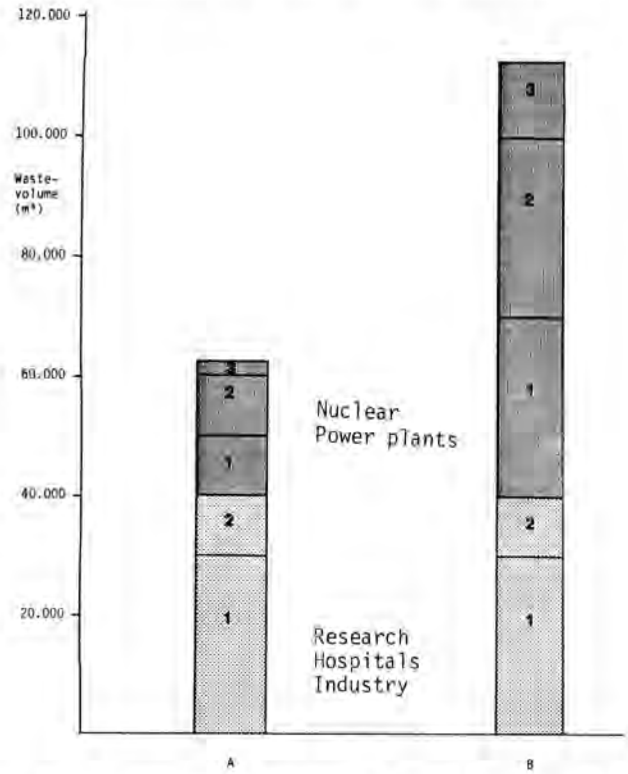

Fig. 1. Volume of radioactive waste expected to be produced in the next 100 years, without (A) and with further expansion of nuclear power plants (B).
1. operational wastes;
2. decommissioning wastes;
3. reprocessing wastes;

HISTORICAL DEVELOPMENT OF THE RADWASTE MANAGEMENT SYSTEM

From as early as 1965 till 1982 packaged low-level waste was dumped into the Atlantic Ocean. The last years in a cooperative action with Switzerland and Belgium under the auspices of the Multilateral Consulation and Surveillance Mechanism of the Nuclear Energy Agency of the OECD. In the late seventies and early eighties there was - not only in the Netherlands - a growing opposition against this method of radioactive waste disposal. Moreover in the Netherlands the environmental management philosophy was developed that dangerous wastes in general should be isolated, controlled and surveyed. Due to these two factors the decision was made in 1981 to opt in principle for another disposal route for radioactive waste, rather then dumping it into the ocean. It took till 1983 to realize this decision at principle. Then the municipality of Zijpe - to which the village of Petten belongs - agreed to the short-term storage of the low-level waste on a small area on the site of the Netherlands Energy Research Foundation at Petten. Government promised the municipality that this short-term storage would not last longer than five, at the utmost ten years. During this period a long-term waste management policy would be developed and put into practice. Something to the direct benefit of the community was offered as well. The artillery tests which caused a lot of noisenuisance would be diminished drastically.

Until the beginning of the eighties not much attention had been given to the management of high-level waste, since the spent fuel was sent to the reprocessing facilities abroad. Contractually the reprocessing-waste could be returned to the country of origin but this was not expected before the mid-nineties.

In 1984 Government issued a waste policy paper in which is stated that the long-term above ground storage for all kinds of radioactive waste is the prefered option. This option is environmentally acceptable and feasible. Therefore a site had to be found which is suitable for both processing and storage of low- and intermediate level waste and for the storage of high-level waste and/or irradiated fuel elements. The storage capacity needed should be sufficient for the waste generated in the next 50 to 100 years. Such storage capacity will ensure ample time for research into, and realization of a final disposal method. Most likely this will be deep underground disposal in geological salt formations within the Netherlands.

Government had set itself the task to find a suitable site for the long-term above ground storage . Needless to say that no one expected volunteers. The NIMBY (not in my back yard) syndrome is also known in our country. Therefore a site selection procedure was set up. A small committee was appointed to advise Government on the final choice. The members of this committee were chosen because of their extensive administrative experience , since it was felt that the administrative feasibility of a selected site would be very important. In a period of less than a year the committee succeeded in finding two municipalities willing to accept a long-term storage and treatment facility: i.e. Borsele and Klundert.

Another, yet unmentioned, item of the newly developed governmental policy was the initiative to establish a specialized organization to take full responsibility for the treatment and storage of the radioactive waste: the Central Organization for Radioactive Waste (COVRA).

COVRA, THE SPECIALIZED WASTE ORGANIZATION

COVRA was founded in december 1982 and came into full operation in the first half of 1984. Though initiated by the Government it is a private company with limited liability. The shares of the company are held by:
- the State of the Netherlands: 10%,
- the owners of the nuclear power plant at Borssele (PZEM): 30%,
- the owners of the nuclear power plant at Dodewaard (GKN): 30%,
- the Netherlands Energy Research Foundation (ECN): 30%.

The latter is the most important representative of waste producers not being a nuclear power plant. All shareholders nominate a member of COVRA's control board and thus all waste producers have an influence on COVRA's activities.

