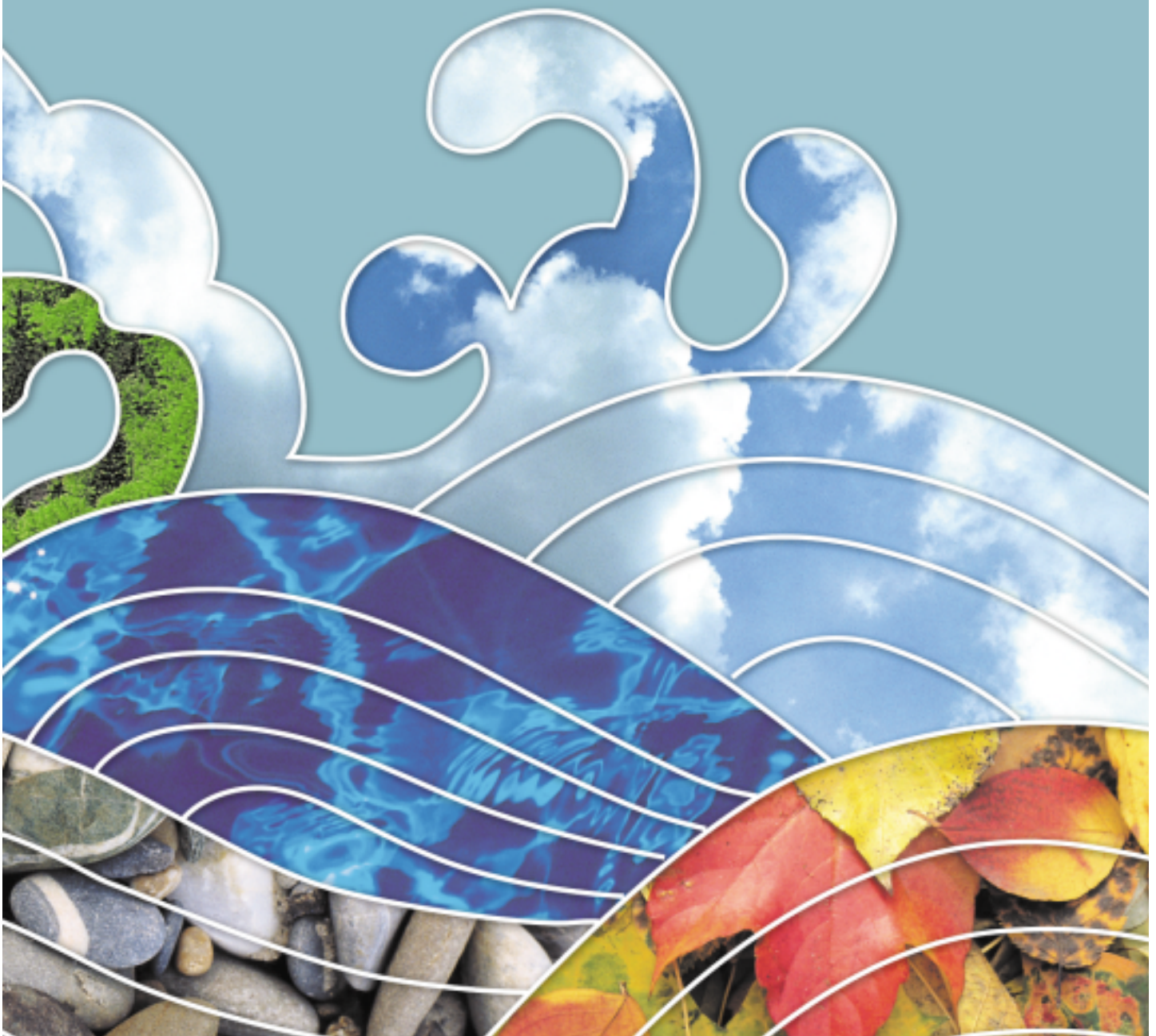




TSMC	2 0 0 0
Environmental, Safety and Health	

*Annual Report*





#### About this Report

- ESH performance indicators of our 2000 report were collected from Fab1 to Fab8.
- ESH performance indicators of our 2000 report are not appropriate to make a comparison with other industries.

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tsmc

Environmental, Safety, and Health  
Annual Report

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tsmc

Environmental, Safety,  
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## Letter from the President



## Letter from the President

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TSMC regards Environment, Safety, and Health (ESH) as important aspects of overall operations and activities. When building new factories, all available pollution control and safety equipment is considered. Those equipment are operated with precise maintenance by well-trained professional personnel who allow TSMC to provide optimal protection to the environment and its employees. We consider such protection to be a basic requirement. In addition TSMC has three core elements which allow it to achieve excellence in the fields of ESH:



### 1. Support and Commitment of Top Management

The support and commitment of top management are clearly articulated via the ESH policy. Site managers conduct inspections and attend routine ESH committee meetings to understand and maintain optimal ESH conditions. Every employee's evaluation includes his ESH performance and involvement. ESH is not just the work of a specialized team of engineers, but every employee's responsibility.

### 2. Clear Responsibility and Competent Training

TSMC has dedicated ESH organizations: the corporate ESH Risk Management Department (RM) and the on-site ESH Industrial Safety and Environmental Protection Department (ISEP). RM acts as a planning and auditing department and sets company policy and general ESH guidelines. RM looks for potential risks using system auditing programs. They introduce the best available technologies and practices to prevent or solve environmental problems. On-site ISEP creates ESH procedures and operating instructions and performs daily inspections to assure that these have been followed.

TSMC believes employees with adequate training is the key element to do things well. TSMC invests significant resources in ESH training.

### 3. A Management System to Achieve Continuous Improvement

Continuous improvement is a core philosophy at TSMC and includes TSMC's ESH management system. TSMC received ISO-14001 Environmental Management System (EMS) certificate in August 1996, and OHSAS-18001 Occupational Health and Safety Management System (OHSMS) certificate in January 2000.

It is every company's responsibility to provide a safe, clean, and healthy workplace for employees. At TSMC, each employee embodies this thinking and works to protect the environment, maintain everyone's health, and keep the workplace safe while conducting his business. TSMC will continue its ESH efforts based on these beliefs. Furthermore, we encourage all industries and companies to work together to make our future better, and to make our next generation healthier.

President

F. C. Tseng

May 2001

tsmc

Environmental, Safety,  
and Health Annual Report

2000



# Company Profile

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## Company Profile

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TSMC (Taiwan Semiconductor Manufacturing Company) is located in the Hsin-Chu Science-Based Industrial Park in what is referred to as Taiwan's "Silicon Valley." The company is listed on the Taiwan Stock Exchange (TSE) and on the New York Stock Exchange (NYSE) under the trading symbol of TSM.

It is not by chance that TSMC is the world's largest and most successful dedicated independent semiconductor foundry . It is by plan and by charter. As the first "pure play" foundry company, we have experienced strong growth by being a true partner with our customers and by not competing against them by designing and manufacturing our own brand of IC products.



Companies from around the world have trusted TSMC with their integrated circuit manufacturing needs for over 13 years (we were founded in 1987) and we continue to work hard at earning that trust every day.

The evolution of advanced IC technology over the past decade has been so rapid that it has changed the way that all companies do business. Demands for faster design cycles have increased. Demands for faster time-to-market have increased. Demands for higher speeds and product quality have increased as well. These are some of the many reasons companies turn to TSMC as their manufacturing partner.

