

# PVC Leads Climate Change Mitigation and Risk Reduction for Sustainable Development

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1. PVC much contributes to Climate Change Mitigation
  - Plastic (PVC) window frames has a huge potential
2. Many advantages of PVC proved as construction materials
  - User industries acknowledge the merits of PVC materials
3. PVC can reduce risks of fires and loses
  - PVC has many advantages vs. other materials
4. VEC Commits Pushing Recycling
  - VEC starts a program to advance PVC recycling

# 1 . Climate Change Mitigation

- Plastic window frames\* can cut CO<sub>2</sub> emissions by 35 m t/yr = 1/5 CO<sub>2</sub> emissions reduction necessary to meet Japan's Kyoto Target
- Huge global potential of CO<sub>2</sub> emission reduction
- Government pushes installation of plastic window frames
  - Subsidies to cover 1/3 of total installation costs
  - New tax incentives to start in 2008
  - Plastic windows installed in the building of the Ministry of the Environment. Foreign Ministry may follow soon.

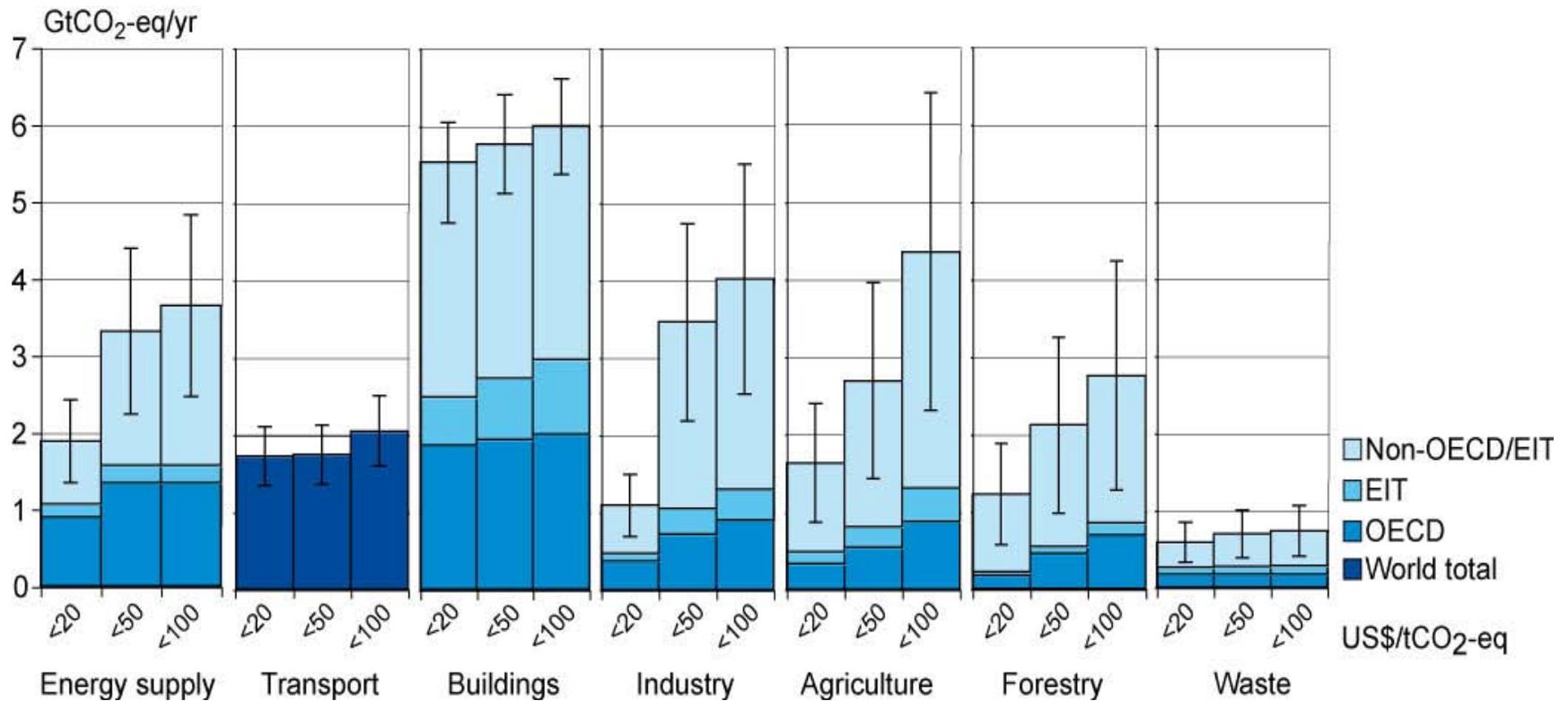
\*Plastic window frames combined with low-e double glazing.

