

Environmental Science Research Laboratory

Brief Overview

The Environmental Research Laboratory, aiming at resolution of various environmental problems from region scale to global scale related to the power industry, is engaged in increasing fundamental technology related to atmosphere, marine, hydrosphere, biology, environmental risk and biotechnology.

Achievements by Research Theme

Atmospheric and Marine Environment

【Objectives】

The field observation procedure, prediction and evaluation procedures for regional atmospheric and marine environment, related to global warming, urban atmospheric and marine problems, are developed.

【Principal Results】

- The evaluation procedure for the flow and thermal environments around urban buildings was developed and this procedure was applied through variations of energy supply and regulation of atmospheric material within urban areas in the future [V09017]. Furthermore, a new computational fluid dynamic (CFD) model of flow and thermal environments within urban areas was developed considering a large-scale turbulent motion caused by a mesoscale disturbance and applied to an actual urban area [V09024] (Fig. 1).
- The stack gas diffusion evaluation model for nuclear facilities, developed by CRIEPI, was applied to actual plants and its prediction accuracy was clarified [Trans. At. Energy Soc. Japan, 8, 184, 2009].

Hydrospheric Environment

【Objectives】

To develop an assessment technique to solve various environmental problems at reservoirs, rivers and coastal areas for the purpose of achieving the efficient management and operation of power plants.

【Principal Results】

- For efficient monitoring of coastal environment around power plants, a new method of sea surface salinity measurement in wide area using the high resolution DBF ocean radar was developed on the basis of the sea surface electric conductivity theory [V09003].

Biological Environment

【Objectives】

Development of effective methods to elucidate the effect of construction and operation of electric power plants on wildlife and ecosystems, and of countermeasures for aquatic nuisance organisms and birds/animals causing problems in the operation of electric power plants.

【Principal Results】

An automatic monitoring system for cypris larvae of barnacles, one of the most common nuisance organisms for coastal electric power plants, was developed in cooperation with Kansai Electric Power Co. Inc. The system worked successfully at a power plant continuously detecting the larvae without serious trouble for a period of 5 months.

Environmental Risk Assessment

[Objectives]

To support environmental risk management in the electric power industry, we develop methods for the assessment and management of environmental risks related to chemical substances and intermediate frequency magnetic fields, and technologies for simple and rapid measurements of hazardous chemicals in waste water and for effective uses of solid waste.

[Principal Results]

- Results from exposure experiments using microorganisms, cells, and experimental animals, including rats and chick embryos, indicated that intermediate frequency magnetic fields generated mainly by home appliances did not show genotoxicity, promotion potentials, acute and sub-chronic toxicity, and reproductive and developmental toxicity under employed experimental conditions [V09007,V09008,V09021].

Biotechnology

[Objectives]

We develop microbial technology for resource recycle and waste water treatment, biosensing technology to trace chemicals and plant production technology as food or energy as biomass.

[Principal Results]

- Microbial process for conversion from biological waste to methane was stabilized with high conversion ratio by using carbon fiber as internal solid phase for bacterial consortia [V09009]. Enzyme production using Escherichia coli was enhanced under the culture condition where potentially controlled by electrolysis [V09026].
- New durable depurating module and alcohol supply equipment were developed and introduced to nitrogen removing bioreactor previously proposed by us. Improved reactor was operated to remove nitrogen from waste water for a year at a power station. Stable and reliable nitrogen removal proved practicality of improved bioreactor [V09033].
- Light conditions to enhance polyphenol accumulation in basil was experimentally identified by changing lighting time with varied wavelength light [Y09030].

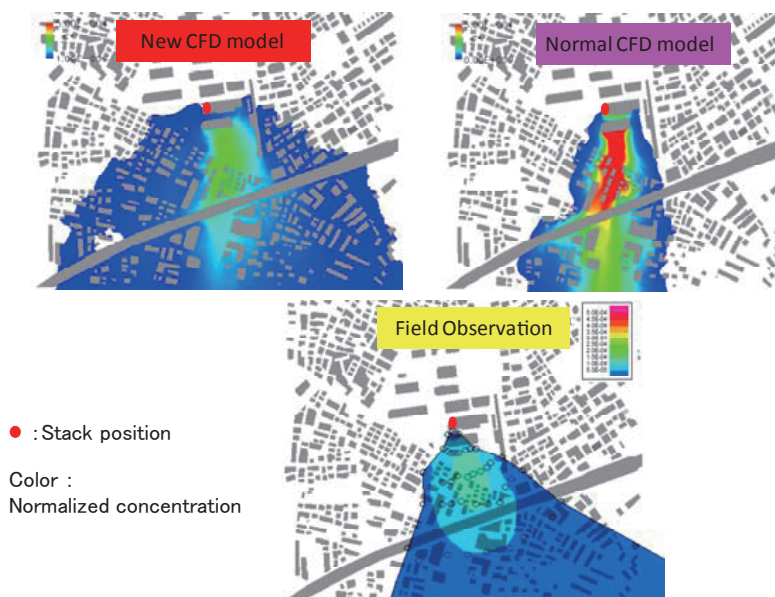


Fig.1 Tracer gas mean concentration (1 hour average value) at ground surface around the urban buildings.
The calculated profiles obtained by new CFD model are in good agreement with those from field observations.