We understand the competitive nature of our customer's business and we are sensitive to what helps make them stronger. We firmly believe and practice the principal that our customers' successes come first. Simply stated, their success is our success.

We have crystallized our focus on those business practices that mean the most to our customers. Process technology, manufacturing excellence, delivery, and customer service.

Being the largest and most successful dedicated IC foundry in the world, we put more resources into our manufacturing facilities and capacity than nearly anyone else. We continue to be the trusted source to a global collection of innovative and savvy businesses, large and small, who appreciate our steadily increasing manufacturing capacity and consistent volume production levels. As we enter into the new decade, we are enhancing our ability to serve our customers by operating,

expanding and developing the following facilities:

- Two 6-inch wafer Fabs in full operation (Fabs 1 & 2)
- Nine 8-inch wafer Fabs in full operation (Fabs 3, 4, 5, 6, 7A, 7B, 8A, 8B, plus WaferTech)
- One 8-inch wafer Fab facility through our TSMC affiliate-Vanguard
- Ground breaking for the company's two initial 12-inch wafer fabs took place in late 1999 in Hsin-Chu Science-based Park and Tainan Science-based Industrial Park
- A joint venture with Philips Semiconductor and with Singapore's EDB Investments (SSMC) will also bring increased capacity in the coming years
- WaferTech, TSMC's first joint venture foundry in 1998 continues to ramp ahead of schedule to meet the needs of our customers

TSMC is committed to leading the dedicated semiconductor foundry business into a new generation of technology and service delivery. Our ability to do this is a tribute to our employees worldwide. It is their integrity and genuine concern for our customer's needs that set TSMC apart from all other manufacturers. As we expand our offices in Taiwan, the United States, Europe, and Japan, we will continue to strive to meet our customers' needs and to exceed their expectations. We exist because of our customers and we honor their trust in allowing us to support them.





## ESH Policy

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### Taiwan Semiconductor Manufacturing Company

#### Environmental, Safety and Health Policy

Founded in 1987, TSMC provides state-of-the-art semiconductor manufacturing services. All materials and tools used in the manufacturing process, including silicon wafers, chemicals, gases, electricity, water, etc., should be well managed in daily operations. TSMC's activities should not only meet relevant environmental, safety and health (ESH) legal requirements, but should also be benchmarked against recognized international practices. TSMC's goals are to prevent incidents, improve employee safety and health, protect property, prevent pollution, and to efficiently use all resources. To achieve these goals, TSMC is committed to continually improving the following.

- (1) All managers should take responsibility to ensure a safe and healthy workplace and maintain the highest-level quality of the environment.
- (2) Comply with ESH legal requirements, and make continuous efforts to implement international state-of-the-art practices.
- (3) Promote ESH concepts and awareness company-wide by providing sufficient training and resources, and actively seek cooperation and communication with employees.
- (4) Introduce new international ESH concepts and technologies to enhance and support all levels of management.
- (5) Conduct ESH assessments for new tools and materials used in research and development to reduce ESH risks.
- (6) Communicate ESH issues with suppliers, and encourage them to improve their ESH performance.

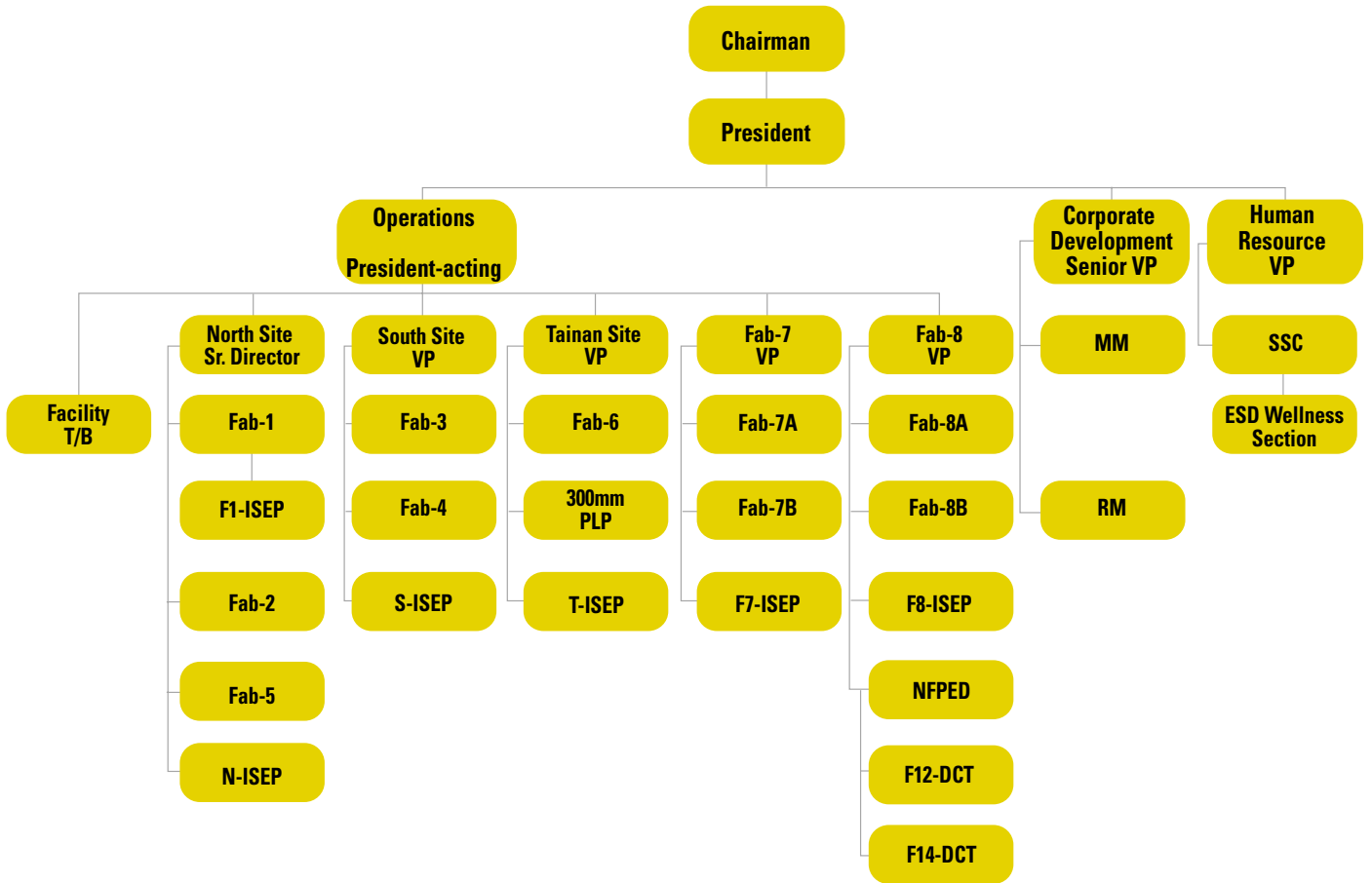




# ESH Organization

Taiwan Semiconductor Manufacturing Company

ESH Organization (Year 2000)



Note:

T/B : Technical Board

ISEP : Industrial Safety and Environmental Protection

PLP : Pilot Line Project

NFPED : New Fab Planning & Engineering Division

DCT : Design Construction Team

MM : Material Management

RM : Risk Management

SSC : Shared Services Center

ESD : Employee Services Department

Management is an important part of environmental performance maintenance. We re-organized the ESH department in 1995. We established the corporate ESH Risk Management Department (RM) and the on-site ESH Industrial Safety and Environmental Protection Department (ISEP). RM acts as a planning and auditing department and sets company policy and general ESH guidelines. RM looks for potential risks using system auditing programs. They introduce the best available technologies and practices to prevent or solve environmental problems. On-site ISEP creates ESH procedures and operating instructions and performs daily inspections to assure that these have been followed.