# Global Potential

(from IPCC WG3 AR4 Chap.6)

- World GHG Emissions(2004) 26.5Gt
- Housing/Bldg ( 2004 ) 8.6Gt
- Housing/Bldg (2030 projection) 14.3Gt
- Reduction Potential, 4.5-5.6Gt to 2030
- Space heating/Cooling: major areas of GHG emissions in Housing/Bldg.
  - US 12%/10% in Bldg, 29%/3% in Housing
  - China 45%/14% in Bldg, 32/7% in Housing

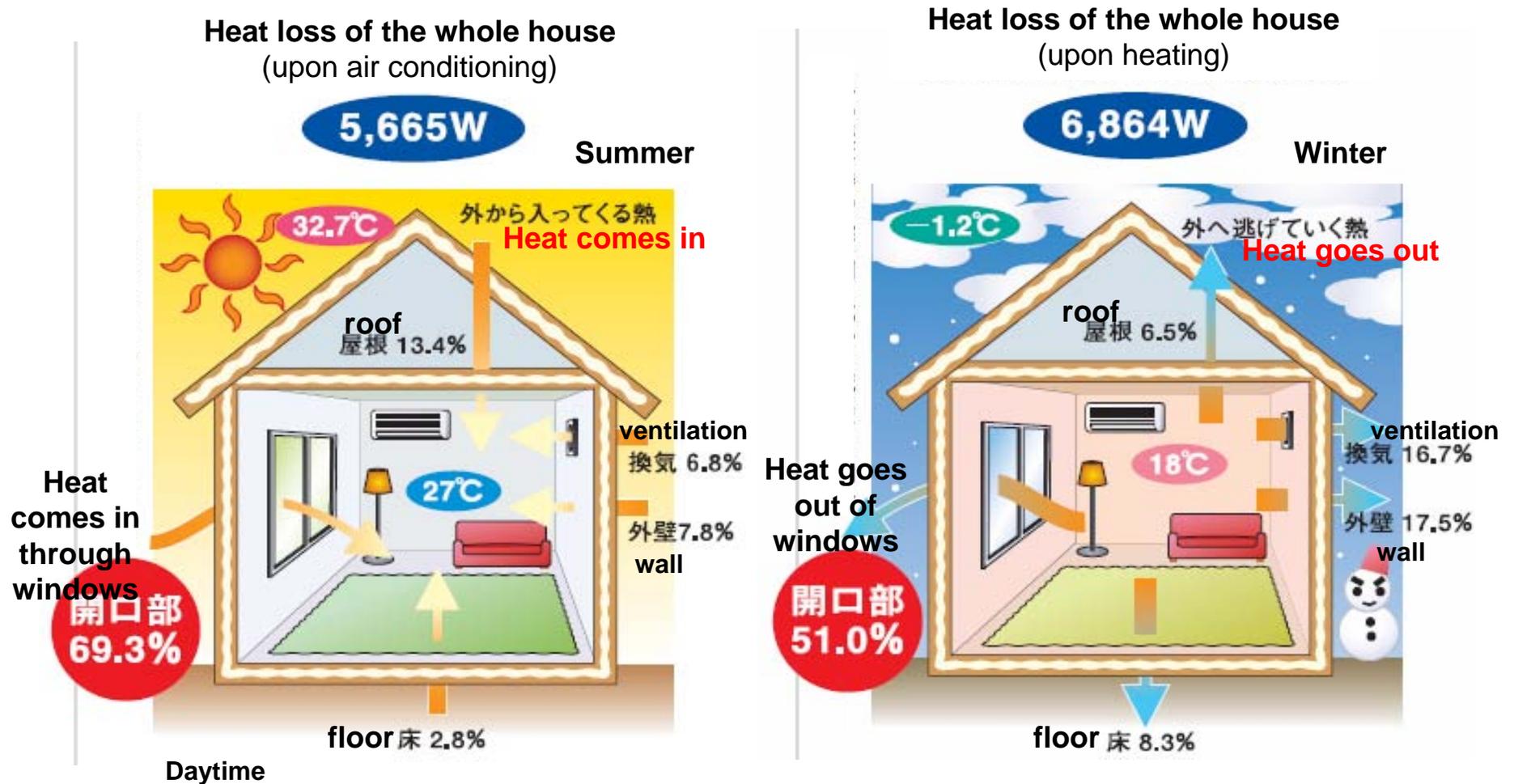
# Estimated potential of GHG emissions reduction



