

## Trends In Work Health

The occupational health situation in Singapore continues to improve. The success of measures to ensure the health of our workers has been possible because of the strong support of employers, unions and other partners for our various enforcement and promotional programmes.

The healthy trend is reflected in the falling incidence of occupational diseases. Data from our medical and industrial hygiene surveillance activities indicate that noise and chemical exposure levels in workplaces remain satisfactory.

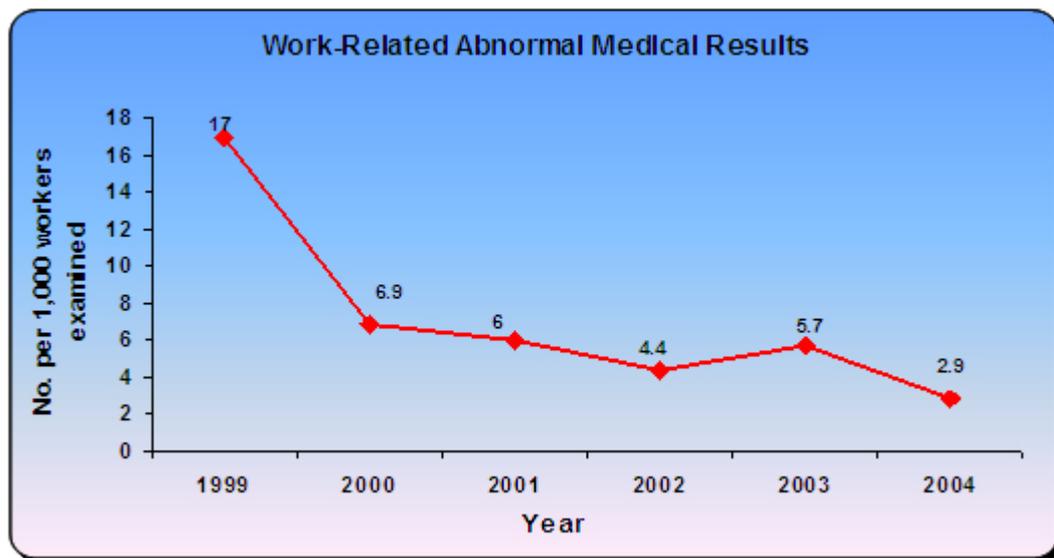
### Monitoring Conditions at Work

Exposure levels of specific workplace hazards provide a good indicator of the conditions in the work environment. Workplaces with [specific hazards](#) are required to have regular industrial hygiene monitoring and medical surveillance (including biological monitoring) for their exposed workers. The frequency of noise monitoring is once every three years, while that for chemical monitoring is usually annual. The results of both industrial hygiene and biological monitoring are submitted to the Department. The Department also conducts detailed industrial hygiene assessments on a selective basis in high risk workplaces.

Industrial hygiene data from our selective assessments, as well as from companies with in-plant monitoring, is maintained in a National Database for Noise and Chemical Exposure. This enables us to identify high risk workplaces, evaluate trends in exposure levels and advise employers regarding control measures and appropriate monitoring programmes.

### Workers' Health Status

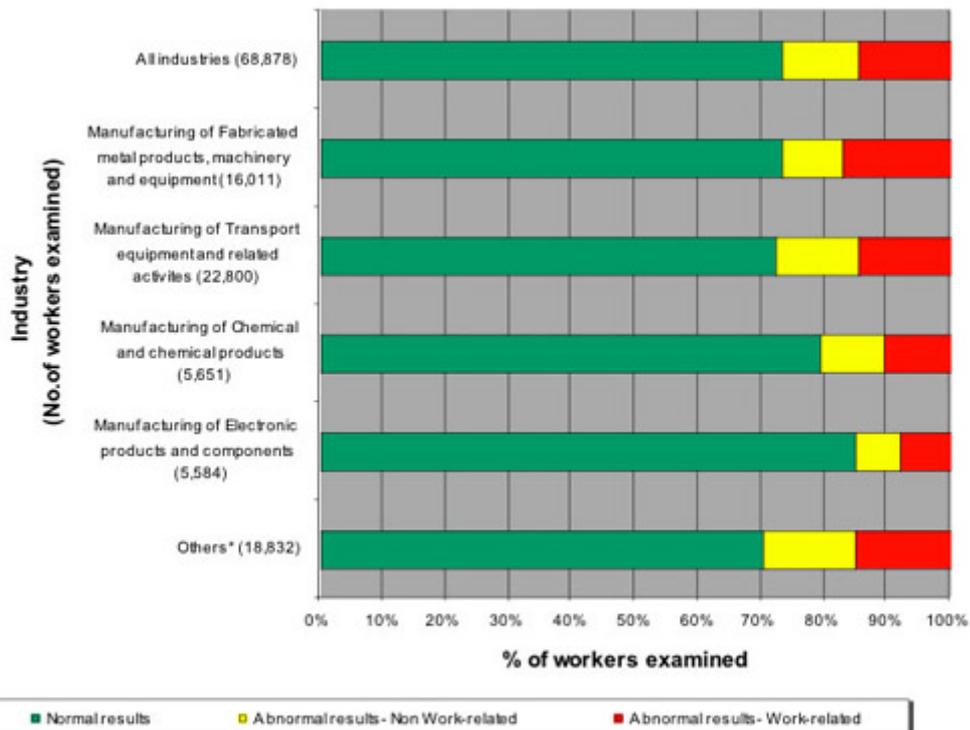
In terms of new work-related abnormal medical results, the overall rate remained low, with a decrease from 5.7 per 1,000 workers examined in 2003 to 2.9 in 2004.



Detection of work-related abnormal results among workers examined for [exposure to noise](#) was highest in the metalworking industries, while among workers examined for [exposure to chemicals](#), detection of work-related abnormal results was highest in dry cleaning work and in the chemical and petrochemical industries.

## Medical Monitoring for Noise Exposure, 2004

### Results of Medical Monitoring for Noise Exposure, 2004



\*Others: include manufacturing of food products and beverages/textiles/wearing apparel/paper and paper products/rubber and plastic/non-metallic mineral products/basic metals/electrical machinery/furniture, printing, saw milling, recycling, construction, wholesale trade and other business activities.

## Biological Monitoring for Chemical Exposure 2004

### Results of Biological Monitoring for Chemical Exposure, 2004



\*Others: include manufacturing of basic metals/electrical machinery/electronic products and components/paper and paper products/transport equipment/medical precision and optical instruments, printing, other service activities, other business activities, and construction industries.

^Excludes medical examinations where biological monitoring is not applicable, viz., chest x ray, lung function and skin examinations for asbestos, silica, raw cotton, tar, pitch and bitumen exposure.

## Exposure Levels

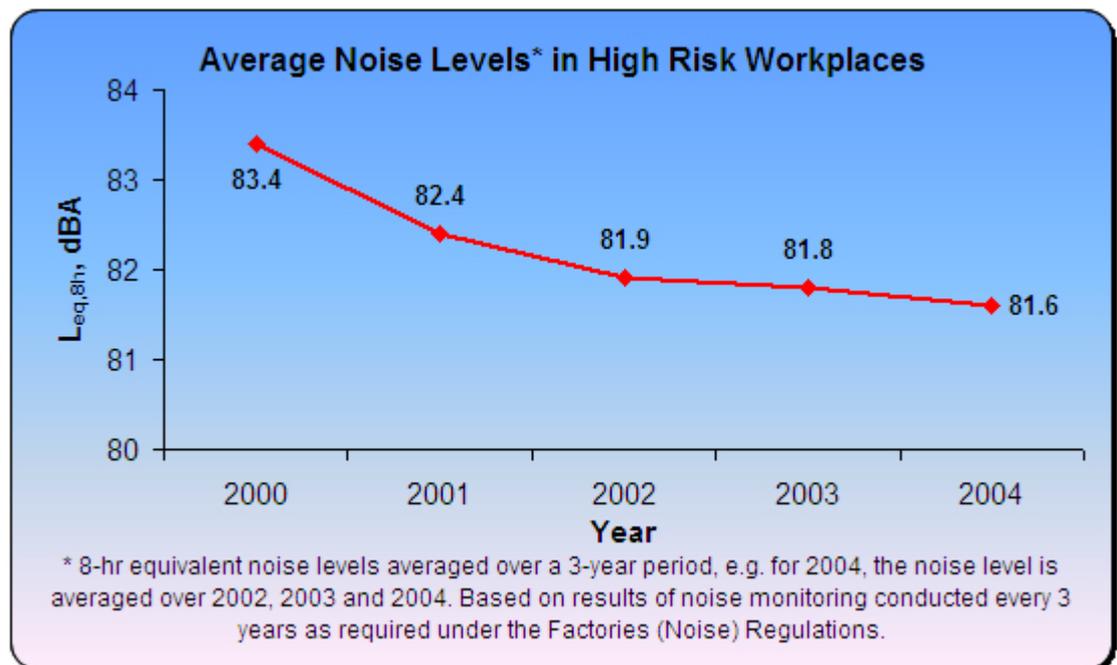
### Noise Exposure Levels

Overall, the average noise levels in high risk workplaces remained satisfactory. The high percentage of workplaces with [excessive noise](#) reflects our ongoing efforts in identifying such workplaces and enforcing requirements to reduce noise exposure.

Under the Factories (Noise) Regulations, companies with 10 or more workers exposed to excessive noise, i.e., above an equivalent sound pressure level of 85 dBA over an 8-hour workday, are required to monitor the noise exposure at least once every three years.

Our [surveillance data](#) indicate that workplaces with very high noise levels (90 dBA and above) are mainly from the following industries:

- [Manufacture of fabricated metal products](#)
- [Manufacture of machinery and equipment](#)
- [Manufacture of transport equipment](#)

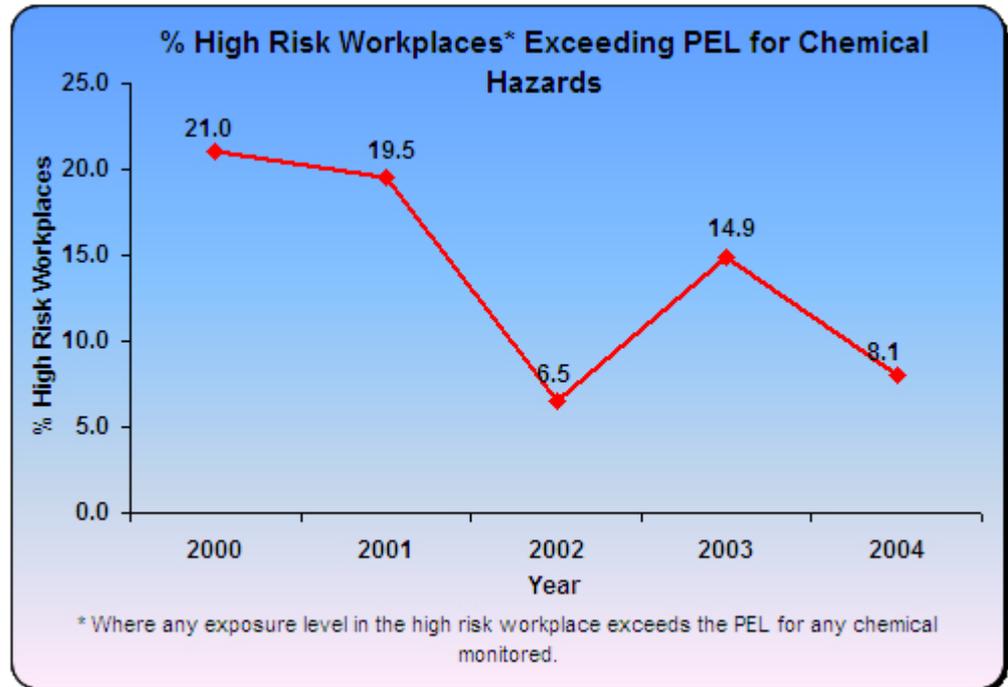


## Chemical Exposure Levels

Regular workplace monitoring by a competent person is required if there is exposure to toxic substances. Factory occupiers or employers must ensure that employees are not exposed to toxic substances above the Permissible Exposure Levels (PEL). Companies with chemical exposures exceeding 10% PEL are required to monitor the exposure levels at least annually.