In addition, TSMC established Operation Technical Board in 1998. Operation Technical Board is acting within TSMC's operational area to enhance the communications, information sharing and cooperation between fabs. The Operation Technical Board integrates limited resources in operation areas to generate Best Known Methods(BKMs) and implement standardization accordingly via cross-fab cooperation, furthermore, to achieve TSMC competitive advantages in the foundry business.

The organization of Operation Technical Board includes Manufacturing, Integration, Lithography, Etching, Diffusion, Thin-Film, PATS, and Facility Technical Board. Regarding ESH, we generated BKMs and implemented standardization to share our experience under the Facility Technology Board.



## ESH Milestones



ISO –14001 Certificate



OHSAS –18001 Certificate

Time	Milestones
1987	TSMC founded
1990	ISEP founded
1995	Established corporate ESH Risk Management Department (RM) and on- site ESH Industrial Safety and Environmental Protection (ISEP)
1996	ISO-14001 Certification of Fab2
1997	ISO-14001 Certification of Fab1, Fab3, and Fab4.
1998	TSMC established an Operational Technical Board. The Operational Technical Board is a virtual/fluid organization within TSMC's operational area. Its function is to enhance the communications, information sharing and cooperation between fabs. Operation Technical Board integrates limited resources in operational areas to generate Best Known Methods(BKMs) and implement standardization via cross-fab cooperation, and to achieve TSMC competitive advantages in the foundry business. The organization of the Operation Technical Board includes Manufacturing, Integration, Lithography, Etching, Diffusion, Thin-Film, PATS, and Facility Technical Board. Regarding ESH subject, we generate BKMs and implement standardization and share the experience under the Facility Technology Board.
1998	As a member company of SEMATECH. We participate in ESH projects to get the advanced ESH technology then to make continuous improvement.
2000	ISO-14001 Certification of Fab5
2000	ISO-14001 Certification of Fab7
2000	OHSAS-18001 Certification of Fab1, Fab2, Fab3, Fab4, and Fab5



# Global Warming Gases Emission in the Semiconductor Industry

Perfluorinated Compounds(PFCs) such as  $CF_4$ ,  $C_2F_6$ ,  $CHF_3$ ,  $C_3F_8$ ,  $NF_3$  and  $SF_6$  are used in the CVD chamber cleaning and etching process. During the process, 60%~80% of PFCs are emitted into the atmosphere without reactions and PFCs which are listed as global warming gases due to their high Global Warming Potential (GWP) listed as table.

### Properties of PFCs

GWG	$CO_2$	$CH_4$	$N_2O$	$NF_3$	$CF_4$	$C_2F_6$	$SF_6$	$CHF_3$	$C_4F_8$
Lifetime in atmosphere (Yr)	50 ~ 200	12	120	50 ~ 740	50,000	10,000	3,200	264	2,800
$GWP_{100}$	1	21	310	8,000	6,500	9,200	25,000	11,700	8,700

### PFCs Emission Reduction Control Status

All member companies of Taiwan Semiconductor Industrial Association (TSIA) have agreed to the goal of reducing PFC emission to 10% below 1998\* levels by 2010. In the mean time, a written agreement has also been signed between member companies to correspond with the PFCs reduction activities. Those Activities are

- Reviewing PFCs efficiency in the process
- Looking for the best available technologies to reduce/recycle PFCs emission
- Searching for environmental friendly chemicals to substitute PFCs current use in process

In addition, member companies also agree to share non-confidential technologies to accelerate the effects of PFCs reduction.

### Implementations of PFCs reduction in TSMC

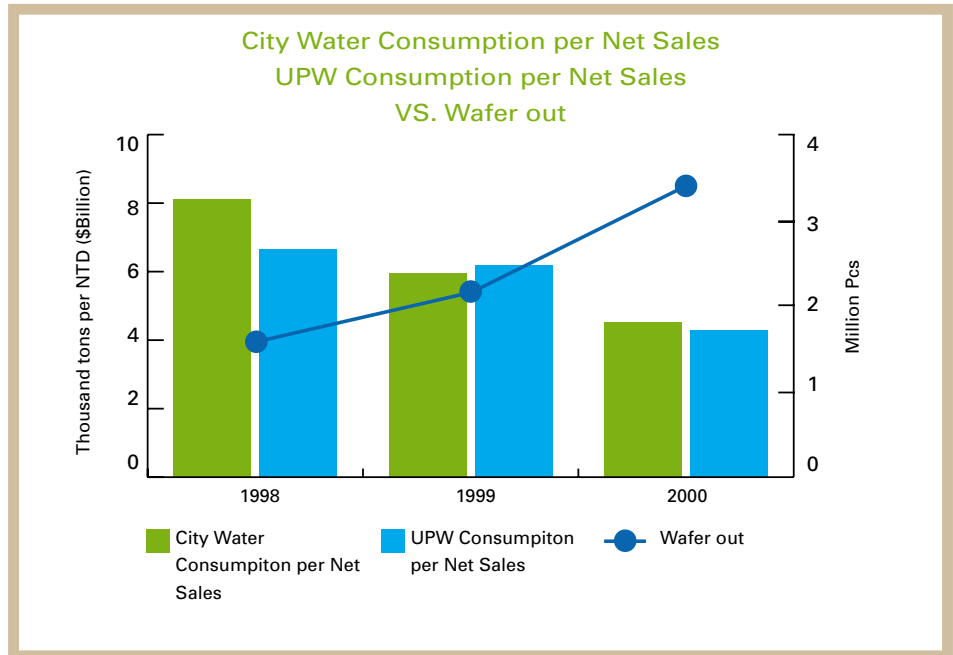
- To comply with the PFCs reduction baseline and target year that has been set up by TSIA, TSMC has teamed up with a PFCs reduction working group in 1999 to promote activities based on the prioritized strategy of (1) process optimization (2) Chemical replacement (3) Abatement (4) Recycling/Reclaim.
- To achieve the 2010 goal, for fabs operating after 2001, fabs should achieve a 95% reduction, 85% for fabs operating in 1999~2000, and 35% for fabs before 1998.
- Held a workshop for the “Application of gas analysis tech in PFCs measurement” and invited experts from the Industrial Technology Research Institute(ITRI), new chemical suppliers, and tool vendors to address new technologies in PFCs reduction.
- To promote activities such as lowering the flow rate of  $CF_4$  and  $NF_3$  to reduce emission quantity without affecting wafer yield, PFCs species chemical replacement and PFCs destruction devices survey...etc.

Note: Baseline year-1998\* which represented the average PFCs emission value of year 1997 and year 1999.



**Resources and Energy**

**Water Resource Recycling**



Since Fab6 started operating in early 2000, the total production of TSMC increased dramatically. The wafer output increased in 2000 to 2.1 times that of 1998. Regarding city water consumption per net sales, it decreased 40% from 1998 to 2000. UPW consumption per net sales decreased 30% from 1998 to 2000. Both results represent all TSMC fabs' efforts on water saving and installing new process water recovery systems.