IPCC WG3 AR4 Summary for Policy Makers

# Heat loss through windows

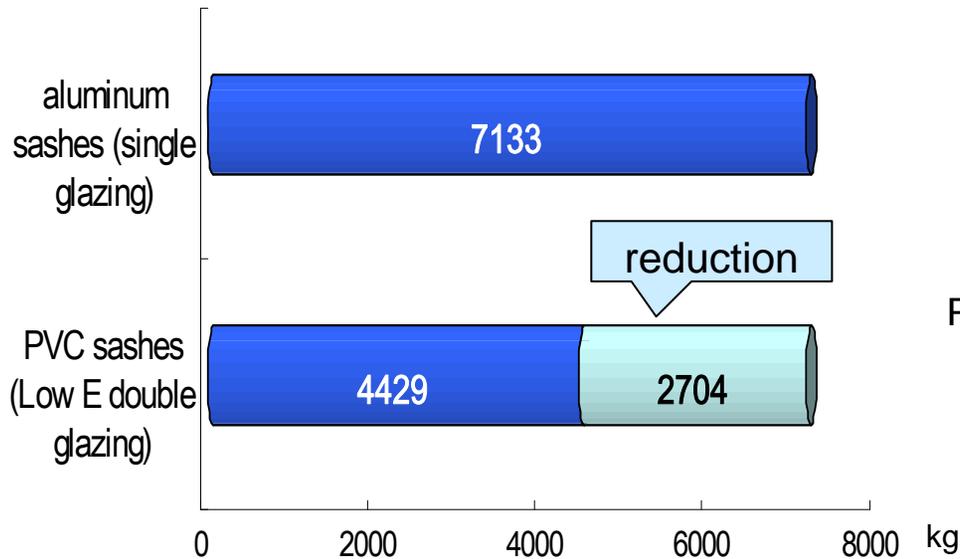
Most houses/bldg.s in Japan use single glazing aluminum window frames. Much heat losses occur mostly through these windows.