Overall, chemical exposure levels remained satisfactory, with the percentage of high risk workplaces that had excessive chemical exposure falling to 6.1%. The significant drop from the higher base of 14.9% in 2003 was largely the result of our ongoing enforcement activities on the identified high risk workplaces and implementation of engineering and other control measures in these workplaces.

[Our surveillance data](#) indicate that workplaces with significant chemical exposure levels (of over 50% PEL), were mainly from the metalworking, chemical and aircraft-servicing industries.



Air levels of solvents, such as methylene chloride (MC), toluene and trichloroethylene (TCE), were higher in 2004, although the exposures remained below the respective PELs. The only exception was MC, but the levels have since been reduced to below the PEL.

The increased air levels of heavy metals reflect some high cobalt-in-air levels detected during our enforcement exercise on battery manufacturing factories. The company concerned was advised on the implementation of engineering control measures, including local exhaust ventilation and improving general ventilation.

## Solvents

### Methylene Chloride

Methylene Chloride The significant increase in [methylene chloride exposure levels](#) was largely due to high levels detected from a degreasing process in a metalworking factory. Local exhaust ventilation on the degreasing tanks was improved and the levels have since been reduced to below PEL.

### Toluene

[Exposure levels for toluene](#) increased to just above 50% PEL as more high risk factories were identified in the metalworking, paint and ink manufacturing industries. The companies were advised to implement effective engineering control measures and safe work practices, and will be further monitored.

[Biological monitoring results](#) remained low with urinary hippuric acid levels at below 0.5 mg/ml as a result of ongoing efforts to reduce toluene exposure in the lamination and ink manufacturing industries, and greater awareness of personal protection following our promotional activities.

### Trichloroethylene (TCE) and Perchloroethylene (PCE)

Exposure levels for [TCE](#) increased, reflecting our efforts in identifying more high risk workplaces with degreasing processes in the optical instruments and metalworking industries. Despite the increase, the exposure levels remained below the PEL. [Urinary trichloroacetic acid \(TCA\) levels](#) of TCE workers were also below the BTLV.

Overall, [PCE exposure levels](#) were lower in 2004, with biological monitoring results([urinary trichloroacetic acid levels](#))at below 1mg/L.

This was the result of the successful implementation of various measures, including the installation of local exhaust ventilation systems in most of the dry cleaning operations, as well as ensuring the proper use of personal protective equipment and good personal hygiene practices.

### Benzene

Despite the more stringent PEL of 1 ppm compared to 5ppm previously, [benzene exposure levels](#) were below the action level of 50%PEL. The [biological monitoring results](#) of benzene-exposed workers remained low. This reflected the continued efforts by the major petrochemical plants and oil refineries to reduce benzene exposure.

### Other Solvents

[Air levels of other commonly used solvents](#) remained low. The continuing upward trend reflects higher levels detected in companies assessed for the first time under our ongoing enforcement activities to identify users of these solvents.

## Heavy Metals

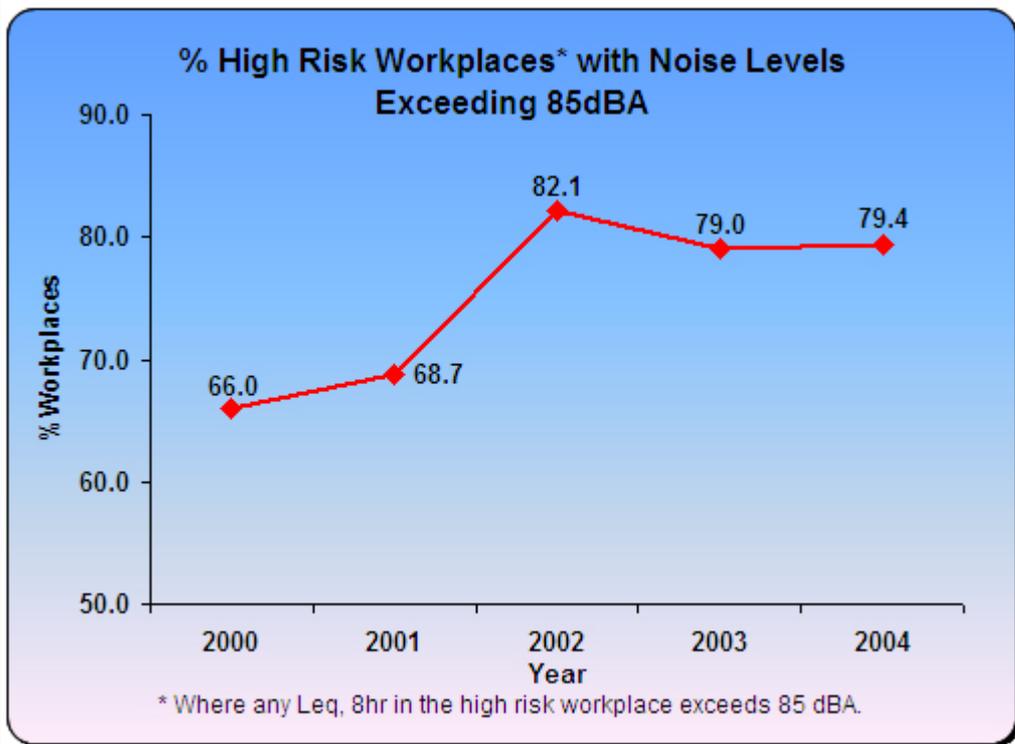
### Lead

The increase in [lead exposure levels](#) was due to high levels detected in a PVC stabilizer manufacturing company. Exposure to lead dust was high from the maintenance work carried out during plant shutdown. The factory was advised to improve and maintain the effectiveness of engineering controls; and to look into other suitable lead-free substitutes. [Blood lead levels](#) continued to be low due to the efforts of managements in ensuring good work practices, as well as continued vigilance in using personal protective equipment.

### Other Heavy Metals

Exposure to [other heavy metals](#) continued to be low. Despite the more stringent PEL of 0.01 mg/m<sup>3</sup> compared to 0.05 mg/m<sup>3</sup> previously, cadmium exposure levels were below the action level of 50%PEL. [Blood cadmium levels](#) fell compared to the high base in 2003. [Urinary manganese levels](#) remained low.

Excessive Noise



Surveillance Data

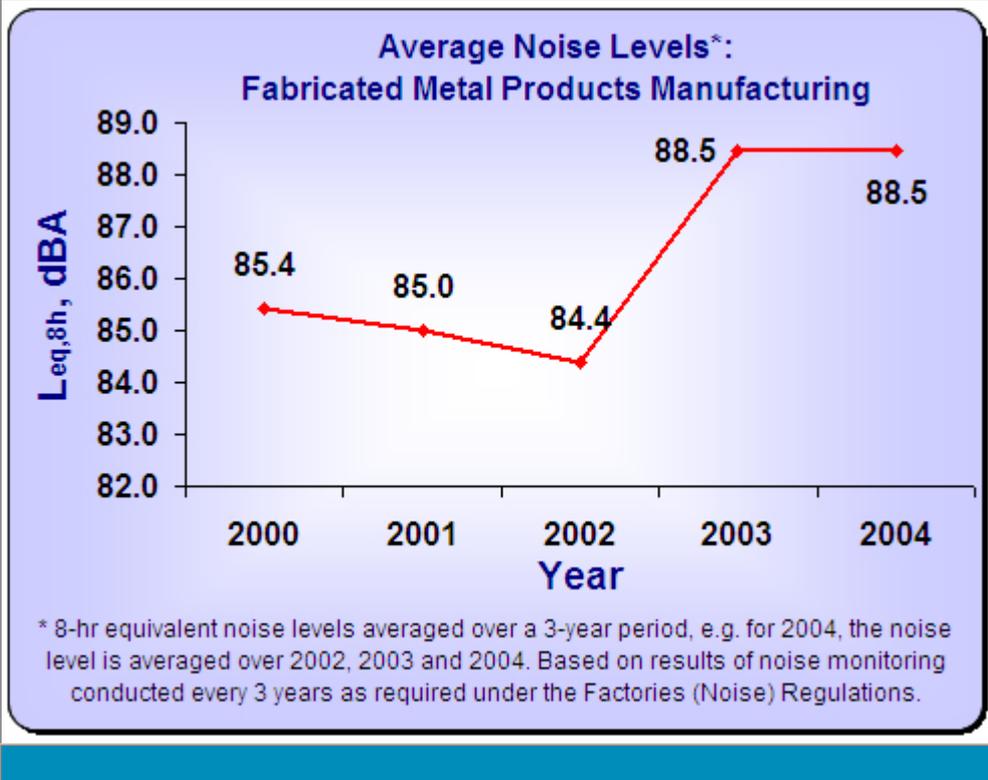
Noise Exposure\* in High Risk Workplaces



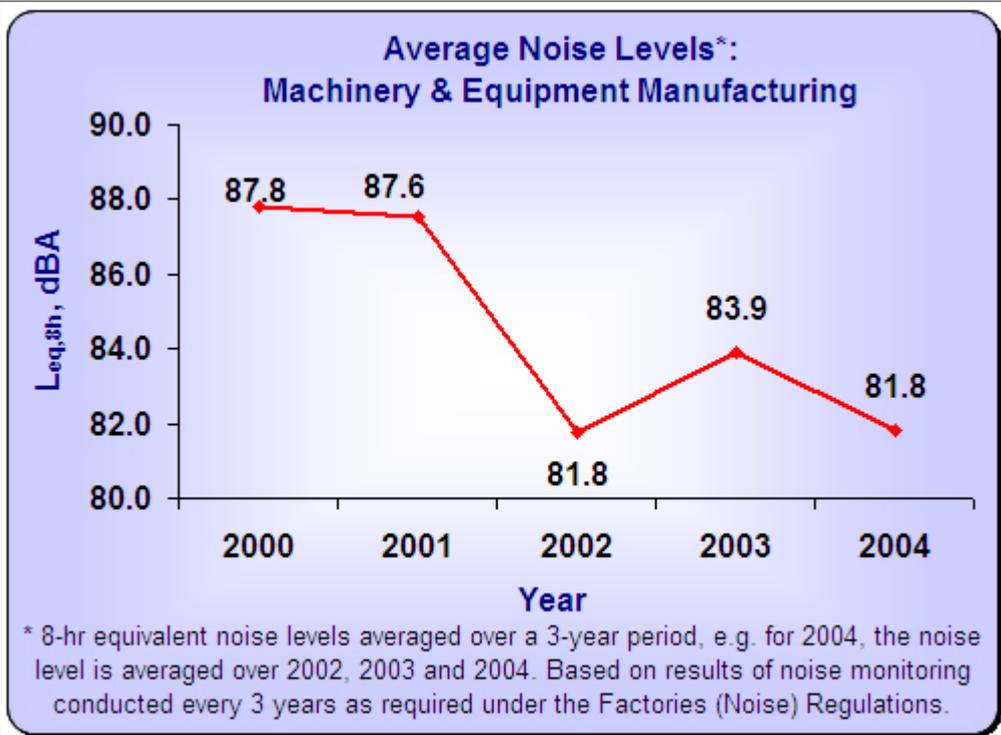
\* The % derived are based on the highest exposure level from the latest assessment results

^ Include: Manufacture of food, paper products, plastics, chemicals, furniture, printing.

