

# Ensuring Safety for Communities and Employees and Reassurance for Customers Earthquake Early Warning (EEW) Disaster Mitigation System Protecting Semiconductor Plant

Miyagi Oki Electric Co., Ltd. is the OKI Group's manufacturer of semiconductors. Learning from the experience of the South-Sanriku Earthquake, which struck Miyagi Prefecture in 2003, it has given top priority to measures designed to minimize earthquake damage, ensure the safety of local residents and employees, and reassure customers that interruptions to production will be kept to a minimum. As part of these efforts, in 2005 Miyagi Oki Electric developed a Earthquake Early Warning (EEW) Disaster Mitigation System that utilizes EEW information, in collaboration with the Real-time Earthquake Information Consortium (REIC)\*1.

**\* 1 Real-time Earthquake Information Consortium (REIC):**

This organization was established in 2003. Its mission is to facilitate the effective use of real-time earthquake information, including early warning information. Activities include the development of structures for cooperation with various organizations, including government agencies, local governments, public facilities, businesses and schools, the standardization of systems, data and information formats, research and development relating to information utilization prototypes for individual sectors, and the development of reliable, fast and economical data transmission methods.

### Development of System Prompted by Earthquake Damage

Japan is an earthquake-prone country. Since 1995, major earthquakes have caused widespread damage in Kobe, Miyagi and Niigata. The earthquake damage to businesses is not only the direct impact including injuries to employees and damage to facilities, but also the indirect costs of interruptions to manufacturing activities.

Located in Ohira-mura, Kurokawa-gun, Miyagi Prefecture, Miyagi Oki Electric was forced to suspend production for approximately 20 days as a result of the earthquakes that struck the region in May and July of 2003, both of which had an intensity of 5 on the Japanese shindo scale. The damage amounted to approximately ¥3 billion, and there were also major disruptions for customers awaiting deliveries of products from the factory.

It is impossible to avoid earthquakes. A particular problem for semiconductor factories is the risk that earthquakes will cause leaks, corrosion or fires caused by the special hazardous gases and chemicals used in manufacturing processes. The continuity of manufacturing operations can also be seriously affected by damage to expensive and sensitive fabrication equipment.

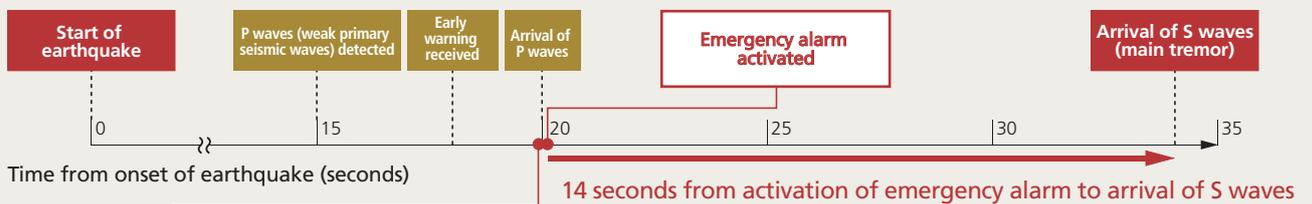
Kentarō Yoshioka, President of Miyagi Oki Electric, was keenly aware that his company had a responsibility to do everything possible to ensure the safety of local residents and employees, and to maintain reliable supplies to its customers. He sought the advice of Professor Masato Motosaka, an earthquake damage limitation expert in the Tohoku University's Graduate School of Engineering Disaster Control Research. Through this contact Yoshioka learned about an earthquake early warning (EEW) system\*2 that was developed by the Japan Meteorological Agency and the National Research Institute for Earth Science and Disaster Prevention.

Early warning of the approach of strong seismic waves would provide time for a variety of countermeasures to be taken in the factory. This knowledge prompted Miyagi Oki Electric to join REIC, which was conducting research and surveys to ascertain the practicality of an EEW system as part of a Ministry of Education, Culture, Sports, Science and Technology project to develop an advanced early warning network. As a member of REIC, Miyagi Oki Electric commenced collaborative development of a disaster mitigation system for industrial plants based on the use of EEW technology.

**\*2 Earthquake early warning system:**

This system estimates the intensity and size of an earthquake based on analyses of readings from seismographs located near the epicenter.