**TSMC Last 3 Years - water saving performance**

Item	1998	1999	2000
UPW consumption (million tons)	3.34	4.51	7.14
Average process water recycle rate <sup>©</sup>	63.7%	63.1%	66.2%
Saved city water quantity (million tons)	2.13	2.85	4.72
Saved swimming pools 50M,25M,2M (L,W,D)	850	1,138	1,890

<sup>©</sup>Following the definition of Hsinchu and Tainan Science-Based Industrial Park Administration (SIPA).

According to the UPW consumption rate and process water recovery ratio, saved city water quantity has increased every year. A standard swimming pool is an easier way to express TSMC's water saving efforts. We are using a standard swimming pool to explain water quantity. The size of standard swimming pool is 50 meter, 25 meter, 2 meter (length, width, depth), which equals 2,500 tons of water. In other words, TSMC saved 850 swimming pools of water in 1998, 1,890 swimming pools of water in 2000, saved city water quantity has increased 2.2 times.

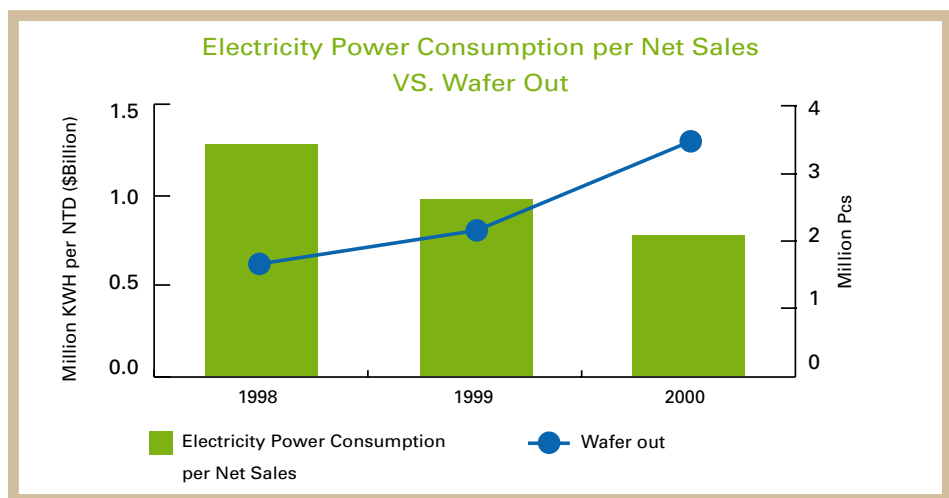




## Resources and Energy

### Energy Saving

Energy conservation design is not only conducted during fab establishment but also during operation. Outstanding energy conservation performance has been achieved in each fab. Under the policy of energy conservation, the new fab is following the existing fabs' experiences and the existing fabs are working hard on continuous improvement. In year 2000, our power consumption rate was only 0.66% for total power generation even though the productivity was rising. In comparison to electricity power consumption per net sales in 1998, year 2000 has decreased by 40%.



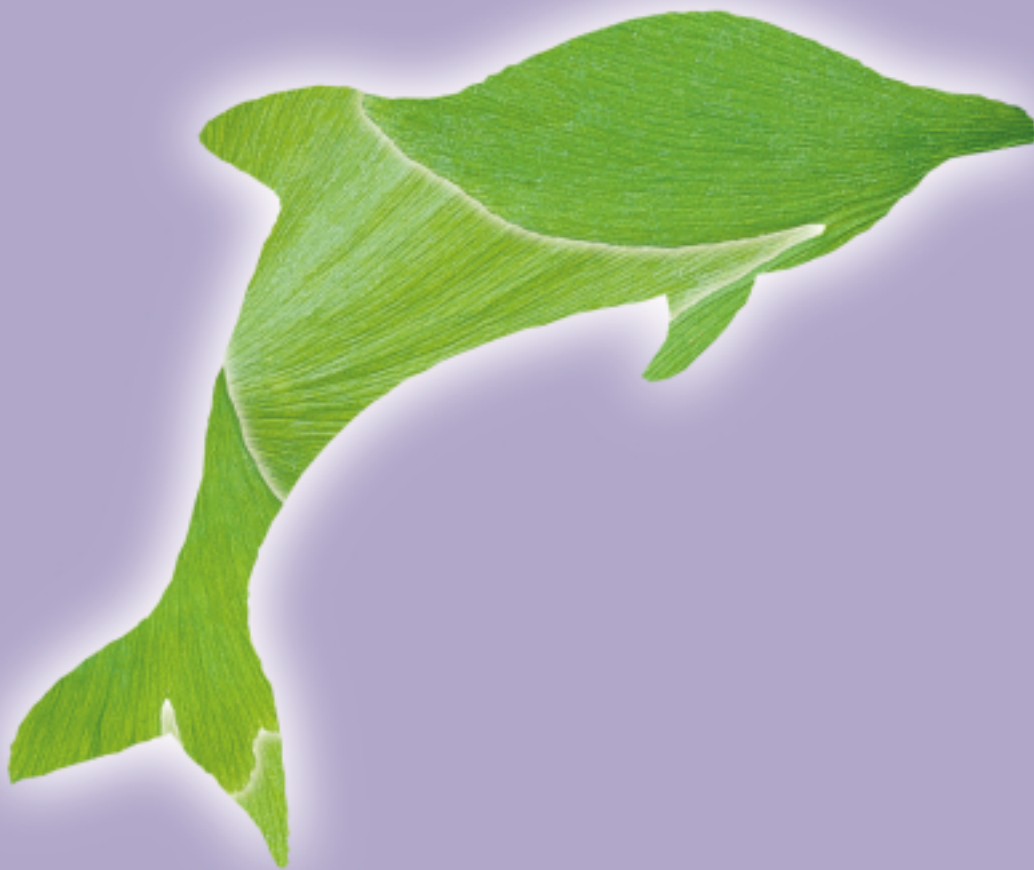
Mini-Environment



High efficiency natural gas boiler

#### Energy conservation approaches:

- Adopted mini-environment to save power consumption.
- Implemented a heat recycling system in the chilled water system.
- Adopted an ice storage type air handling system to optimize on-peak and off-peak power consumption.
- Adopted a high efficiency natural gas boiler.
- Installed various frequency drivers on the air handling, exhaust, and UPW systems.
- Conducted energy measurement and analysis.
- Optimized exhaust in the cleanroom.
- Implemented Lighting management.
- Changed existed electrical boil to natural gas boiler in fab2.
- Keep joining SEMATECH energy saving project, including:
  - (1) Tool Energy Analysis
  - (2) Exhaust reduction
  - (3) HEPA velocity optimization



# Pollution Prevention



## Pollution Prevention

### Air Pollution Control

Regarding to air pollution prevention, TSMC not only installed new air pollution prevention facilities to meet new environmental standards, but also plans to expand backup pollution prevention facilities to reduce the risk of facility breakdown.

All TSMC fabs monitor the real time concentration of Non-Methane Hydrocarbon (NMHC) and conduct an annual emission measurement as required by environmental law. TSMC's emissions are far below the legal standard every year. The following table is a sample of TSMC's Fab2 measurements in 2000.