## Manufacture of Fabricated Metal Products



## Manufacture of Machinery and Equipment



## Manufacture of Transport Equipment

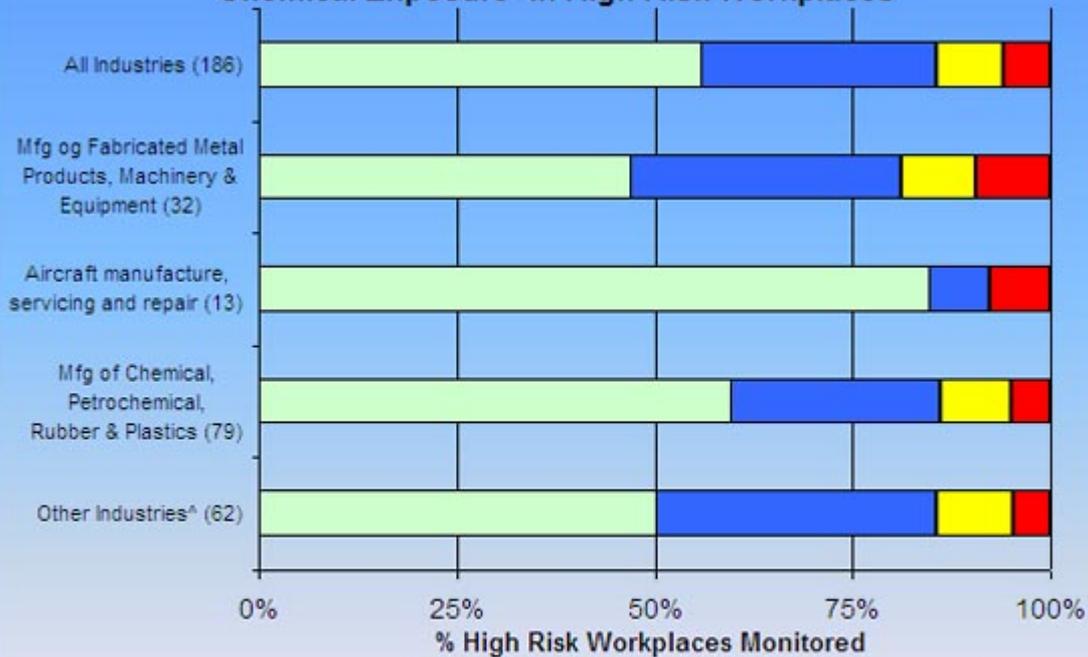
### Average Noise Levels\*: Transport Equipment Manufacturing



\* 8-hr equivalent noise levels averaged over a 3-year period, e.g. for 2004, the noise level is averaged over 2002, 2003 and 2004. Based on results of noise monitoring conducted every 3 years as required under the Factories (Noise) Regulations.

## Surveillance Data

### Chemical Exposure\* in High Risk Workplaces

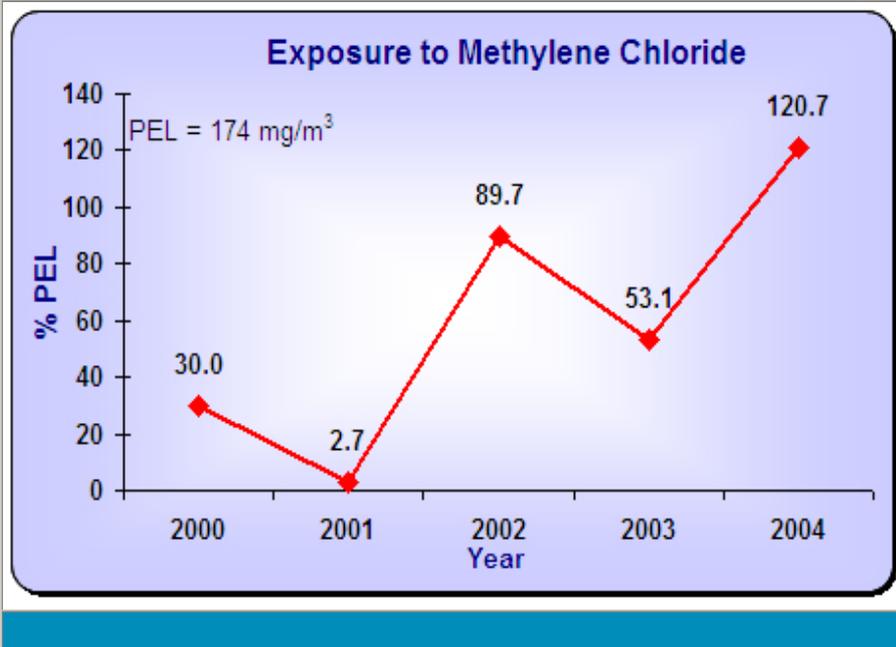


□ < 10% PEL    ■ 10% - 50% PEL    ■ > 50% PEL - < 100% PEL    ■ ≥ 100% PEL

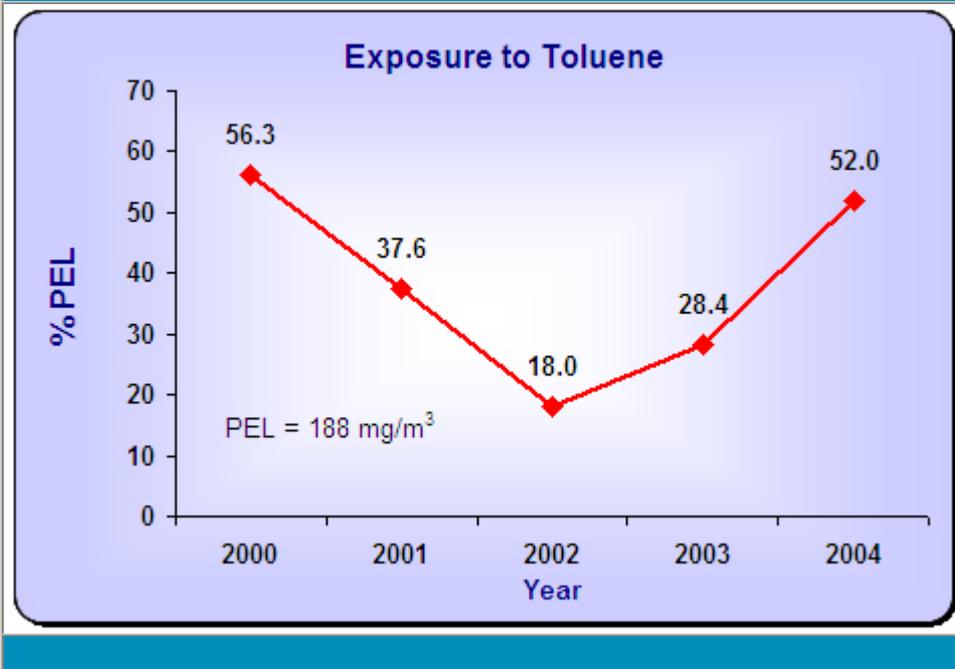
\* The % derived are based on the highest exposure level from the latest assessment results.

^ Include: Medical laboratories, mfg of electronic products & components, electrical machinery & apparatus.