Athough the State holds only 10% of the shares, this does not mean that the governmental influence is minor. Through appropriate provisions in the statutes and in the share-holders agreement compliance with the government policy is warranted.
The governmental representative is not depening on the percentage of the shares hold by the State and his vote is essential for all major decisions in the control board. Furthermore a separate control and surveillance mechanism by the State exists, since COVRA has to operate within the limits of a license under the Nuclear Energy Act, a license granted by the Government.

The statutory task of COVRA is to take care of all kinds and categories of radioactive waste in the Netherlands on the basis of the governmental policy. COVRA has a monopoly since it is the only organization authorized to collect radioactive waste. The use of radioactivity is only permitted if licensed under the Nuclear Energy Act and this act stipulates that a licensee can dispose of his waste only by handing it over to the authorized waste collection organization.

COVRA is obliged to conduct its financial affairs in such a way that all costs will be covered by the fees paid for the wastes transferred to COVRA. The costs of future storage and also of final disposal must be covered as well. The latter can not yet be calculated exactly and therefore a provisional fund has been built up.

In practice COVRA's tasks comprises: collection, transport, treatment, storage and disposal. On request COVRA collects the low- and medium-level waste at the producers. They are supplied with standardized drums for liquid and solid waste or cooling-boxes for animal carcasses in deep frozen form.
Collected drums with solid waste are integrally compacted with a 1500 tonnes press. The resulting "parcels" are then embedded in concrete in 200-liter galvanized drums.
Inorganic liquids are chemically treated and the resulting radioactive precipitates are conditioned with cement and packaged in 200-liter galvanized drums.
Organic liquids are stored to await incineration in an installation to be built in future. Animal carcasses are stored in a cooling container and will also be incinerated in future. A flow scheme of the various waste forms is given in Fig. 2.

At present, COVRA stacks the conditioned and packaged waste temporarily in a building on the site of the Energy Research Foundation at Petten. The 200 l drums are received on galvanised metal pallets, in units of three lying horizontally. With an electric forklift truck the pallets are positioned in the store. They are stacked 4 deep and 9 high in long blocks, along the walls and in the centre of the store, leaving corridors for inspection. Drums and containers of different volumes (400 liter up to 1500 liter) are placed among the others, wherever convenient.

Lower dose rate packages are stored along the walls and on the top layer in order to provide additional shielding for higher dose rate packages. The drums on pallets are offset by one half diameter horizontally and vertically so as to eliminate any gaps in the shielding. In the store, the average dose rate is some tenths of a millisievert per hour in the inspection corridors. The dose limit outside the store, at the site fence, is 0,15 mSv per year.

The store has a capacity of 5000 m^3 of packaged low- and medium level waste, which is a good five years production. In principle there is an extension capability for another five years.

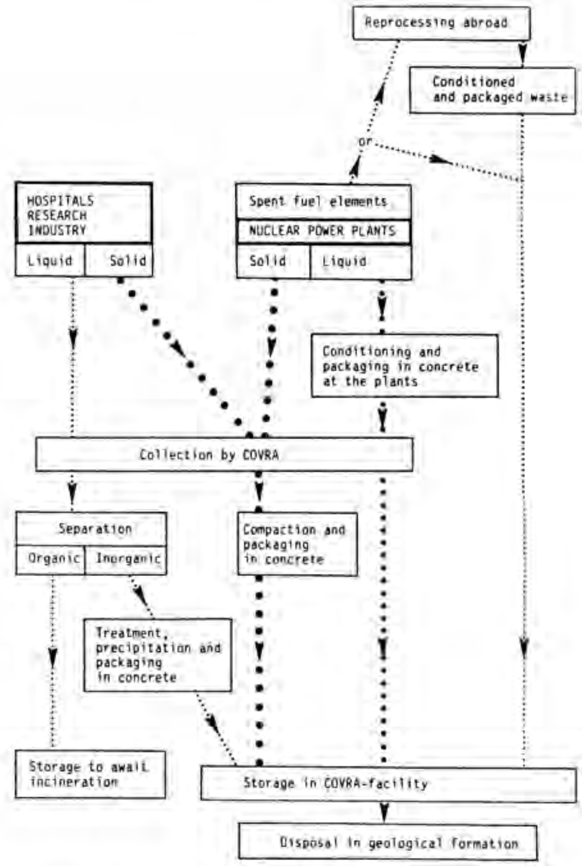

Fig. 2. Flow scheme of Radioactive Wastes in the Netherlands.

FUTURE DEVELOPMENTS

As was explained in the historical development of the management policy, in the near future COVRA will be located at a new site suitable for long-term storage. Of the mentioned sites the preferred one is located at Borsele, and measures about 30 hectares. New treatment facilities will be constructed there alongside modular storage buildings.
At this moment preparations have been made for the overall and engineering design of the new facilities as necessary for the application of a licence under the Nuclear Energy Act. Included now of course will be a storage building for spent fuel and/or high level waste from reprocessing. A general lay-out of the site is given in Fig. 3. Indicated are an office including an exhibition centre, a garage, the building for treatment of low- and medium level waste the building for treatment and storage of spent fuel or vitrified waste and storage buildings.