#### Fab2 Exhaust Analysis Result

Date: Dec. 4,5,6, 2000

Item	Stack1	Stack2	Stack3	Stack4	Stack6	Stack7	Stack8	Stack9	Stack10	Standard
SO <sub>3</sub> (mg/Nm <sup>3</sup> )	1.5	1.0	0.9	1.1	×	0.6	×	×	×	200
Fluoride (mg/Nm <sup>3</sup> )	0.1	0.09	0.4	1.3	×	0.5	×	×	×	10
HCl (ppm)	<2.5	<2.5	<2.5	<2.5	×	×	×	×	×	80
Cl <sub>2</sub> (ppm)	<0.16	<0.16	<0.16	<0.16	×	×	×	×	×	30
NH <sub>3</sub> (g/s)	×	×	×	×	0.031	×	0.035	×	×	150
HNO <sub>3</sub> (mg/Nm <sup>3</sup> )	0.0016	<0.0029	0.0051	<0.0011	×	<0.0030	×	×	×	15
H <sub>3</sub> PO <sub>4</sub> (mg/Nm <sup>3</sup> )	<0.0015	<0.0028	<0.0030	<0.0010	×	<0.0030	×	×	×	6
NMHC (before treatment /after treatment (ppm)	×	×	×	×	×	×	×	173/11	140/10	
NMHC cut down rate (%)	×	×	×	×	×	×	×	92	93	90
Exhaust (Nm <sup>3</sup> /min)	431	792	830	293	812	828	926	952	679	

Note: × not need to analyze



## Pollution Prevention

# Wastewater Treatment

Wastewater drained by TSMC can be divided into two major parts: process wastewater and sewage. Process wastewater is the greater of the two.

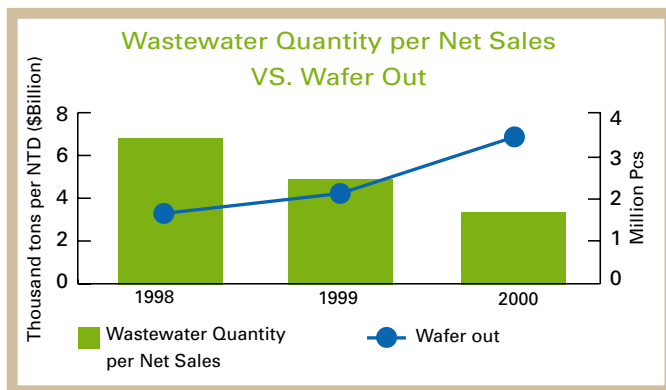
Process wastewater includes general acid wastewater and fluoride wastewater. This wastewater is collected separately by pipes from the process area and then to sent to TSMC's wastewater treatment plant. The treated wastewater, which corresponds to the Science-Based Industrial Park Administration (SIPA) wastewater standard, drains into the science park sewer system. The SIPA wastewater treatment plant collects and again treats all process wastewater and sewage.

### 1. Wastewater Quantity

Since Fab6 started to operate in early 2000, and Fab7 and Fab 8 joined the TSMC family in July 2000, the total production of TSMC increased dramatically. The wafer out increased in 2000 to 2.1 times that of 1998. By the water saving effort of all TSMC fabs, wastewater quantity per net sales in 2000 reduced 51% compared to 1998.

In the future, reducing the amount of wastewater from each fab and improving wastewater recovery will control water usage. Before new fabs are built, new design ideas will be adopted to reduce the amount of

wastewater.



### 2. Wastewater Quality

All TSMC fabs not only monitor the real time wastewater quality, but also perform wastewater analysis at least three times a year. The analysis results meet the wastewater standards of Hsinchu and Tainan SIPA(Science-Based Industrial Park Administration) and Industrial Technology Research Institute(ITRI). Attached is a table of the wastewater analysis report for TSMC Fab2 from 1998 to 2000.

### Fab2 Last 3 Years Wastewater Quality Analysis Report

Item	Date	1998			1999			2000			SIPA Standard
		20 Feb	23 Jun	2 Nov	18 Jan	11 Jun	28 Oct	22 Feb	13 Jun	2 Nov	
pH		6.2	6.4	6.2	7.0	6.2	6.4	6.8	6.8	7.0	5-10
Temperature (Celsius)		22.0	25.5	24.0	23.0	25.6	26.4	23.1	26.4	21.0	35
Suspended Solid (mg/L)		2.6	8.0	25.0	23.0	100.0	35.0	10.8	146	6.5	300
Chemical Oxygen Demand (mg/L)		97.0	18.0	70.0	145.0	62.0	46.5	43.9	68.7	53.7	500
Biochemical Oxygen Demand(mg/L)		11.0	18.0	55.0	89.0	30.0	19.0	29.6	42.7	22.7	300
Fluoride (mg/L)		5.8	5.6	6.8	8.8	6.8	3.2	3.48	3.34	5.31	15



## Pollution Prevention

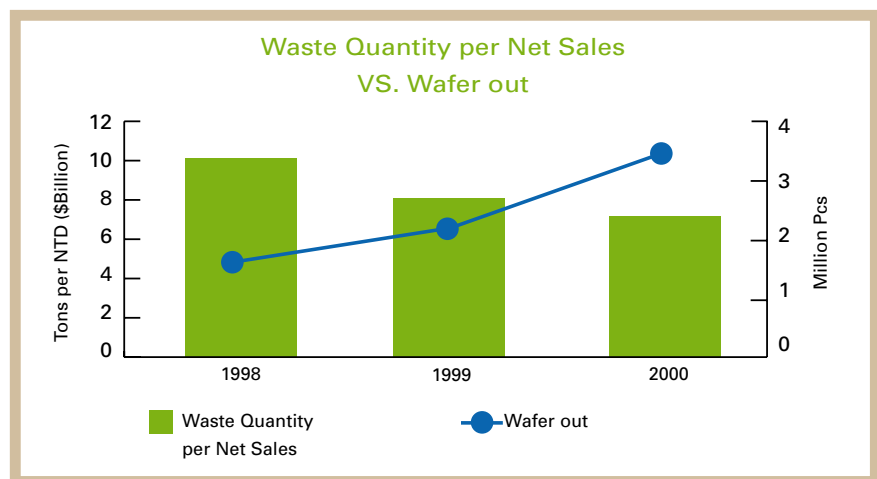
# Waste Management

In year 2000, some of TSMC's waste solvent and  $\text{CaF}_2$  sludge were stored on-site temporarily due to the insufficient capacity of waste treatment contractors. Consequently, the recycling ratio has declined. There will be sufficient capacity for waste treatment contractors in 2001, and the recycling ratio will improve.

Under the circumstance of insufficient capacity of waste treatment contractors, we are trying more effort to search for waste recycling. EPA approved waste IPA, NMP and photoresist recycling in 2000. There are some methodologies for waste recycling under development such as: using  $\text{CaF}_2$  sludge to replace cement, walkway tile and steel manufacturing of raw material.

As for contractors' operations, TSMC set up an annual audit plan and conducted 54 man-day on-site audits in 2000.

In comparison to waste quantity per net sales in 1998, year 2000 waste decreased by 29%.



### Waste recycling approaches

- $\text{CaF}_2$  sludge recycling.
- Cement rotary kiln uses waste solvent as complementary fuel.
- Return chemical drums to suppliers
- Waste  $\text{H}_2\text{SO}_4$ ,  $\text{H}_3\text{PO}_4$  recycling.
- Team-up a committee to study waste treatment related subjects.

### Waste reduction approaches

- Reduce water content in waste solvent by drainage pipes inventory.
- Set-up empty drums cleaning station to eliminate chemical residues.