## Methylene Chloride Exposure Levels

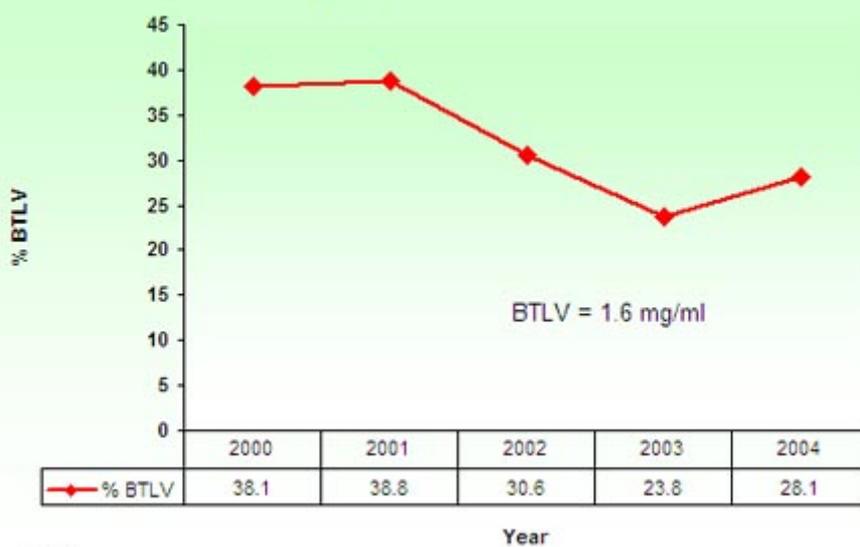


### Toluene Exposure Levels



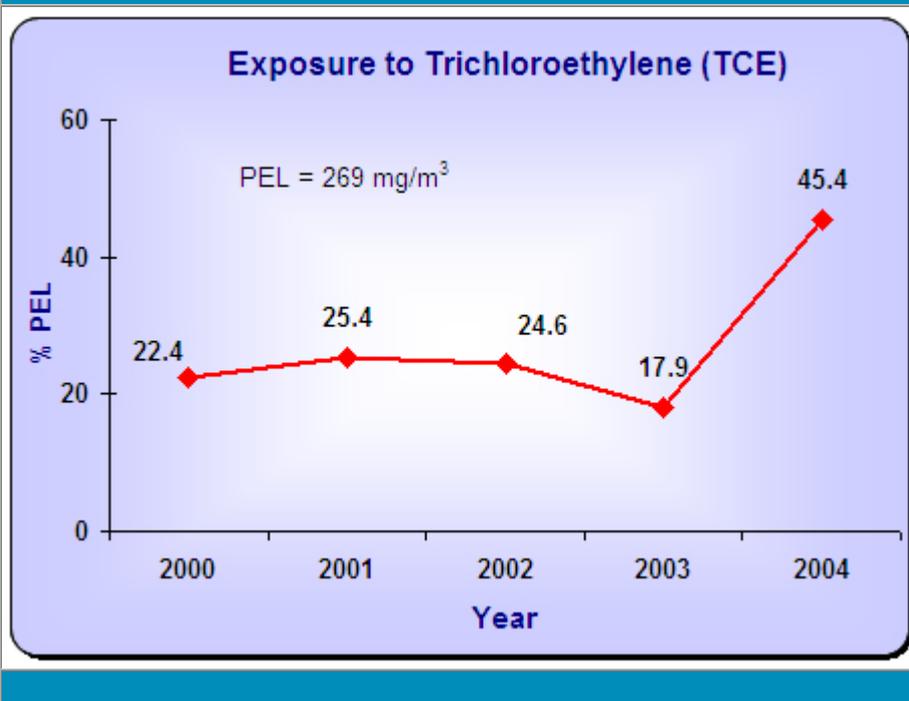
## Biological Monitoring Results

### Biological Monitoring Results for Exposure to Toluene --- urinary hippuric acid levels\*



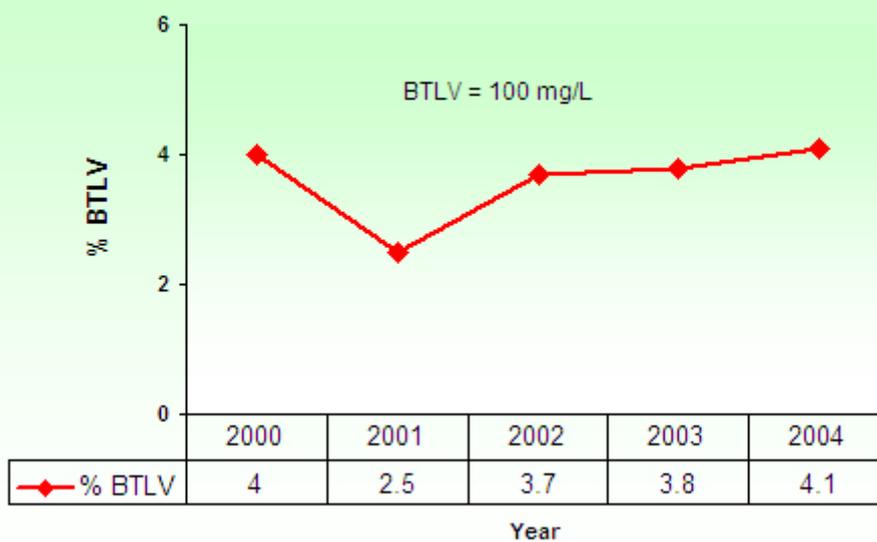
\*Geometric Mean

### TCE Exposure Levels



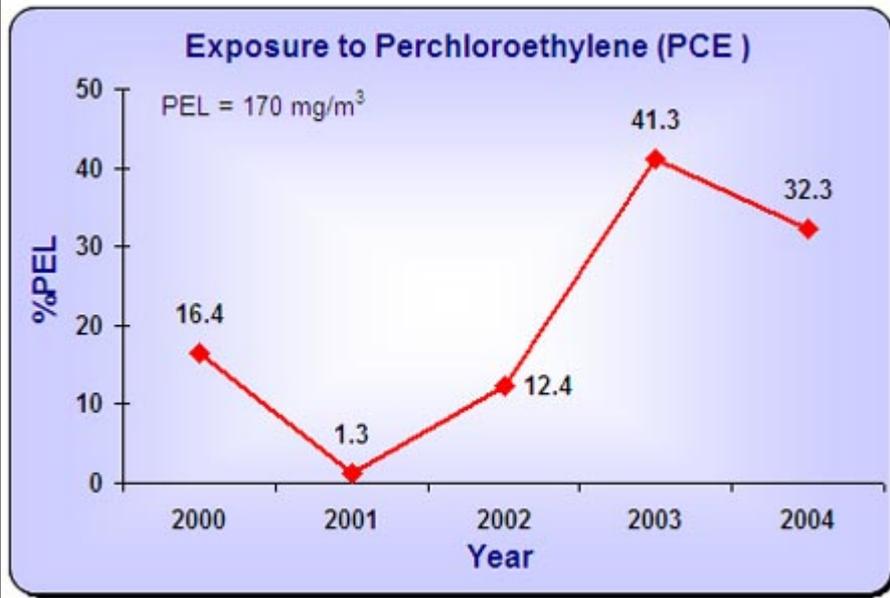
## Urinary Trichloroacetic Acid (TCA) Levels

### Biological Monitoring Results for Exposure to TCE --- urinary trichloroacetic acid levels\*



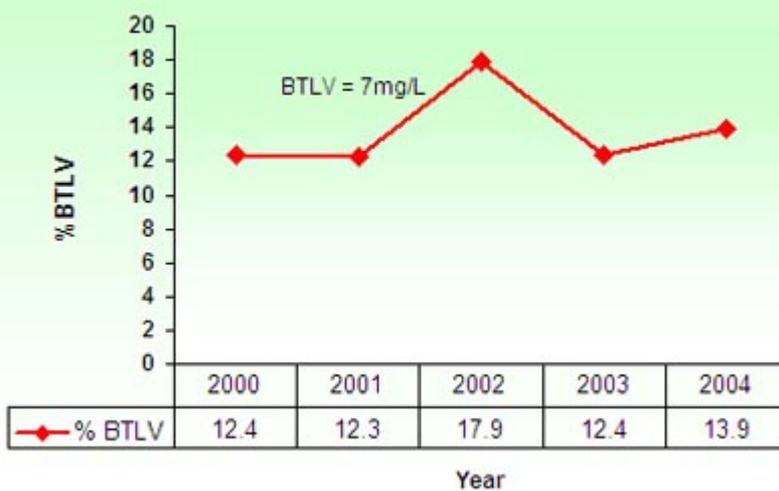
\*Geometric Mean

### PCE Exposure Levels



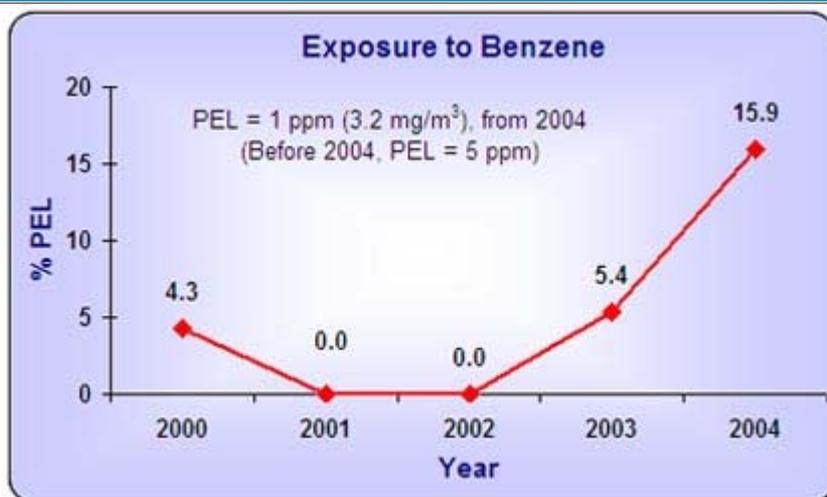
## Urinary Trichloroacetic Acid (TCA) Levels