### Time Chart for System Operations (Scenario: Earthquake Offshore from Miyagi Prefecture)



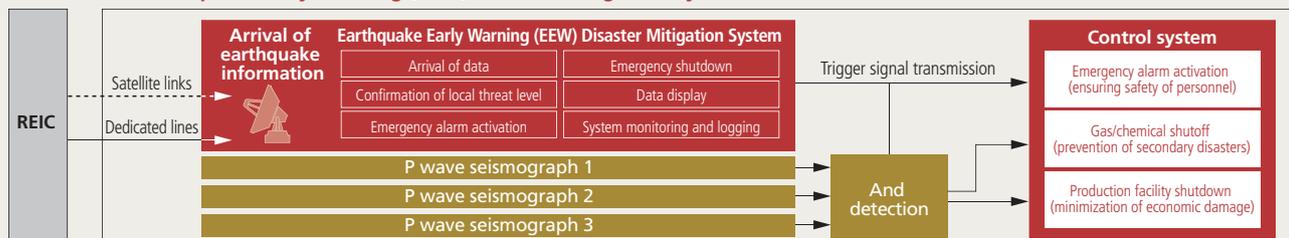
Activation of Earthquake Early Warning (EEW) Disaster Mitigation System



### Countermeasures

- Ensuring that employees are in safe situations or evacuated to safe locations
- Prevention of secondary accidents through termination of supplies of special hazardous gases and chemicals
- Minimization of damage to equipment and products through shutdown of manufacturing facilities

## Overview of Earthquake Early Warning (EEW) Disaster Mitigation System



### A Few Seconds' Warning the Key to Safety

By using the EEW data, the Earthquake Early Warning (EEW) Disaster Mitigation System will be able to trigger an alarm before the arrival of the S waves carrying the main tremor. Such an advance warning would provide time to take various actions, including the shutoff of supplies of hazardous gases and chemicals, and would be the key to the mitigation of human casualties and secondary disasters. However, while intensity data and other aspects of the early warning system are now accurate enough for practical use, the system is not yet perfect. Once semiconductor manufacturing facilities have been shut down, it takes several hours to resume operations. Unnecessary losses would be incurred if disaster-prevention measures were initiated on the basis of inaccurate data. Miyagi Oki Electric has therefore enhanced the accuracy of the system by installing its own P wave seismographs in the grounds of its plants and combining data from those instruments with information supplied by the early warning system.

There is believed to be a 99% probability of an offshore earthquake in the vicinity of Miyagi Prefecture within the next 30 years. Scientists estimate that the S waves would reach the facilities of Miyagi Oki

Electric approximately 34 seconds after the start of such an earthquake. The Earthquake Early Warning (EEW) Disaster Mitigation System would require around 20 seconds to activate an alarm, providing 14 seconds before the S waves' arrival. Though brief, this would be enough time to take various actions to minimize damage and ensure an early resumption of operations after the earthquake.

Miyagi Oki Electric introduced the system in September 2005. Shortly before that on August 16th, an earthquake with an intensity of just over 5 on the Japanese shindo scale struck Miyagi Prefecture. Since 2003, Miyagi Oki Electric had been working to strengthen its buildings and facilities against earthquakes and ensure the safety of its employees. The effectiveness of these measures was proved by the fact that the damaged plant recovered full operation six days after the earthquake. However, the company is determined to minimize damage and reduce the interruption to operations further by using the new system as the basis for extremely effective earthquake countermeasures.



These evacuation guidelines are issued to all employees.

### Comments from an Expert

#### Targeting Further Improvements in the Technology

Senior Managing Director, Real-time Earthquake Information Consortium  
**Yukio Fujinawa**



We have worked with businesses and agencies to develop 14 prototypes for the use of earthquake early warnings by organizations in various sectors, such as fire stations, medical institutions and schools. With the cooperation of Miyagi Oki Electric, which has previously suffered earthquake damage, we have been able to develop an EEW application system for a semiconductor plant and establish a highly reliable system based on the combined use of seismic data from seismographs in the plant and earthquake early warnings. We will continue to work closely with Miyagi Oki Electric to achieve further improvements in this technology.

#### Operating a Semiconductor Plant in an Earthquake-Prone Country

President, Miyagi Oki Electric Co., Ltd.  
**Kentaro Yoshioka**



We have an important responsibility to local residents and the customers who rely on our products to prevent secondary disasters and restore operations as quickly as possible. This new system will shut down some of our key manufacturing facilities in the event that an earthquake with an intensity of 5 or greater is detected. We plan to implement it fully from the year ending March 2007 onwards. To ensure the safety of our employees, we have updated our manual of procedures for major earthquakes, which is distributed to all employees, and implemented disaster drills. As a company operating a semiconductor plant in an earthquake-prone country, we must assume that major earthquakes will occur, and we will continue to implement a range of countermeasures to ensure the continuity of our business activities.

The OKI Group has begun supplying Real-Time Earthquake Disaster-Prevention Systems to customers in the year ending March 2007.