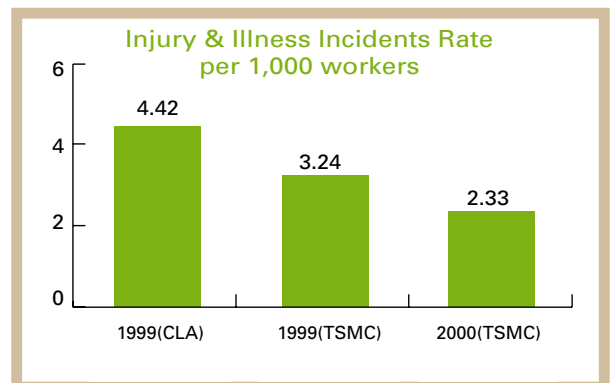


**Management of Safety and Health**

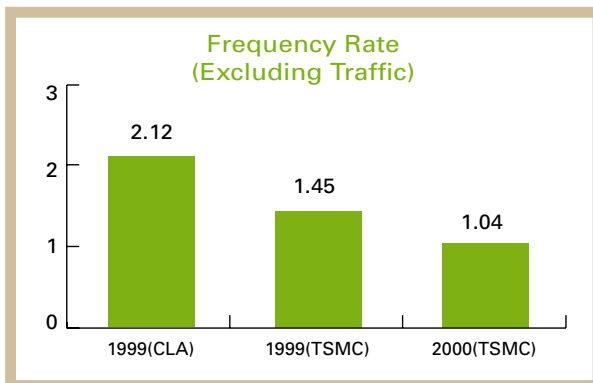
**Occupational Injury / Illness Statistic & Analysis**

TSMC's occupational injury/illness statistics for 1999 and 2000 are summarized below. These statistics are based on the indices that established by the Council of Labor Affairs (CLA) of the Executive Yuan.

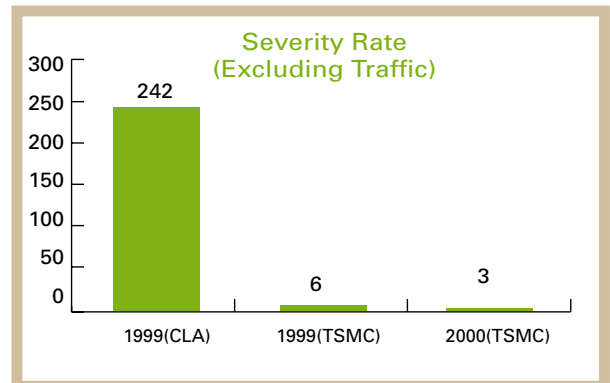
These national indices include Injury & Illness Incidents Rate (The number of loss-day injury & illness cases per 1000 workers), Frequency Rate (FR, the number of disabling injury & illness cases per million man-hours), and Severity Rate (SR, the number of loss days due to disabling injury & illness per million man-hours).



■ The Injury & Illness Incidents Rate fell from 3.24 in 1999 to 2.33 in 2000. This rate for 2000 was much lower than the CLA Injury & Illness rate of 4.42 in 1999.



■ The Frequency Rate fell from 1.45 in 1999 to 1.04 in 2000. This rate for 2000 was much lower than the CLA F.R. of 2.12 in 1999.



■ The Severity Rate fell from 6 in 1999 to 3 in 2000. This rate for 2000 was much lower than the CLA S.R. of 242 in 1999.

In summary, TSMC's occupational injury/illness statistics for the year 2000 was lower than what in 1999, and significantly lower than the CLA's 1999 national indices.





## Management of Safety and Health

# Muscular Skeletal Injuries Prevention- Ergonomics

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With the development of 300mm technology, the weight of the wafers and Front Opening Unified Pods (FOUPs) have increased from 5-6 kg to 8-9 kg, respectively. This may cause potential hazards and adherent problems associated with manual material handling by the operator. So, TSMC is cooperating with the National Tsing Hua University to evaluate the carrying nature of 300mm FOUPs, to see whether female workers handling these loads are susceptible to any occupational injuries.

This study was conducted at Fab6 300mm Pilot Line Project, with the utilized tools including FOUP, Standard Mechanical InterFace (SMIF), rack and cart. Twenty-four female workers at Fab6 were randomly selected for the field experiment. The subjects' anthropometrical dimensions were measured first. Each subject was then asked to perform six tests (3 lifting position x 2 lifting frequency). The dependent variables were radial/ulnar deviations, heart rate, Rating of Perceived Effort (RPE), and Maximum Acceptable Weight of Lift (MAWL).

The results show that the MAWL is about 9.45 kg (for one lifting per five minutes), that is, a little heavier than the weight of existing FOUP (8.9 kg). With the expected move to full production of 300mm, the frequency is expected to increase, which will cause operator handling problem.

Based on TSMC's belief that 「Fit for Work, not Work for Fit」, the solution to this issue appears to be increased use of automation. TSMC is now adding Automated Material Handling System (AMHS), and Over-head Hoist Transportation (OHT), which will be installed for the whole fab. The FOUPs can be transported directly from the stockers to the process equipment. This will dramatically reduce manual handling, providing a more human factors oriented working environment.



300 mm FOUP carry



OHT system



## Management of Safety and Health

### Health Management



TSMC's health clinic

With the vigorous development of the Science-based Industrial Park, the number of employees in this park is now close to one hundred thousand. The only medical resource is a single clinic, which can not serve enough labor code prescription; to conduct labor safety, health education, and training, to guide the related departments to implement labor safety and health management, to oversee occupational illness and prevention.

TSMC is the first company in the SBIP to hire a profession doctor in August 2000. The organization status of the health center has been upgraded from health center to health promotion section.

At beginning of the year, this TSMC clinic was opened, providing employees and families, contractors a comprehensive health care facility. TSMC is the only company with its own exclusive clinic.

TSMC plans and conducts the labor health examinations annually. The examination items include urine biological monitoring of Arsenic compound, which is used at the ion implanter area as a dopant. The results show that the inorganic arsenic metabolism was far below the Biological Exposure Indices (BEI) standard of American Conference of Governmental Industrial Hygienists (ACGIH) : 50 ug/liter.

Based on this analysis of health examination, TSMC found no abnormality that was directly related with their work. Leading abnormalities were related to un-healthy life style. The Wellness Section has provided a series of activities such as chronic disease management, hypertension prevention and control, high blood lipid prevention, massage service, stress management and women's cancer prevention programs. In late 2000, we also provided flu vaccination services to TSMC employees and their dependents. There were totally 5,000 shots provided during the activities. In 2001, most of the wellness services can be accessed and reserved by all employees though the intranet. The Wellness Center of TSMC will put all employee health check records on the web, so that employees can search for their health check records and do health management though the TSMC's intranet. Integrated with the clinical service which was set up in January 2001, employees now have more resources to manage their health care.