### Biological Monitoring Results for Exposure to PCE --- urinary trichloroacetic acid levels\*



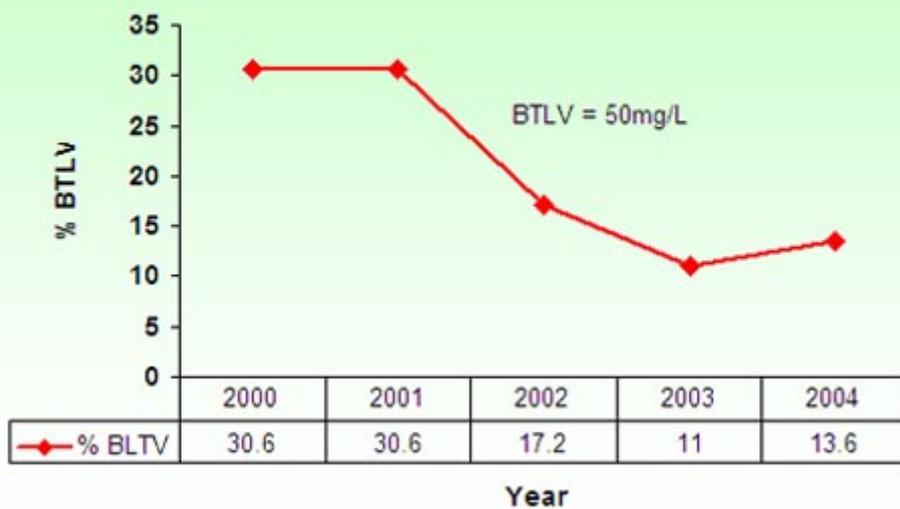
\*Geometric Mean

## Benzene Exposure Levels



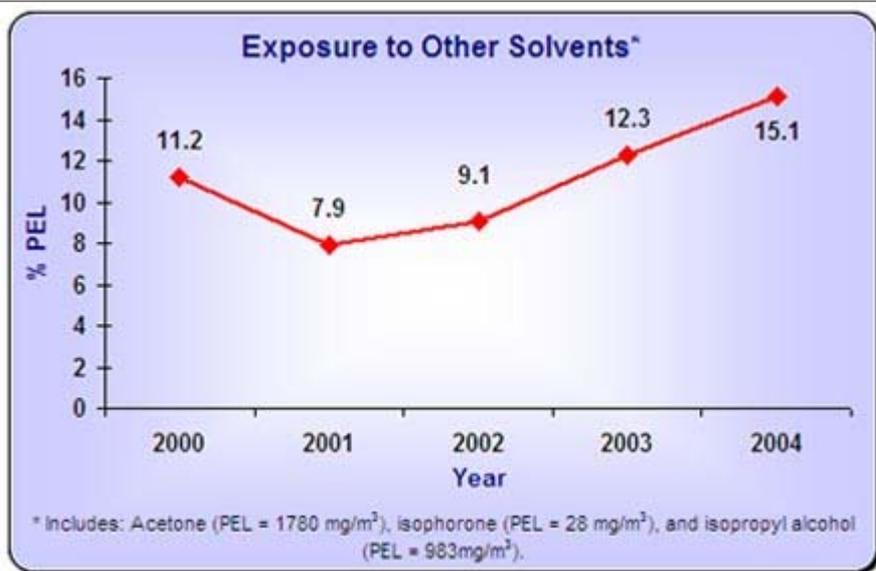
## Biological Monitoring Results

### Biological Monitoring Results for Exposure to Benzene --- urinary phenol levels\*

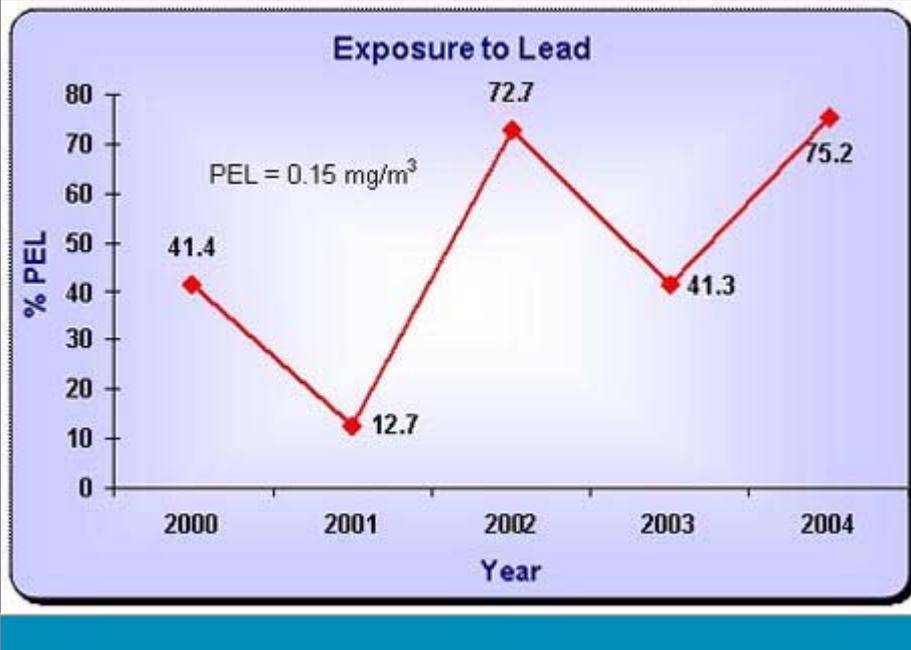


\*Geometric Mean

### Air Levels of Other Commonly Used Solvents



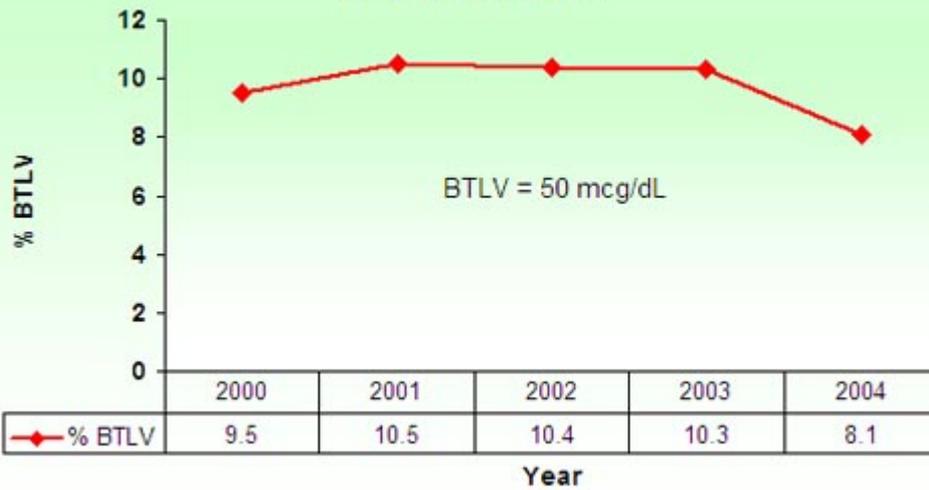
## Lead Exposure Levels



## Blood Lead Levels

### Biological monitoring results for exposure to lead

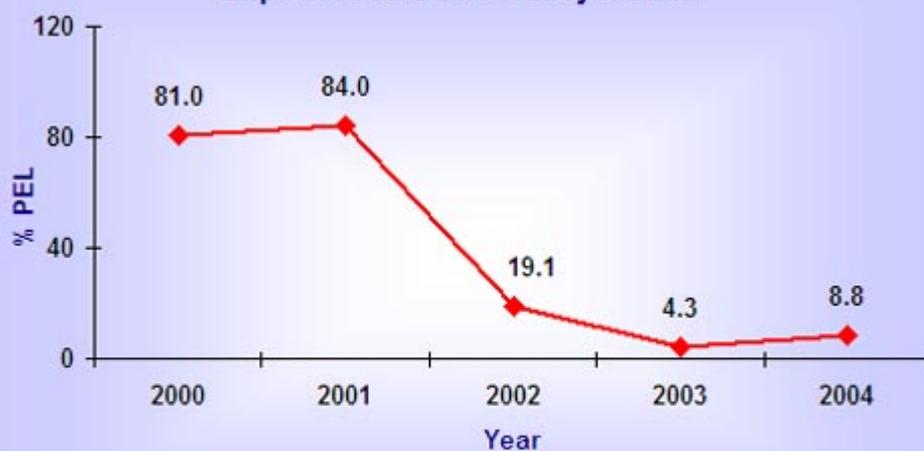
--- blood lead levels\*



\*Geometric Mean

## Other Heavy Metals

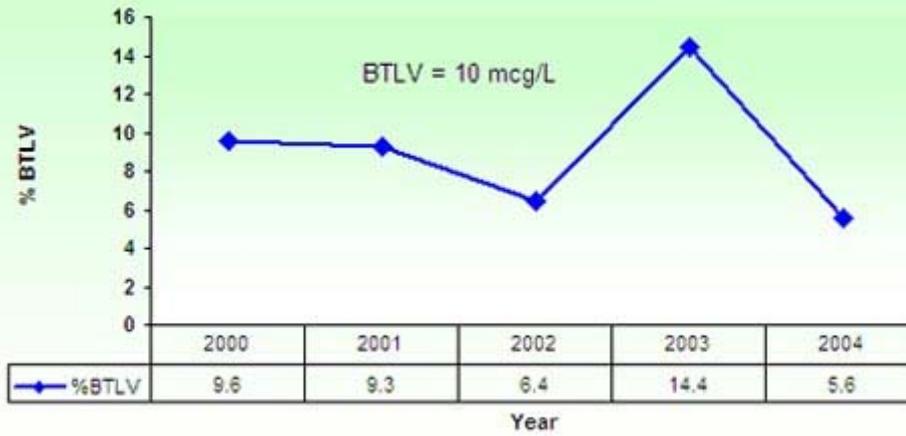
### Exposure to Other Heavy Metals\*



\* Includes: Cadmium (PEL = 0.01mg/m<sup>3</sup>), chromium IV, insoluble (PEL = 0.01 mg/m<sup>3</sup>), copper dust & mists (PEL = 1 mg/m<sup>3</sup>), manganese dust (PEL = 1 mg/m<sup>3</sup>) and manganese fumes (PEL = 1mg/m<sup>3</sup>).

## Blood Cadmium Levels

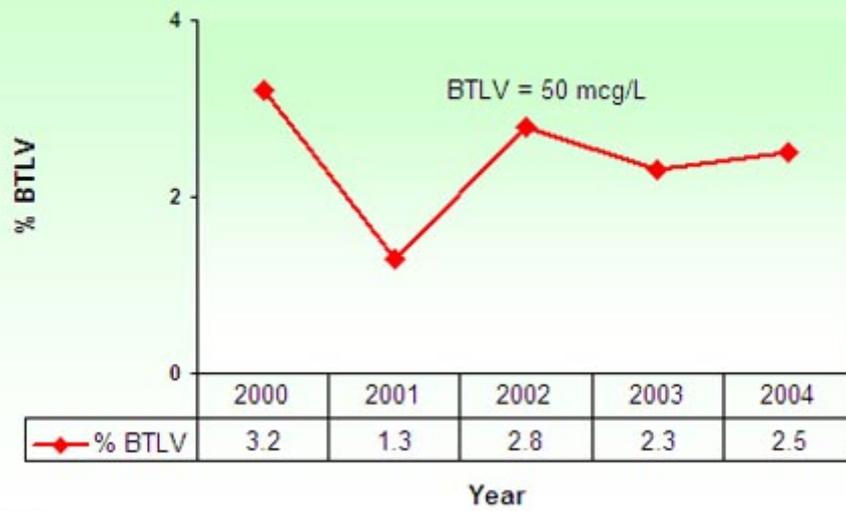
### Biological Monitoring Results for Exposure to Cadmium --- blood cadmium levels\*



\*Geometric Mean

## Urinary Manganese Levels

### Biological Monitoring Results for Exposure to Manganese --- urinary manganese levels\*

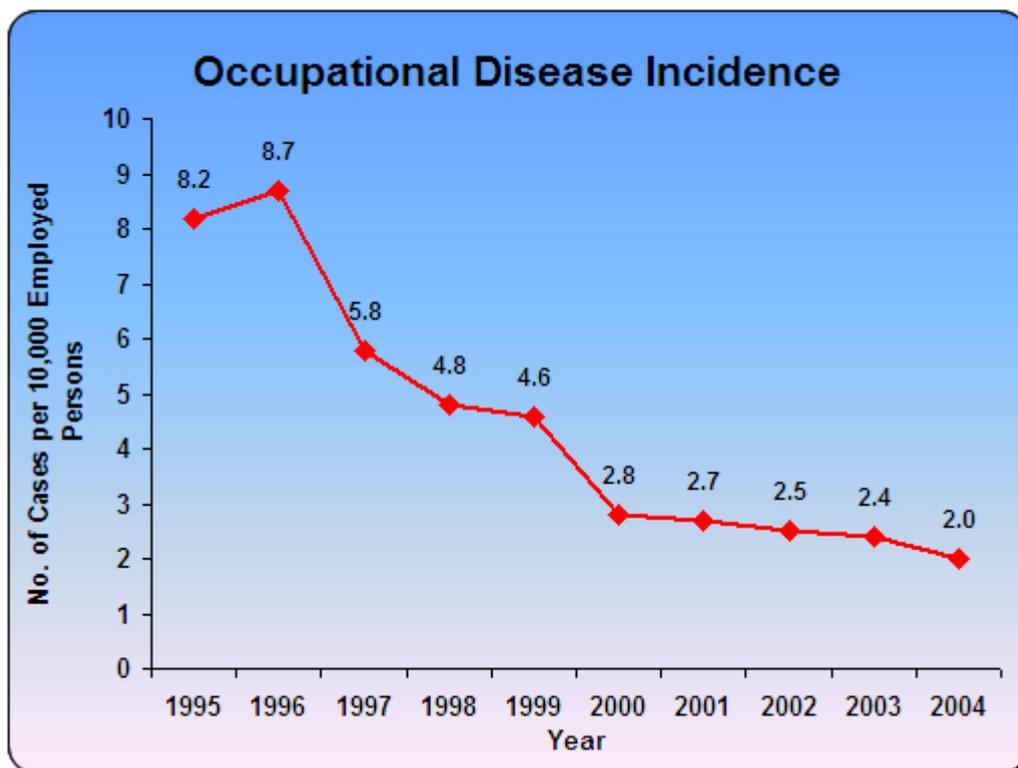


\*Geometric Mean

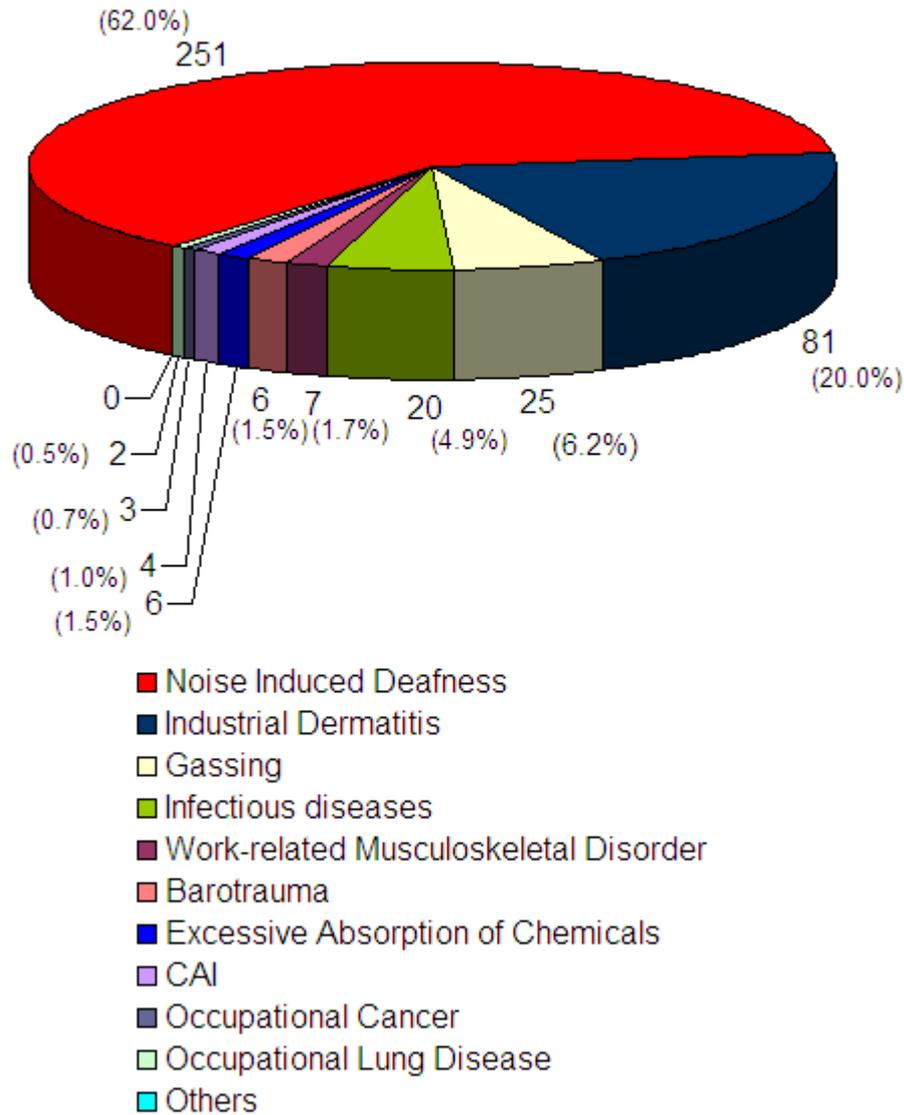
## Occupational Diseases

Notification of occupational diseases by doctors and employers is required under the Factories Act. There are [31 notifiable diseases](#). To facilitate such notifications, the Department conducts joint specialist clinics that are located at various hospitals and polyclinics. The department also advises the Ministry's Work Injury Compensation Department regarding cases notified under the Workman's Compensation Act. All notifications are investigated to confirm the work-relatedness of the cases, as well as identify any other employees who may be similarly affected. Preventive measures are recommended to the company and employees concerned.

