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In the event of any differences in interpretation of this guide, the Finnish version shall take precendence over this translation.

METEOROLOGICAL MEASUREMENTS IN THE ENVIRONMENT OF NUCLEAR POWER PLANTS AND ONSITE METEOROLOGICAL PROGRAMME

1 GENERAL

During constuction permit review, the license applicant shall provide information, based on the long-term observations of nearest meteorological stations, on the meteorological conditions in the surrounding area. The following items shall be included:

- frequency distribution of wind in various direction and speed classes
- monthly and annual averages for temperature and humidity including maximum and minimum values
- data on precipitation, its various forms and duration of snow cover
- stability distribution in the various directions obtained by means of direct measurements or Pasquill stability classification
- a description of distinguishing meteorological features

In addition, a description of the planned meteorological programme shall be included.

Onsite meteorological measurements covering an equivalent of a whole calendar year shall be conducted prior to the commissioning of the nuclear power plant.

During the operating license review, the applicant is required to present a more detailed description of the meteorological conditions compiled, for example, in accordance with "Guidelines for the Preparation of Safety Assessment Documents for Stationary Nuclear Power Plants with Water-Cooled Reactors, Nordic Working Group on Reactor Safety", as well as the results of the onsite meteorological programme.

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Temporary and long-term meteorological conditions can be determined by means of the onsite meteorological programme during plant operation. For this purpose, near-by weather stations are relied upon as well.

2 SCOPE

This guide gives a presentation of the onsite meteorological programme implemented prior to commissioning, and during the operation, of a nuclear power plant. The measurements conducted are used in calculating dispersion factors for operating and accident conditions. These factors are needed to compute the radiation doses to the local population caused by radioactive materials in gaseous effluents. Furthermore, the influence of the nuclear power plant on local climate is estimated on the basis of these measurements

3 REQUIREMENTS FOR INSTRUMENTS AND MEASUREMENTS

3.1 Measurement procedures

Meteorological conditions are measured by instruments mounted on a mast. The mast shall be sited at approximately the same elevation as finished plant grade and in an area where plant structures and buildings or the surrounding terrain will have no significant influence on the results. The mast shall be sufficiently high to permit measurements of atmospheric stability and representative wind values. In practical terms, it means that the mast shall reach as high as the stack of the plant.

One or several sets of instruments shall be used for weather measurements. It is recommended that the weather mast type in general use in Finland be adopted.

3.2 Siting of Instruments and Required Parameters

Measurements shall be performed at a minimum of 3 levels, spaced at a distance of 30 m from one another. The sensors shall be mounted sufficiently firmly and far away from the mast. At the lowest level, wind speed and direction, temperature and humidity shall be measured, as a minimum. This level shall be placed 10 m above the ground or the tops of the surrounding trees. The second level sensors shall measure at least temperature. At the highest level, wind speed and direction, temperature and humidity shall be measured, as a minimum.

As to observation times and measurement practices, the same procedures shall be followed as at other weather stations in Finland.

3.3
Instrument Accuracy

The accuracy requirements for the instrumentation on the mast are:

- wind direction $\pm 5^{o}$
- wind speed $\pm$ 0.5 m/s in speed range up to 10 m/s, otherwise $\pm$ 5 %. Starting speed of anemometer $<$0.5 m/s
- temperature differences between the two thermometers $\pm$ 0,1 ^{o}C when using absolute measurements or direct difference measurements
- relative humidity $\pm$ 5 % using direct measurements

Recommendation issued by WMO (World Meteorological Organization) shall be adhered to in weather stations.

3.4
Maintenance and Calibration

The maintenance required by the instrumentation on the mast depends upon the methods of measurements. All instruments on the mast shall be calibrated simultaneously once a year. Anemometers shall be calibrated in a wind tunnel.

Maintenance and calibration of instrumentation is performed following the same proceduce as at other weather stations in Finland.

3.5
Data Recording and Compilation

Wind measurements are made either continuously or avaraged over a period of at least 15 minutes once each hour. Temperature and humidity measurements are performed once every hour, using sufficiently slow sensors, or avaraged over the same period as wind measurements. Both strip chart and digital recording of data are utilized.

Wind data are compiled into tables specifying wind speed - wind direction separately for each stability category every month, calendar quarter, grazing season and calendar year. The tables shall present the frequency distribution of the various classes as well as the percentage of the measurement data used as compared to the maximum and average wind speeds. One model for such a table is found in appendix 1.

Recording of data is performed following the same procedure as at other weather stations in Finland.

3.6
Indication of meteorological data in the Control Room of nuclear power plants

Recorders for wind speed and direction at a level representative of the release height of effluents, temperature difference (measured at three levels) and the lowest temperature shall be located in the Control Room. The data shall be stored such that it is possible afterwards to verify the meteorological conditions that prevailed at a certain point of time.

3.7
Reporting of Meteorological Data

The data obtained through the meteorological programme prior to commissioning of the facility are reported during the operating license review. Regulations for reporting meteorological data during operation are provided in Guide YVL 7.8.

4
LITTERATURE. RECOMMENDATIONS

Guidelines for the Preparation of Safety Assesment Documents for Stationary Nuclear Power Plants with Water-Cooled Reactors, Nordic Working Group on Reactor Safety, 1975

Onsite Meteorological Programs, Regulatory Guide 1.23, U.S. Atomic Energy Commission, 1972

D.H.Slade, Meteorology and Atomic Energy, TID-24190, U.S. Atomic Energy Commission, 1968

Table 1 Duration of Meteorological Condition (hr)

Stability class:

Observation time:

Wind	Speed (m/s) at highest level								Total	Average
Direction	0 to 1	1 to 3	3 to 5	5 to 8	8 to 12	12 to 16	16 to 20	20>20		speed m/s
1 to 30										
31 to 60										
61 to 90										
91 to 120										
121 to 150										
151 to 180										
181 to 210										
211 to 240										
241 to 270										
271 to 300										
301 to 330										
331 to 360										
Total										

Periods of calm (hours):

Missing data (hours):

Tables are compiled for stability categories A,B,C,D,E,F and G.