## Management of Safety and Health

### Contractor Management

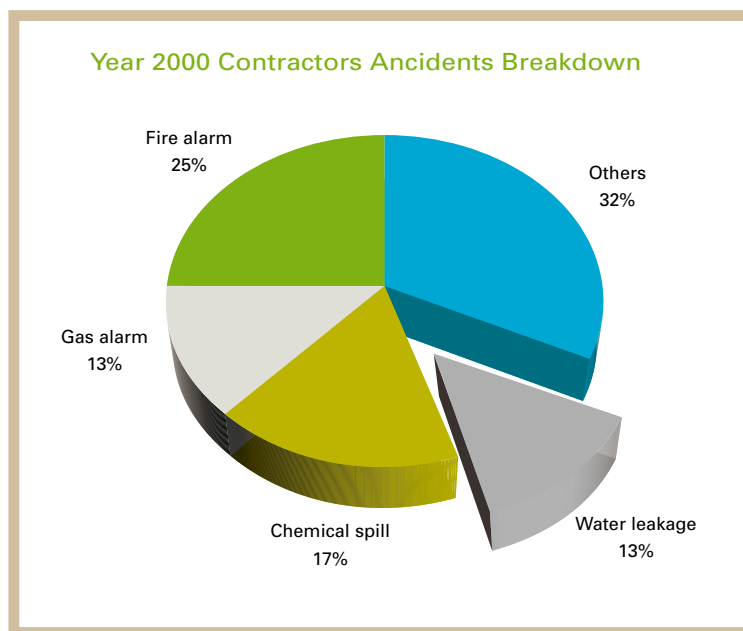
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Contractors continue to play an important role in TSMC's growth. Many contractors have made significant contributions to the construction of our fabs. This business partnership has allowed TSMC to establish a stable operation.

In our ESH policy, President Tseng committed TSMC to communicate ESH issues with contractors and vendors, to encourage them to improve their ESH performance. So, TSMC annually hosts a communication meeting with our contractors to promote mutual understanding and experience sharing.

Generally speaking, contractor ESH performance is an integral part of TSMC's ESH performance index. In order to prevent incidents caused by contractors, each contractor employee is required to attend an ESH training course, pass a written test, and attend an on site pre-start meeting to recognize work place hazards, before entering the work site.

In 2000, there were a total of 24 incidents caused by contractors (with breakdown)



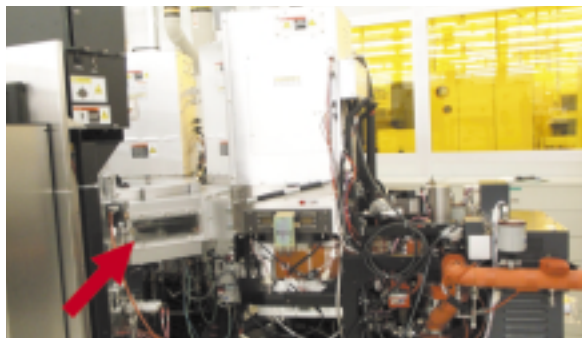


## Management of Safety and Health

# Workplace Environment Measurement



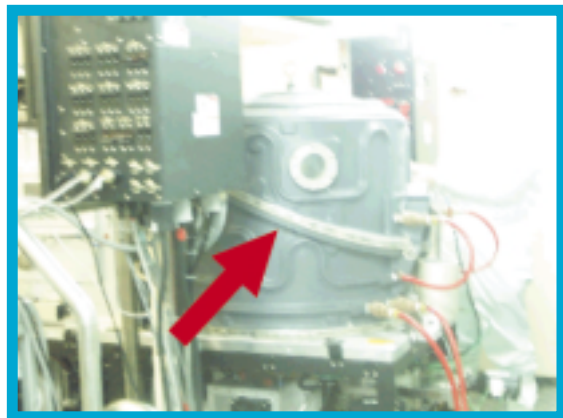
Proceeding RF & Microwave measurement at operation area  
(Non-ionization radiation measurement specific program)



Proceeding RF & Microwave measurement at equipment view point  
(Non-ionization radiation measurement specific program)

In order to effectively manage employee health and safety, each site's ISEP Dept..(Industrial & Safety Environment Protection) regularly monitors the workplace environment for hazardous materials such as HF, H<sub>2</sub>SO<sub>4</sub>, IPA, Acetone, and CO<sub>2</sub> within the HVAC system in the environment. This measurement is conducted in addition to that done for the general work area, on workers, and high risk equipment work area with in periodic maintenance.

In radiation hazard parts, all new ion-implantors and electron microscope equipment must be monitored for radiation and be highlighted. This is to ensure no equipment has leakage issues. In addition to understanding worker exposure to electromagnetic hazards of process tools. Such as Radio Frequency (frequency between 30KHz and 300MKz electromagnetic wave) & Microwave frequency (frequency above 300Mkz electromagnetic wave), TSMC setup a specific program for the development of a measurement method. With this project, we concluded the measurement result to be much lower than the ACGIH value (Taiwan's CLA has no such standard for this measure). TSMC's Non-Ionization Radiation Management Procedures detail the measurement frequency, method, and other related operation rules for worker safety.



Proceeding RF & Microwave measurement at equipment contact place  
(Non-ionization radiation measurement specific program)



## ESH Training

In order to protect employee safety, hygiene, and the workplace environment, all new employees must undergo three hours of general safety training, three hours of hazardous communication training, and one hour of environmental protection training. This training provides a better understanding of TSMC's safety & hygiene policies, environmental protection regulations, chemicals/gas hazards and related accident prevention. TSMC also provides continuous hazard-specific supervisor training, such as organic solvent supervisor training, dust place supervisor training, and specific chemical supervisor training courses to meet legal requirements.

In order to enhance hazard recognition and emergency response capability, TSMC pro-actively conducts training for chemical safety, Personnel Protective Equipment, gas safety, basic & advanced Emergency Response Team (ERT). Statistics are also monitored by department for completion rate and follow up results. ERT drills such as the KAISHIN Fire Fighting Training, site fire drills and the periodic ERT drills enhance employee crisis response capability and hazard assessment.



KAISHIN Fire Fighting Training



First Aid Training



Fire Drill Training



Evacuate Training





A computerized system is used for safety, hygiene & environment management within TSMC. Safety, hygiene, environment information can be found in this computerized system, which allows information and experience sharing for all TSMC employees.



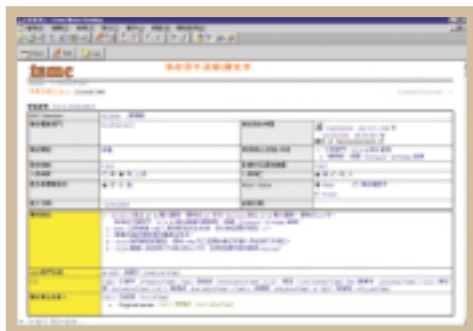
**MSDS(Material Safety Data Sheet) Management System**

TSMC has set up a MSDS Management system, and updates gas/chemical safety related information to provide the MSDS for protecting employee safety & health.



**Occupational Injury / Illness Management System**

This system supports occupational injury/illness investigation processes for employees. The system also provides information on medical care and accidents prevention.



**ERC-Incident Transmission Management System**

This system supports ERC incident investigation processes and documents incident cases. The risk prevention and improvement action plans are documented to minimize the occupational injury/illness.



**Environment Management System**

This system provides identification & documentation of environmental management issues. Working in conjunction with the OA (Office Automation) system. It reduces information loss by manual transmission.



**Occupational Hygiene & Safety Management System**

This system provides identification & documentation of occupational hygiene & safety management issues. Working in conjunction with the OA (Office Automation) system. It reduces information loss by manual transmission.