The occupational disease incidence continued to decline, from 2.4 per 10,000 employed persons in 2003 to 2.0 in 2004. The denominator is based on data of all employed persons from the Singapore Labour Force Survey 2004. Noise induced deafness and industrial dermatitis remained the two leading occupational diseases, accounting for 82% of the 405 cases. The number of persons affected by asphyxiation and gassing rose from one in 2003 to 25 in 2004, accounting for 6% of the cases.



## Occupational Diseases, 2004



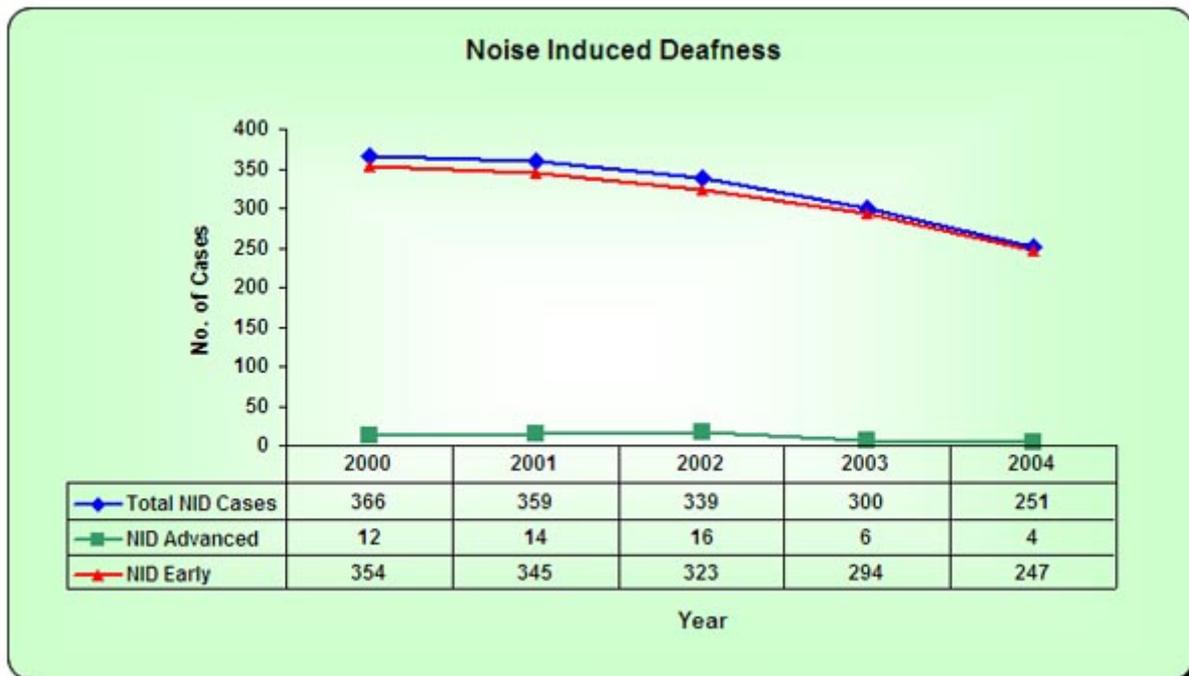
### 31 Notifiable Diseases

- 1 Aniline Poisoning
- 2 Anthrax
- 3 Arsenical Poisoning
- 4 Asbestosis
- 5 Barotrauma
- 6 Beryllium Poisoning
- 7 Byssinosis
- 8 Cadmium Poisoning
- 9 Carbamate Poisoning
- 10 Carbon Bisulphide Poisoning
- 11 Chrome Ulceration
- 12 Chronic Benzene Poisoning
- 13 Compressed Air Illness
- 14 Cyanide Poisoning
- 15 Epitheliomatous Ulceration (due to tar, pitch, bitumen, mineral oil or paraffin or any compound product or residue of any such substance)
- 16 Hydrogen Sulphide Poisoning
- 17 Industrial Dermatitis
- 18 Lead Poisoning
- 19 Liver Angiosarcoma
- 20 Manganese Poisoning
- 21 Mercurial Poisoning
- 22 Mesothelioma
- 23 Noise Induced Deafness
- 24 Occupational Asthma
- 25 Organophosphate Poisoning
- 26 Phosphorus Poisoning
- 27 Poisoning From Halogen Derivatives of Hydrocarbons
- 28 Repetitive Strain Disorder Of The Upper Limb
- 29 Silicosis
- 30 Toxic Anaemia
- 31 Toxic Hepatitis

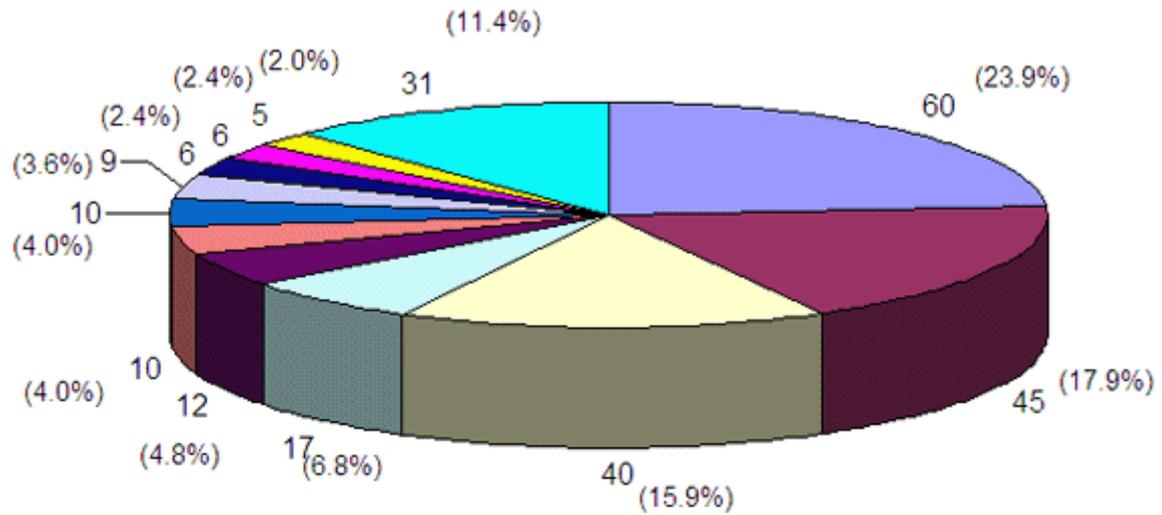
## Noise Induced Deafness

Noise Induced Deafness (NID) continued to be the leading occupational disease in 2004, with 251 cases, accounting for 62% of all occupational disease cases confirmed. Most of these cases were in the early stages of the disease. Only four (or 1.6%) had advanced or severe hearing loss, compensable under the Workmen's Compensation Act, compared to six in 2003.

The majority of the NID cases (57.7%) worked in companies manufacturing transport equipment (e.g., shipbuilding and repair), machinery and equipment (e.g., tools and die), chemicals and chemical products.



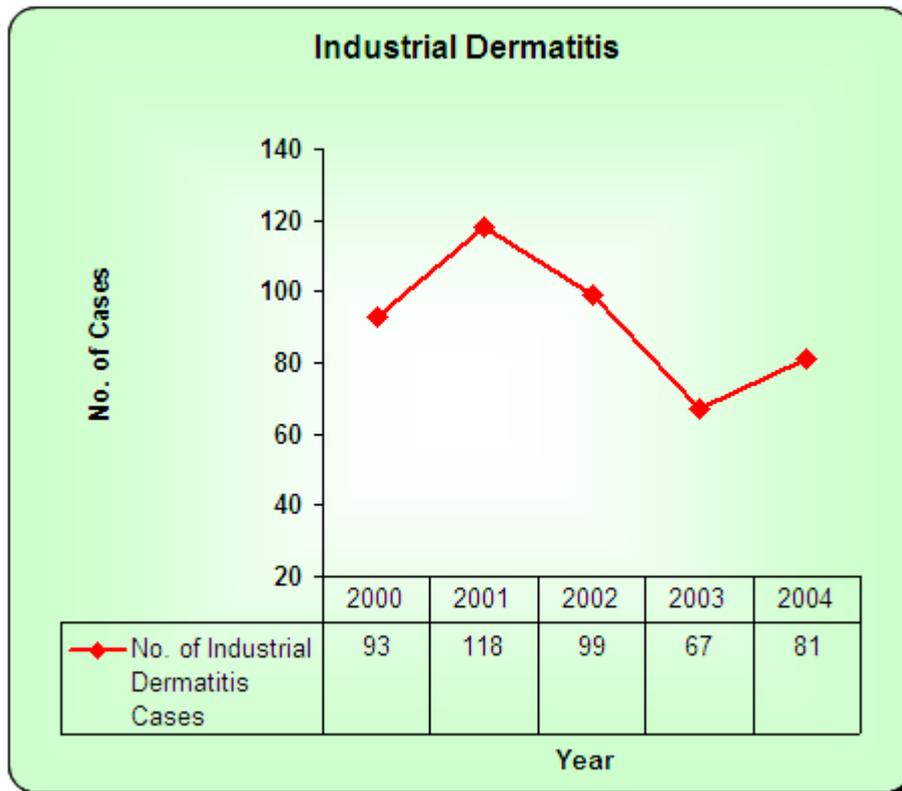
## Noise Induced Deafness By Industry, 2004



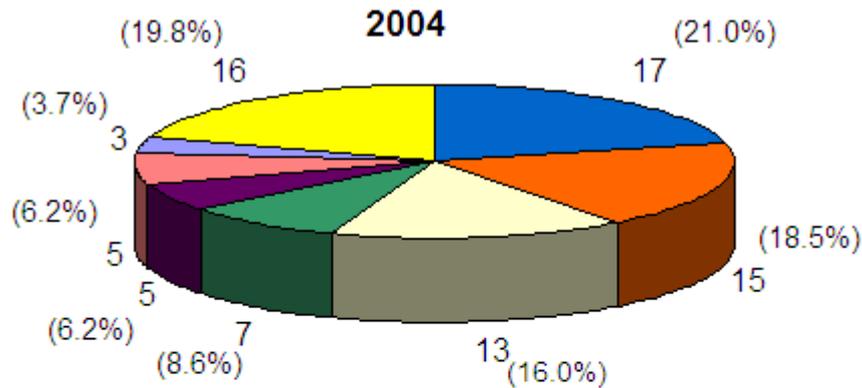
- Manufacture of transport equipment (SSIC 33)
- Manufacture of machinery and equipment (SSIC 29)
- Manufacture of Chemicals and Chemical Products (SSIC 24)
- Manufacture of fabricated metal products except machinery and equipment (SSIC 28)
- Wholesale Trade and Commission Trade (SSIC 50)
- Manufacture of electronic products and components (SSIC 31)
- Printing and Reproduction of Recorded Media (SSIC 22)
- Construction (SSIC 45)
- Manufacture of furniture; Manufacturing Nec (SSIC 34)
- Supporting and Auxiliary Transport Activities; Activities of Travel Agencies (SSIC 63)
- Manufacture of Paper and Paper Products (SSIC 21)
- Other industries

## Industrial Dermatitis

Industrial dermatitis continued to be the second most common occupational disease, with 81 cases in 2004. The common [causative agents](#) were cement, oils, heat and wet work.