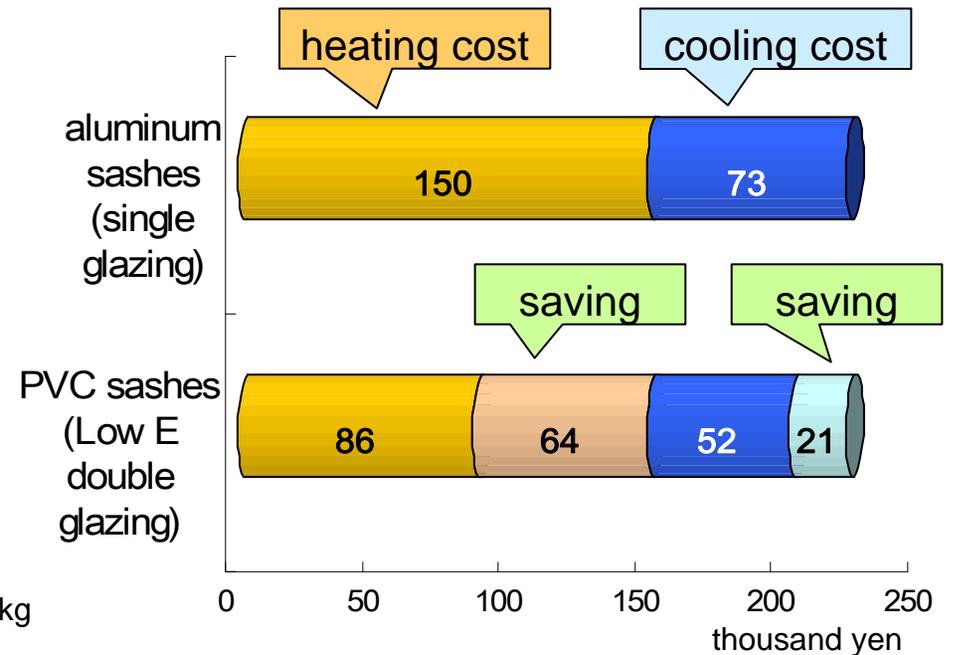
Source: Jmado

# Very substantial CO<sub>2</sub> Emissions can be reduced with PVC Window Frames, thus much energy cost can be saved

■ CO<sub>2</sub> Reduction



■ Heating and Cooling Cost Saving



Substantial energy cost saving can be achieved by replacing “aluminum sashes + single glazing windows” with “PVC sashes + low E double glazing windows” together with conditioning room temp. at 27 °C in summer and 18 °C in winter.

Ministry of Environment have PVC-frame inner windows

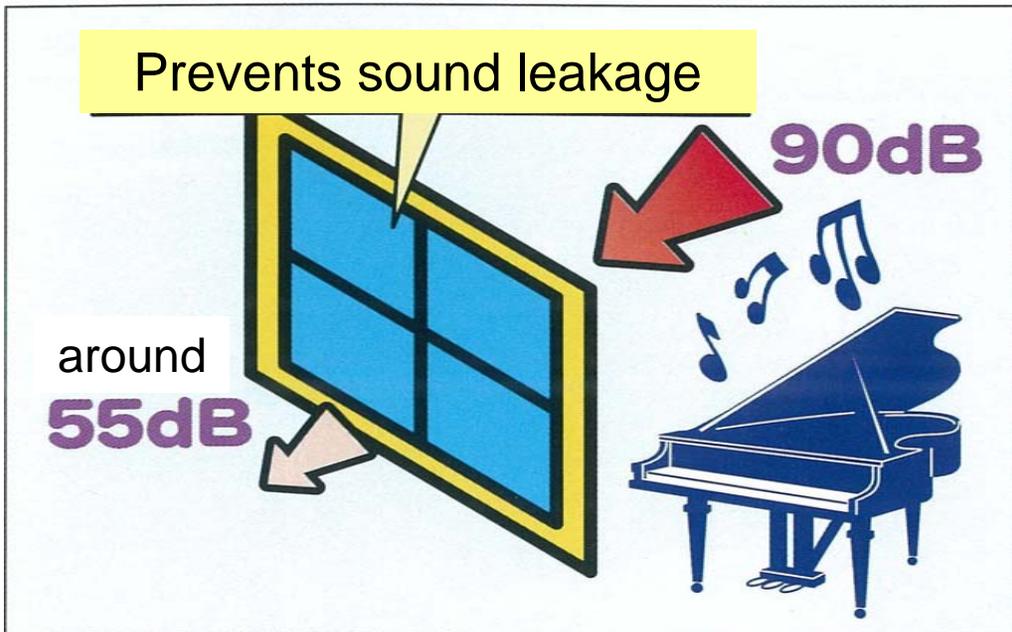
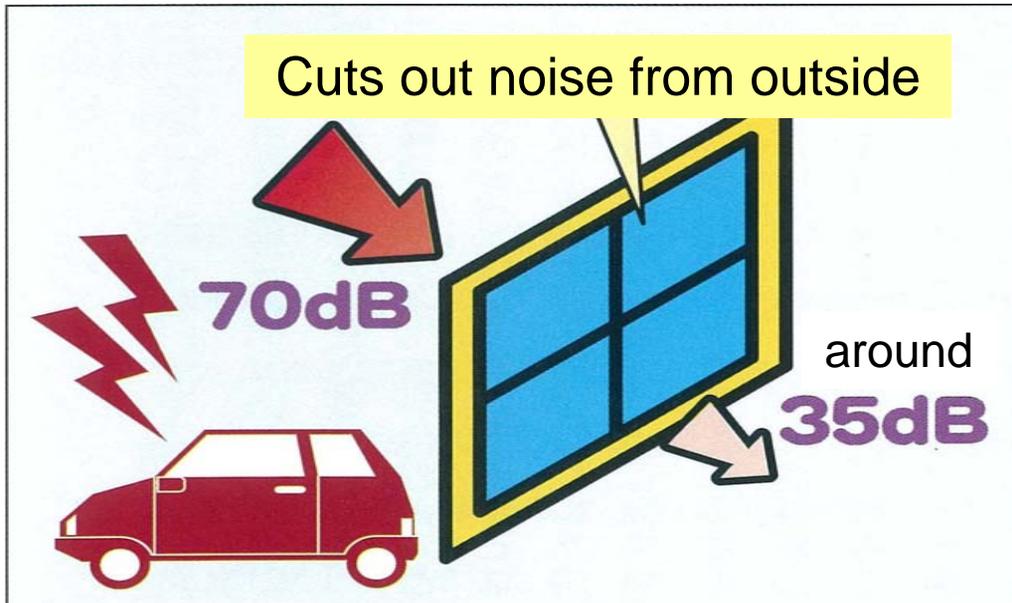


