

5. Social and Business Risk Management: Contributing to More Comfortable and Safer Communities

(1) Development of cyber security risk management framework for electric utilities: FY 2006 - FY 2008

[Objectives]

To clarify measures to evaluate and reduce artificial risks, such as IT failure, to firmly ensure a stable supply of electricity which is essential for national life.

[Principal Results]

- The findings of the interim examination of desirable security measures with a high cost-benefit performance were compiled into a report and a basic framework to evaluate the IT failure risk was developed.
- A basic technique to analyse inter-dependency was developed to analyse the impacts and spread of damage between closely related important infrastructure and such analysis was conducted taking the different impacts due to durations of failure into consideration.

(2) Construction of earthquake scale assessment recipe by high accuracy active fault survey: FY 2006 - FY 2008

[Objectives]

To create a rational and highly reliable earthquake risk management recipe in connection with the aseismatic design of important nuclear power facilities based on a high accuracy active fault survey and other surveys.

[Principal Results]

- A highly accurate digital elevation map was prepared using aerial laser surveying to extract topographical deformation due to the accumulated movement of the earthquake source fault in the epicentre area of the Nagano West Earthquake in 1984. In addition, it was made clear topographical deformation which could not be recognised by existing techniques would be extracted through the application of the newly developed image analysis technique.

- The latest helical X-ray CT scanner was introduced to examine the deformation process of the geological structure due to fault displacement and its function was verified in a laboratory model experiment.

(3) Disaster prevention assessment technology for power facilities against wind and storms: FY 2006 - FY 2008

[Objectives]

To establish a disaster prevention assessment technology against wind and storms based on analysis of the weather forecast, wind analysis, wind observation and non-linear structural analysis, etc. in order to ensure the adequate construction, operation and maintenance of transmission and distribution facilities against the elements and to predict damage by strong wind; to formulate draft guidelines for Japanese-type wind power generation; to develop a system to predict the electric energy to be generated by wind power generation based on the weather forecast.

[Principal Results]

- The maximum wind velocity and wind direction prediction technique which takes the effect of complicated topography increasing or decreasing the wind velocity into consideration was verified using existing typhoon data and a prediction system for typhoon damage to distribution facilities was developed incorporating the above technique. Using this system, likely sites for damage to distribution facilities were predicted with the approach of a typhoon and the applicability of the system to the rehabilitation work of power utilities was confirmed.
- A prototype system to predict the electric energy to be generated by wind power generation was developed by combining a weather model featuring wind power generation facilities in an area with complicated topography with a local wind condition model and the sufficient prediction accuracy of this system was confirmed.
- The provisional guidelines for the design of a Japanese-type windmill were formulated based on the wind tunnel test using a model windmill and the analysis of turbulent wind in an area with complicated topography. Following this exercise, draft revisions of the technical standards for wind power generation facilities were presented to the central government.

(4) Assessment technology of ground seismic collapse effect: FY 2006 - FY 2008

[Objectives]

To conduct an experimental and analytical assessment of the form of ground collapse at the time of a major earthquake and the effects of such a collapse, featuring the ground of a nuclear power facility and its surrounding slopes, in order to establish a technology to assess the effects of the seismic collapse of the ground.

[Principal Results]

- The accuracy of the already developed dynamic 3D nonlinear response analysis method was improved by means of modifying the ground model capable of taking the phenomenon of liquefaction into consideration. In addition, a laboratory element test featuring a slope-structure system and a centrifugal loading model test, etc. were conducted to develop prototype codes for analysis of the effects of slope collapse to verify the accuracy of the analysis.
- A simplified method was established to assess the dynamic damage curve of a nuclear reactor building due to ground or neighbouring slope collapse. Another method to assess the ground stability at the time of an earthquake, newly incorporating a deformation performance indicator, was also developed.

(5) Development of lightning damage risk management technology: FY 2006 - FY 2011

[Objectives]

To develop an insulation design technology considering the lightning risk and an insulation coordination technology for a total system which includes low voltage, control and communication circuits for the purpose of reducing the construction and maintenance costs of power facilities.

[Principal Results]

- The basic concept for lightning risk management was developed. This risk management consists of three phases, i.e. lightning hazard evaluation, lightning risk assessment and lightning damage risk management.
- “A facility to test the lightning surge mode of the low voltage and communication circuits of customers” was developed and the characteristics of lightning surge were quantitatively determined.
- A Rogosky coil capable of measuring low frequency lightning current was developed to prepare a lightning resistance design guide for wind power generation equipment and the lightning energy striking wind power generation equipment in winter in an area with frequent lightning was quantitatively determined. Moreover, the relationship between a lightning strike on wind turbine blades and the surface damage was clarified through a simulation test.

(6) Technology to support the recovery of electric power distribution facilities from a disaster: FY 2006 - FY 2008

[Objectives]

To develop real-time damage prediction and disaster recovery simulation technologies and a technique to assess the social impacts of disaster recovery to improve the efficiency of the rehabilitation work for distribution facilities damaged by earthquake, etc.