### Industrial Dermatitis by industry,



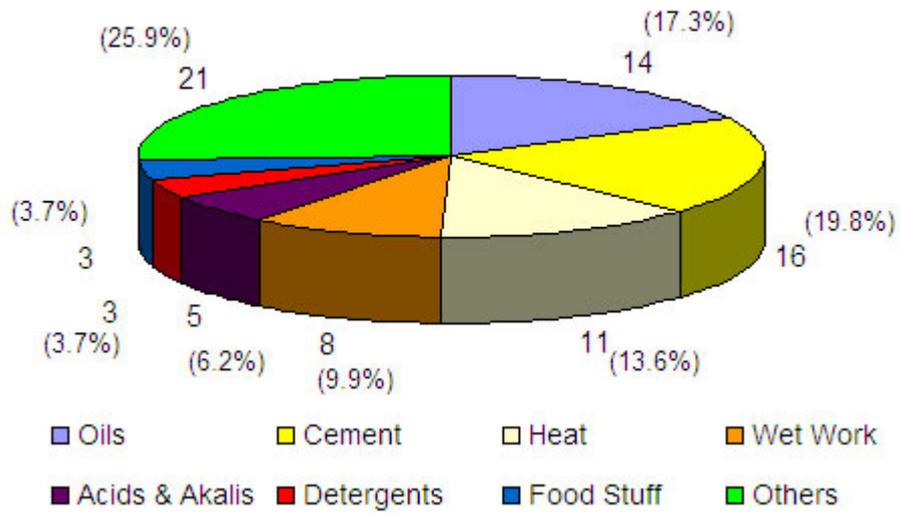
- Manufacture of Electronic Products and Components (SSIC 31)
- Construction (SSIC 45)
- Hotel and restaurants (SSIC 55)
- Manufacture of fabricated metal products except machinery and equipment (SSIC 28)
- Manufacture of Machinery and Equipment (SSIC 29)
- Manufacture of Chemicals and Chemical Products (SSIC 24)
- Manufacture of transport equipment (SSIC 33)
- Other industries

The increase in cases was due mainly to a cluster of cases from an [electronics factory](#) and cases detected in [the restaurant and catering industries](#).

There were 15 cases from the construction industry - a further decrease from 31 and 25 in 2002 and 2003, respectively. This was due to a drop in cement dermatitis cases, reflecting the increasing awareness and use of personal protective gloves among plasterers in this industry.

Causative Agents

Industrial Dermatitis by Causative Agent, 2004



CLOSE

### Heat Rashes in an Electronics Factory

Thirty five contract employees involved in inspecting heated television panels at an electronics plant were referred to the department by the safety officer for investigation of skin rashes. Eleven of the cases were found to have rashes on the forearms and lower legs. In the majority of cases, the rashes occurred within 2–3 months of starting work.

Assessments conducted showed that the ambient temperature and humidity at the inspection areas exceeded the acceptable limits. The rashes were mainly caused by the hot work environment coupled with poor ventilation. Protective guards against broken glass worn on the forearms and lower legs had an occlusion effect and aggravated the skin condition. After the factory improved the thermal environment by lowering the ambient temperature and humidity, and increasing the air velocity at the affected work areas and advised workers on skin care and personal hygiene, no new cases of skin rashes were detected.



Rash on forearm aggravated by a protective guard

## Dermatitis in the Restaurant and Catering Industry

A total of 11 workers from the restaurant and catering industries were detected to have irritant contact dermatitis, nine of them from a [survey](#) conducted in this industry. Most were cooks. The commonest risk factors were contact with strong industrial detergents and frequent wet work either because of failure to wear gloves or usage of wrong type of gloves. Other irritants include handling foodstuff and papain, a tenderizer occasionally used for meat. The workers were advised on usage of the proper type of impervious gloves to protect their hands. A set of guidelines will be developed for the restaurant and catering industry.

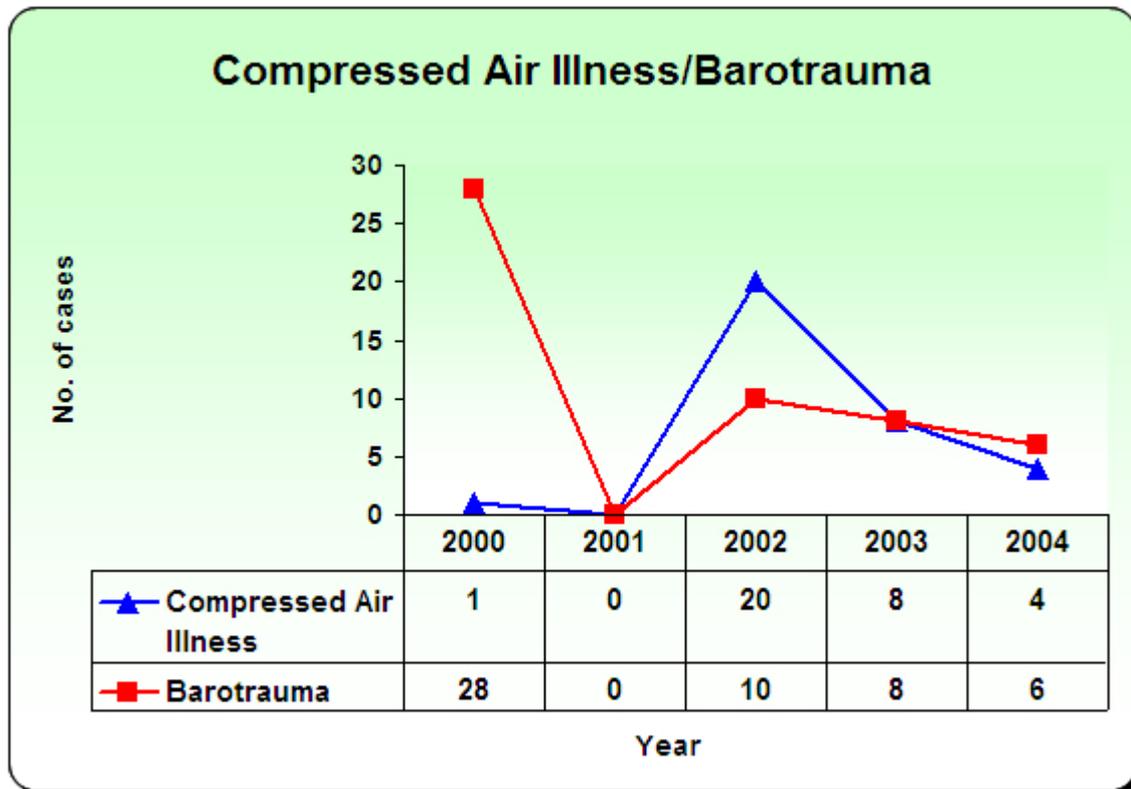


## Others

### Compressed Air Illness / Barotrauma

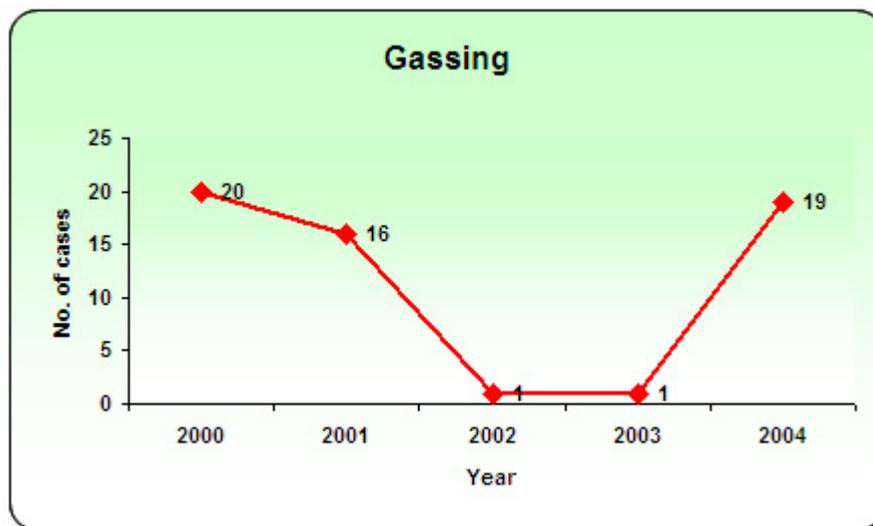
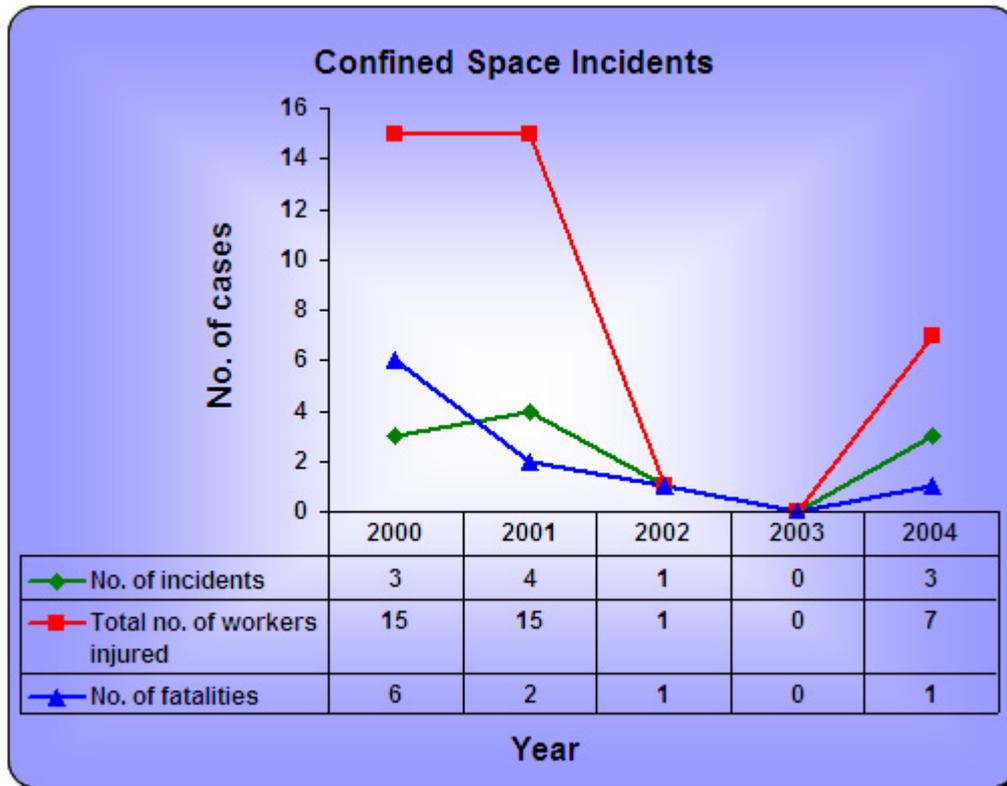
The number of compressed air illness/barotrauma cases fell to 10, compared to 16 in 2003. All the four compressed air illness and six aural and/or sinus barotrauma cases had mild symptoms. Four were employees from the Deep Tunnel Sewerage System Project in which compressed air of up to 2.7 bars was used. Another five were involved in the construction of the transmission cable tunnel. In two of these cases, there was a rapid decompression as a result of leakage of air via the inner door from the working chamber to the man-lock, due to damage to the door seal, probably by mud or rock. The last case was a shipyard welder undergoing training for commercial divers.

The fall in number of cases was largely the result of closer supervision of work procedures, as well as screening of employees prior to entry into the compressed air environment for symptoms of upper respiratory tract infection and earache - both medical contraindications to compressed air work. All workers were advised to report any symptoms of upper respiratory infection, cough and earache to the supervisors and doctors.