**Before**

**PVC-frame inner windows installed**

Windows of the Environmental Minister's Room

# Inner windows also effective to shut out sounds



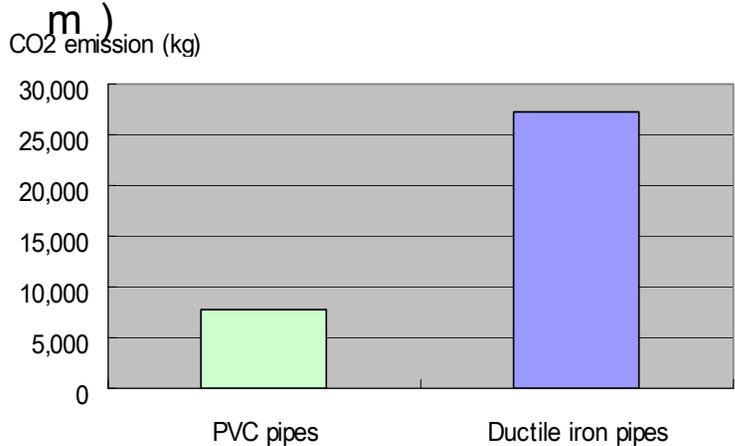
## Noise Level ( d B)

30	midnight in a suburb
40	quiet park
50	quiet office
60	large store
70	busy street
80	busy crossing
90	bowling gym
100	beneath a railroad bridge

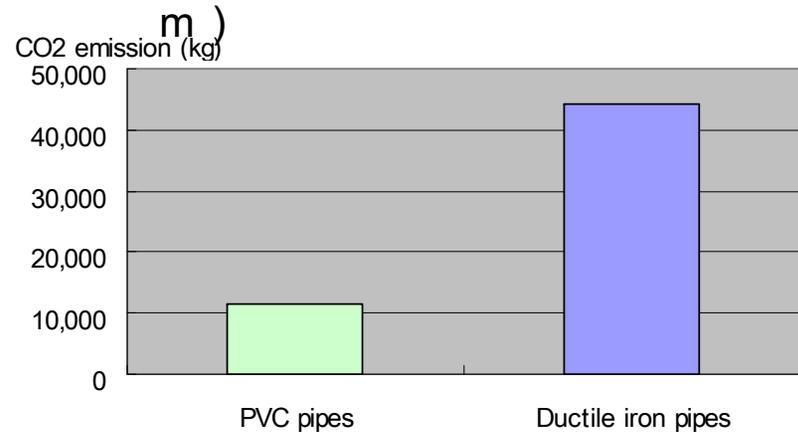
# Much less CO<sub>2</sub> emitted at/upon production/combustion of PVC vs. other materials

- **1/3 ~1/4** emissions at production vs. steel pipes

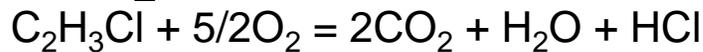
Water supply pipes (150m mφ per 1 k m)



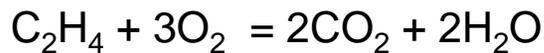
Sewage pipes (250m mφ per 1 k m)



- **1/2** CO<sub>2</sub> emissions upon combustion vs. olefin



$$62.5 \text{ g} \quad \quad \quad 88 \text{ g} \quad \longrightarrow \quad \mathbf{1.41 \text{ g-CO}_2/\text{g-PVC}}$$



$$28\text{g} \quad \quad \quad 88 \text{ g} \quad \longrightarrow \quad \mathbf{3.14 \text{ g-CO}_2/\text{g-PE}}$$

## 2. Many advantages of PVC proved as construction materials

- Some 18 PVC user industry associations see PVC positively as construction materials