[Principal Results]

- A hazard map and a predicted facility damage map were prepared for the model area to predict real-time damage at the time of a typhoon or earthquake. In addition, a prototype real-time damage prediction system was developed.
- A prototype simulator was developed to simulate the recovery process of distribution facilities for each branch to predict the time to complete the recovery work when information on the situation of damage due to a typhoon or earthquake is provided.

(7) Analysis and presentation of global warming prevention policies (promoted project subject): FY 2005 - FY 2007-12-10
[Objectives]

To compile more effective policies regarding the international framework for global warming prevention as well as global warming prevention efforts in Japan since the launch of the Kyoto Protocol with a view to contributing to the design of suitable systems.

[Principal Results]

- The ex-post evaluation of pioneering cases of emission right trading was conducted in US SO_x trading and European CO₂ trading and it was concluded that many of the expected benefits based on the theory have not been realised.
- The ex-post evaluation of Japanese technology development programs for alternative energies and energy conservation (Sunshine, Moonlight and New Sunshine Programs) was conducted and it was concluded that the cost-benefit performance of these programs was generally good.
- Global energy scenarios were examined and it was shown that there could be a case of the low energy price continuing due to the economic slow down originating from China.

(8) Comprehensive assessment of the Japanese model for electricity liberalization and future direction: FY 2006 - FY 2008
[Objectives]

To objectively evaluate the reform of the electricity business system in Japan from the viewpoint of society in general and also from the long-term perspective based on the study and analysis of the trends of wholesale and retail electricity markets in Japan and abroad, business and financial data and electricity trading data, etc.

[Principal Results]

- It was substantiated that the potential pressure for competition due to the existence of the target customers for liberalisation, private power generation facilities and other electric companies was significantly contributing to the lowering of the electricity tariff.
- A proposal was made to use a simultaneous equation consisting of two functions, i.e. supply and demand, to analyse the trading trends in the spot market of the Japan Electric Power Exchange. It was confirmed that the use of such an equation can accurately emulate the actual trading situation.
- “Study group on electricity liberalization”, the members of which include external experts, examined a desirable model for liberalization of the electricity market in Japan and published a report entitled “Future Prospects and Issues of Electricity Liberalization in Japan” covering such issues as, among others, the performance evaluation of electricity liberalization so far, lessons learned from experience and the future direction for the Japanese model for liberalization.

(9) Construction of human performance enhancement measures at power-related facilities: FY 2006 - FY 2008
[Objectives]

To construct a comprehensive range of “human performance enhancement measures” to prevent accidents and problems at the time of the construction and operation of power facilities for their field application.

[Principal Results]

- A framework for “support system for enhancement of human performance” (Fig.6) was developed to provide a tool, etc. to solve problems which involve a human factor at operating power facilities through a combination of human error analysis, safety assessment, education and risk assessment, etc. Another tool called HINT/HFT to support the root cause analysis (RCA) of human error was also developed.
- Instances of human error among accidents and problems at domestic nuclear power plants reported under the Nuclear Reactor Control Law and Electricity Utilities Industry Law were analysed and evaluated. These cases and their evaluation reports were registered in a database for the purpose of information sharing within the electricity industry.

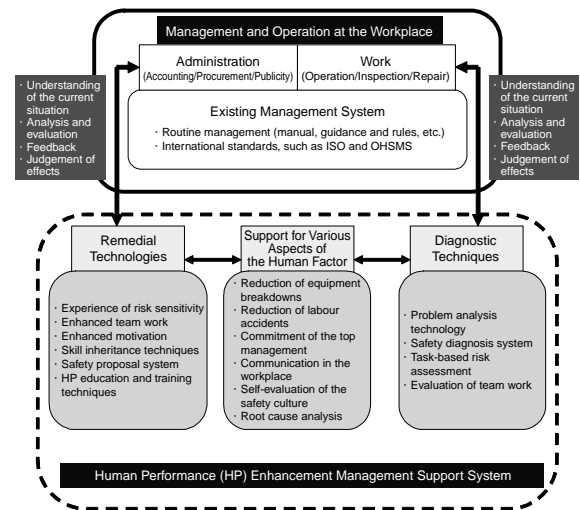


Fig.6 Systematisation of Human Performance

(10) Biological effects of intermediate frequency magnetic fields: FY 2006 - FY 2008
[Objectives]

To evaluate the effects of the intermediate frequency and commercial frequency magnetic fields on human health through experiments with chicken eggs and rodents.

[Principal Results]

- A mammalian cell test was conducted to examine the cellular gene level biological effects of the intermediate frequency magnetic fields generated by an induction heating magnetic cooker and other equipment using “a device to expose cells to intermediate frequency magnetic fields”. It was concluded that no effects due to magnetic fields occur.
- An exposure test was conducted using chick embryos on which many studies involving commercial frequency magnetic fields have been conducted to examine the effects of magnetic fields on ontogenesis. No effects of magnetic fields were found.