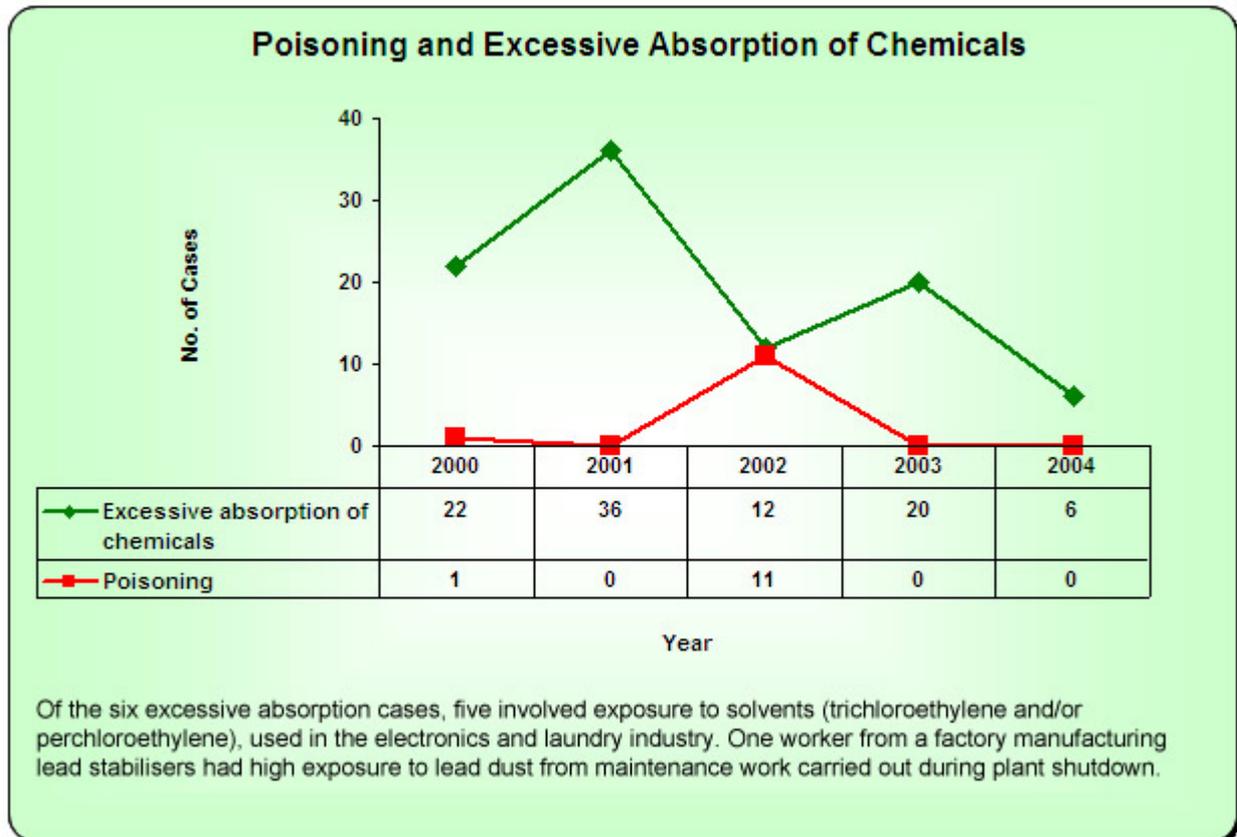
### Confined space and gassing incidents

In 2004, a total of 25 persons were affected in confined space and gassing incidents compared to only one in the previous year. Nineteen of these had acute exposure to ethylene oxide following a [gas leak in a sterilization plant](#). While there were no confined space incidents in manhole work and in the logistics industry, there were three [confined space incidents on board ships](#), affecting six persons who lost consciousness due to oxygen deficiency. Of these, one died and one developed permanent brain damage.



### Chemical Poisoning and Excessive Absorption of Chemicals

Cases of over-absorption of chemicals detected from compulsory medical examinations fell from 20 in 2003 to six last year. These mainly involved workers in the electronics and laundry industries. No cases of chemical poisoning were detected from the medical examinations.



## Others

### Work-related Musculoskeletal Disorders (WRMSD)

Patients from a range of occupations attend the two Joint WRMSD Clinics set up since 2001 at Tan Tock Seng Hospital and Singapore General Hospital. In 2004, there were seven such cases. All recovered following treatment and preventive measures, including automation, redesign of tools and machinery, use of mechanical aids, job rotation, and training on proper work posture and manual lifting techniques.

[Saying Goodbye to Body Aches & Bad Backs](#)

#### The cases...

##### Backache

- Technician from a metal stamping plant who developed low back pain and numbness of his left leg after adjusting a die into position onto a stamping machine using a crowbar and with his arms extended overhead.
- Warehouse packer involved in manual handling of between 10-50 boxes of fasteners per day, weighing from 20-30 kg each.

##### Repetitive Strain Disorders of the Upper Limb

- Baker with bilateral carpal tunnel syndrome from repetitive and forceful movements of the hands while kneading, cutting and piping dough to make cookies and cakes.
- Meat carver in a restaurant who developed tendon injury to his right shoulder from force exerted on his shoulder in trying to manoeuvre a meat wagon weighing more than 250 kg.
- Hospital nursing aide with De Quervain's Tenosynovitis of the left thumb from frequent fetching of patients on wheelchair.
- Fabricator with bilateral carpal tunnel syndrome from repetitive panel beating and exposure to vibration from grinding.
- Storeman who developed inflammation of the tendon sheath of the right thumb from frequent transferring of bags of resins, each weighing 25 kg.



Handling 20-30 kg boxes



Manoeuvring meat wagon of over 250kg



Fetching patients on wheelchair

### Severe Acute Respiratory Syndrome (SARS)

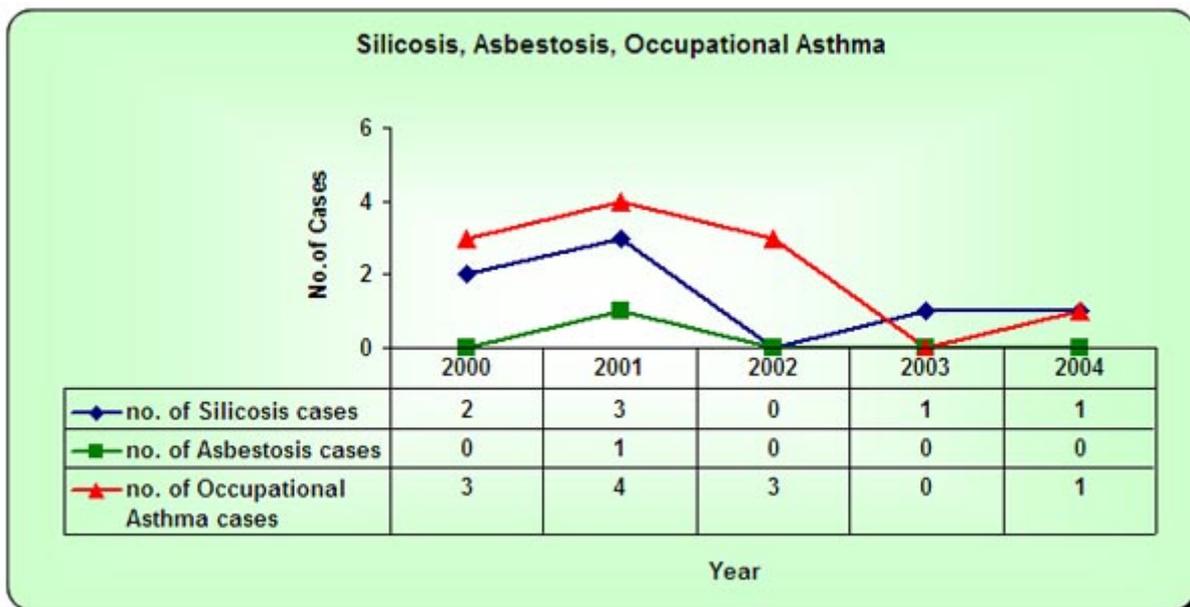
SARS was made a compensable disease under the Workmen's Compensation Act following the outbreak of the disease in 2003. The department investigated and confirmed as work-related another 20 SARS cases, bringing the total number of such cases to 97. All were healthcare workers who had attended to SARS patients or worked in the vicinity of the affected wards during the 2003 outbreak. These included 54 nurses, 13 doctors, nine healthcare attendants, three radiographers, 14 auxiliary workers and four student nurses. Of these, two nurses and one doctor died.

### Other occupational diseases

There were three cases of work-related **malignant pleural mesothelioma**. All had worked on board ships and had more than 20 years exposure to asbestos during maintenance work on asbestos-insulated steam pipes and engines that involved the removal of asbestos insulation. All had retired and have since died.

A 57 year old retired lorry driver developed **silicosis** from exposure to silica dust in a granite quarry. He had been exposed for 12 years to the dust while working as a crusher attendant until 1991. He had no significant disability.

A 56 year old welder developed **occupational asthma** due to exposure to fumes generated from plasma welding. He had worked in an engineering workshop for three years. Dust masks used were not of the correct type and no local exhaust ventilation (LEV) system was provided. He has since left the company and has fully recovered. Following the case, the company installed an LEV system at the plasma welding machine, and subsequent assessments showed that the LEV was effective.



## Case Study

### **Ethylene Oxide Gas Leak**

Nineteen employees were exposed to ethylene oxide that leaked from a process for sterilising medical products. They developed dry throat, nausea, vomiting and headache. All have since recovered. Emergency evacuation procedures were not followed despite high concentrations of ethylene oxide detected by the fixed monitoring system. The sterilization system had not been adequately maintained.

Safety audits conducted in nine other companies with similar activities showed that systems and emergency procedures were in order except in two companies, for which requirements on gas monitoring systems have been imposed.

## Case Study

### **Confined Spaces on Board Vessels – Death Traps at Shipyards**

In 2004, there were three accidents involving confined space work on board ships undergoing repairs and maintenance in which victims suffered asphyxiation from lack of oxygen:

- A ship crew collapsed and died from oxygen deficiency inside a cargo tank while trying to retrieve a helmet which had accidentally dropped inside the tank by a surveyor. The tank was inerted with nitrogen and was being loaded with butanol, a flammable liquid, at the time of the accident.
- A 28 year old surveyor became unconscious when he entered a ballast tank on board a barge. Two workers also became unconscious while trying to rescue him. All three were rescued. Unfortunately, the surveyor suffered permanent brain damage with severely impaired function. The other two victims have fully recovered. Investigations showed that the accident was due to oxygen deficiency and exposure to high concentration of carbon monoxide.
- Two crew members on board a fishing vessel collapsed inside a fish hold shortly after they entered the freezer tank to carry out cleaning work. Both were rescued and have since recovered. The tank was used for temporary storage of diesel fuel, and had contained residual diesel from the last refueling. Investigations showed that the victims were likely to have been affected by lack of oxygen and high level of hydrocarbon vapours.

In these three accidents, ventilation was not provided and the confined space was not tested for oxygen, toxic or flammable gases. Suitable breathing apparatus was not worn by the victims, and an emergency rescue plan was not in place.

An OSH Alert was issued to warn shipyards and factories of the dangers in confined space work, and the precautionary measures to take.

### Saying Goodbye to Body Aches and Bad Backs

Workers had to manually lift up the die assembly weighing over 12 kg and transfer it onto the machine, and were at risk to hand and back injuries. An adjustable mobile stacker was fabricated at a cost of S\$1,800. Now, workers do not need to carry the heavy dies onto the machine.



Manual lifting of 12 kg dies eliminated with the use of mobile stacker