In the building for treatment of low- and medium level waste the following installations are foreseen:
- reception bay - buffer storages for untreated waste
- high pression compactor
- incinerator for biological waste (carcasses etc.)
- organic - inorganic liquid separator

- waste water treatment system
- incinerator for organic liquids
- shearing and cutting installations
- cementation station
- incinerator for solid wastes
- decontamination facilities
- decay-storage areas for short-lived waste

The incinerator for solid waste, the decontamination facilities and the decay-storage areas are planned but will only be installed when needed, i.e., when there will be an increase in waste production.

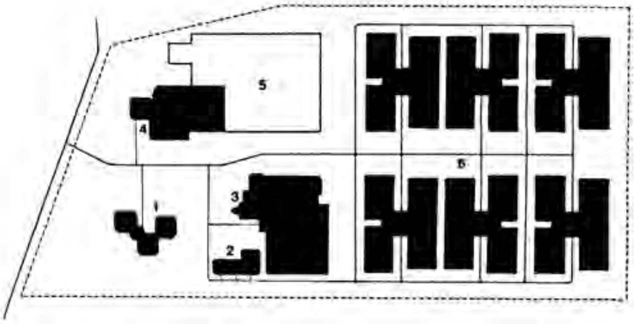

Fig. 3. Lay out of the new COVRA-site at Borsele
1. office building
2. garages
3. treatment building for low- and medium level wastes
4. treatment building for vitrified waste and spent fuel
5. expansion capability for storage of vitrified waste and/or spent fuel
6. storage buildings

The building for treatment and storage of vitrified high-level waste or spent fuel elements will contain the following:

- a reception bay where train-or truck-lorries can be unloaded;
- a cleaning area, where transport containers can be cleaned;
- hot cells, where vitrified waste or spent fuel can be inspected, decontaminated if necessary, and overpacked in storage hulls;
- a transfer-area where the waste will be brought in a storage-loading machine:
- a dry-storage area, with cooling by means of natural ventilation. This part will be built in a modular form and will have a maximum capacity suitable for approximately 5000 tonnes of uranium as spent fuel elements or the equivalent in vitrified waste.

As an alternative for this option also an overall engineering design has already been made for a water-pool storage building and a design is under progress for a container-storage building. A choice from these three options will be made depending on costs, future development of waste quantities and evaluation of the environmental impact.

Because of the specific geographic situation in the Netherlands the dry and wet storage buildings will have to be designed such that they can withstand major flooding. Also the impact on the environment of an air-fighter crash must be minimal.

The storage buildings for low- and medium level waste will also be of a modular nature. Four units comparable with the present stores at Petten will be combined with a central reception bay. Each unit will have a storage capacity of about 5000 m^3. In practice the storage will be performed in the same way as is done now already. One storage unit will be used for high-level, no heat generating wastes. Here thicker shielding in roof and walls is necessary as well as remote handling equipment.

An integral part of the licence procedure is the submission of a site specific environmental impact assessment. Information about the environment at the site in general will be given and the impact on the environment under normal operation and under internal and external accident situations. The assessment report and the licence application will be submitted to Government mid 1987. A licence could be granted then in 1988 and at the end of that year construction work could start. So it is expected that the new site will become operational within the next five years.

THE FAR FUTURE

After a storage period of about 50 - 100 years some 100.000 m^3 of radioactive waste will have been accumulated and then an economic exploitation of a geological disposal facility seems feasible. Also extensive research results and practical experiences from countries abroad will be available by that time. The present Dutch research acitivities on geological disposal are combined in the OPLA program. In general this program deals with:

- safety assessment work, notably development of computer codes for the description of processes related to water instrusion into a disposal mine;
- rock mechanics, including long-term creep behavior experiences with in-situ experiments, validation of computer codes, radiation damage;
- development of safety criteria for geological disposal of radioactive waste, including site selection criteria;
- philosophy and details of waste disposal facilities.

More detailed information on the OPLA-research program will be given in posters presented at this conference: i.e. on engineering safety aspects of the high-level waste disposal project, and on site-specific calculations of radionuclide migrations with the geohydrological model METROPOL. Finally there will be a paper that deals with convergence phenomena in rocksalt, which is not only important for the stability of a repository in rocksalt but has also a dominating impact on the outcome of "flooding" scenario's.

Also mentioned in this context must be the very fruitfull cooperation with the German - Asse project, as well as the existence of a formal agreement between the Dutch Government and the US Department of Energy on the exchange of information concerning research programs and policy development in the field of radioactive waste.

CONCLUSION

Since the beginning of the eighties the present-day radwaste policy in the Netherlands is shaped and structured. The management system choosen is specific for the Dutch situation, however, parallels can be noticed if compared with the situation in surrounding countries. The most striking are the establishment of a specialized waste organization and the development of a policy including temporary storage followed by geological disposal on a longer time.
At this time the realization of the long-term management scheme is set in motion. The years to come will prove that a sound policy was developed and this will create public confidence in and acceptance of the management of radioactive waste.