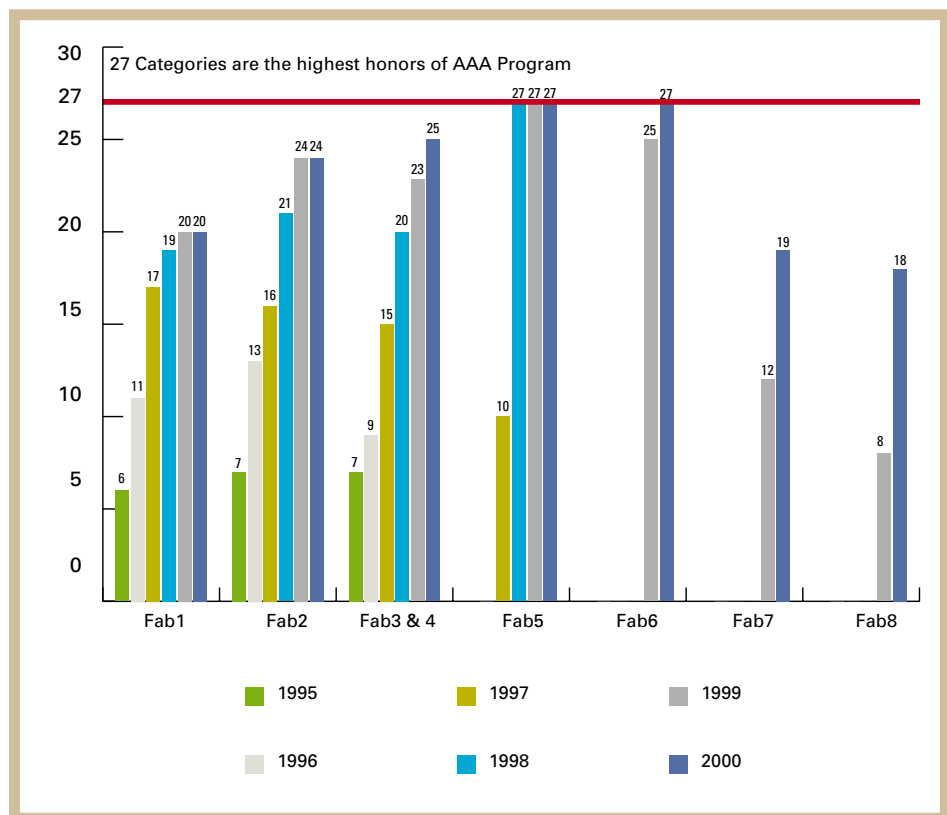
## AAA (Triple A)

# Property Loss Control Program

The AAA Program is a property loss control program that is comprised of 27 categories, including fire safety management systems, fire protection equipment, and semiconductor material distribution systems.

The function of this program is to help employees establish fire protection knowledge through a simple easy-to-understand program that allows the difficult-to-understand loss prevention concept to be applied throughout all fabs. The rating system is standardized, allowing top management to understand improvement performance as compared with all fabs of TSMC. This also allows top management to set priority for facility improvement recommendations and to enhance safety protection for each fab to reach world-class standards. This allows integration of loss prevention concepts within TSMC's corporate culture, to reach our goal of continuous growth.

Since we implemented the AAA program in 1995, risk reduction plans and continuous improvement projects have been continuously introduced to TSMC. Fab 5 achieved the highest AAA honors for the last three consecutive years. Fab 6 also achieved the highest AAA honors last year. Each fab continues making improvements to lower their risk.





# Environmental Activities

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## Environmental Activities

# Earth Week at TSMC



Control Center  
(Co-gen power plant of Hsin Yu Energy Development Co., Ltd.)



Control Center  
(Co-gen power plant of Hsin Yu Energy Development Co., Ltd.)

Starting in 1994, TSMC has promoted environment protection activities during the 3rd week of April as part of TSMC's Earth Week. This coincides with the worldwide Earth Day activities held annually on April 22nd. During TSMC's Earth Week, environmental protection activities are promoted which include:

- Waste Minimization
- Resources Recovery
- Energy Saving
- Ecological Conservation
- Environment Policy Recognition

In consideration of 921 earthquake disaster in 1999, we have deeply recognized the electricity power is very important to our life. In 2000 Earth Week activity, we arranged a tour to visit Co-gen power plant of Hsin Yu Energy Development Co., Ltd. located at Science-based Industrial Park, Hsin Chu.



Site Tour  
(Co-gen power plant of Hsin Yu Energy Development Co., Ltd.)



## Awards



Industrial Excellence  
Award



National Safety &  
Hygiene  
excellent unit  
Award

Year

2000	1st Industrial Excellence Award
2000	Pollution Control Equipment Maintenance Outstanding Performance Plant
2000	National Safety & Hygiene excellent unit award
2000	SIPA Safety & Hygiene excellent unit 5 star award
1999	8th Outstanding Environmental Protection Company
1999	National Industrial Waste Minimization Outstanding Performance Plant
1999	Energy Conservation Award
1999	Special Award for Outstanding EP Performance
1999	National Safety & Hygiene excellent unit award
1999	SIPA Safety & Hygiene excellent award
1999	CLA VPP 3 years honor
1998	SIPA Safety & Hygiene excellent unit award
1998	World Safety Organization (WSO) specific award
1997	6th Outstanding Environmental Protection Company
1997	National Outstanding ESH Performance Company
1997	National Industrial Waste Minimization Outstanding Performance Plant
1997	National Safety & Hygiene excellent unit award
1997	CLA VPP 2 years honor
1996	Energy Conservation Award
1996	5th Outstanding Environmental Protection Company
1995	Outstanding Environmental Protection Performance Company in Hsin Chu County
1995	Pollution Control Equipment Maintenance outstanding Performance Plant
1995	4th Outstanding Environmental Protection Company
1995	National Pollution Control Outstanding Performance Company
1995	National Industrial Waste Minimization Outstanding Performance Plant
1994	Outstanding Environmental Protection Performance Company in Hsin-Chu County
1994	National Safety & Hygiene excellent unit award
1993	National Pollution Control Outstanding Performance Company
1993	National Safety & Hygiene excellent unit award
1993	SIPA Safety & Hygiene excellent award
1992	1st Outstanding Environmental Protection Company
1992	SIPA Self-Inspection excellent award
1991	National Self-Inspection excellent award



## Perspective

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It has been fourteen years since TSMC was founded in 1987. When we walk down this road, Environmental, Safety and Health (ESH) has been a core element of our operation. If we look back now, we will find that it was not an easy road at all. We were constantly learning, changing, improving and operating. It's like modifying your clothes while you put them on. Not only it's in terms of comfort, but also efficiency. Even in such a tough situation, we were able to get something done and receive recognition from the government agencies in terms of incident prevention, waste minimization, water and energy conservation, environment friendly packaging, and encouraging suppliers to improve their ESH performance.

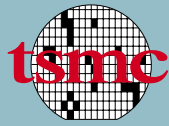
We have learned from our experiences in the past fourteen years, and we promise that we will apply Best Know Methods(BKMs) to all new fabs, both in hardware design and management systems. This way we will fulfill proactive ideas of pollution prevention, design for the environment, and accident prevention.

Recently more and more organizations and media are paying extra attention to the ESH performance of a corporation. How to communicate ESH information is becoming more and more important. From now on, we will also spend more effort in communicating with interested parties and legislative authorities. We expect them to listen and respond rationally so that together we can build a healthy and sustainable living and working environment.

With a view to the coming years, new manufacturing processes will be changing fast to keep up with the demands of "high-tech." . We will impose ESH R&D efforts to develop ESH friendly manufacturing methods so that technology development and ESH management can develop at the same pace. We believe that this is the only way to ensure sustainable development of the semiconductor industry and fulfill the true value of high-tech. to create a better life for all creatures on the earth.







No. 121 Park Ave. III, Science-Based Industrial Park, Hsin-Chu, Taiwan 300, R.O.C.  
Tel: 886-3-578-0221 Fax: 886-3-578-1546  
<http://www.tsmc.com.tw>