### Examples:

PVC cables have many advantages against EM cables\*

PVC pipes confirmed durable for more than 50 years

PVC window frames have a high potential for CO<sub>2</sub> emissions reduction

PVC siding provides economic maintenance free solutions for decades

PVC modular carpets friendly to the environment by recycling

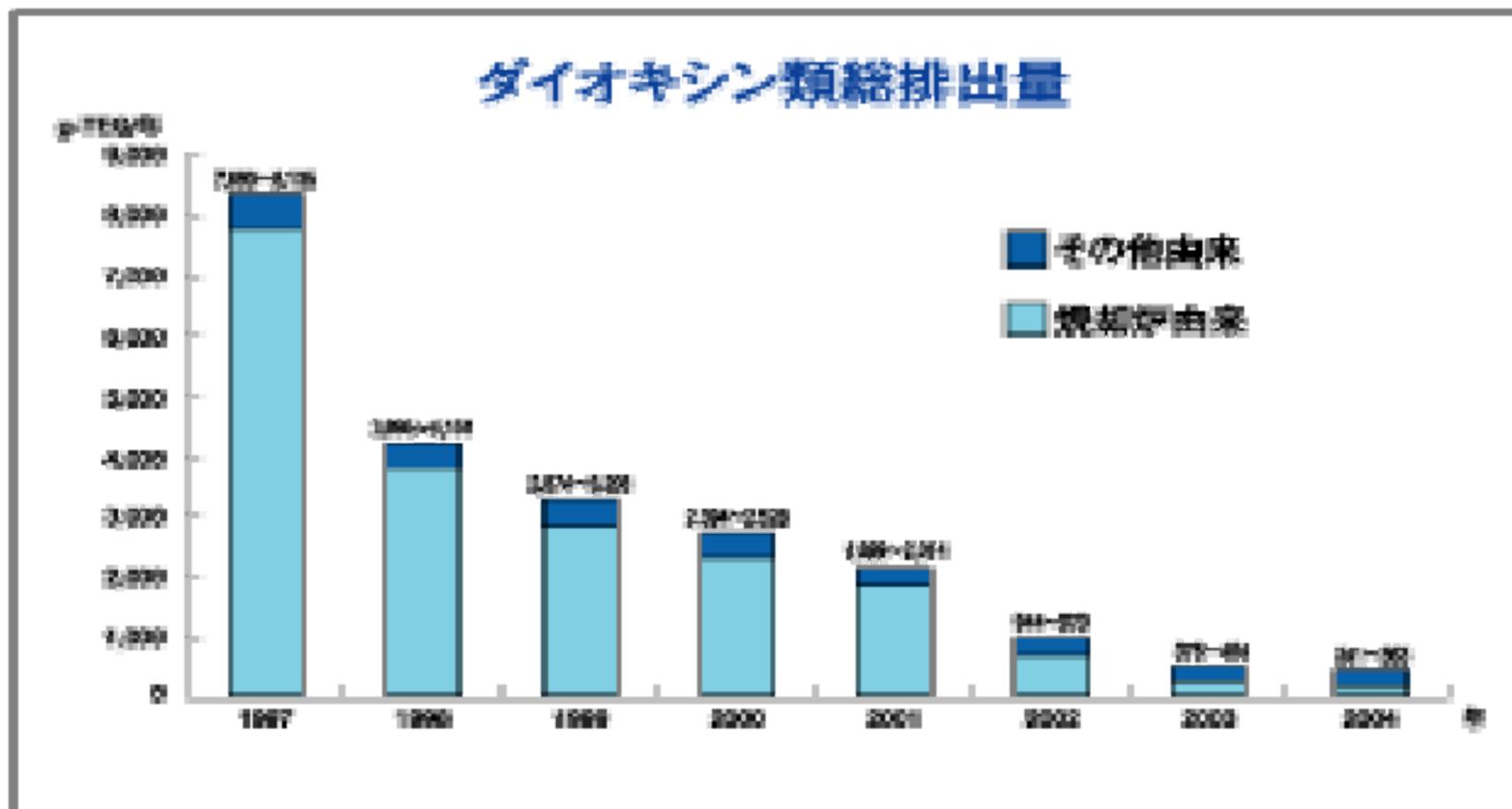
\*so called “eco-material” cables made of non-halogenated polyethylene

# PVC has many advantages over EM\* Cables

\*so called “eco-material” cables made of non-halogenated polyethylene

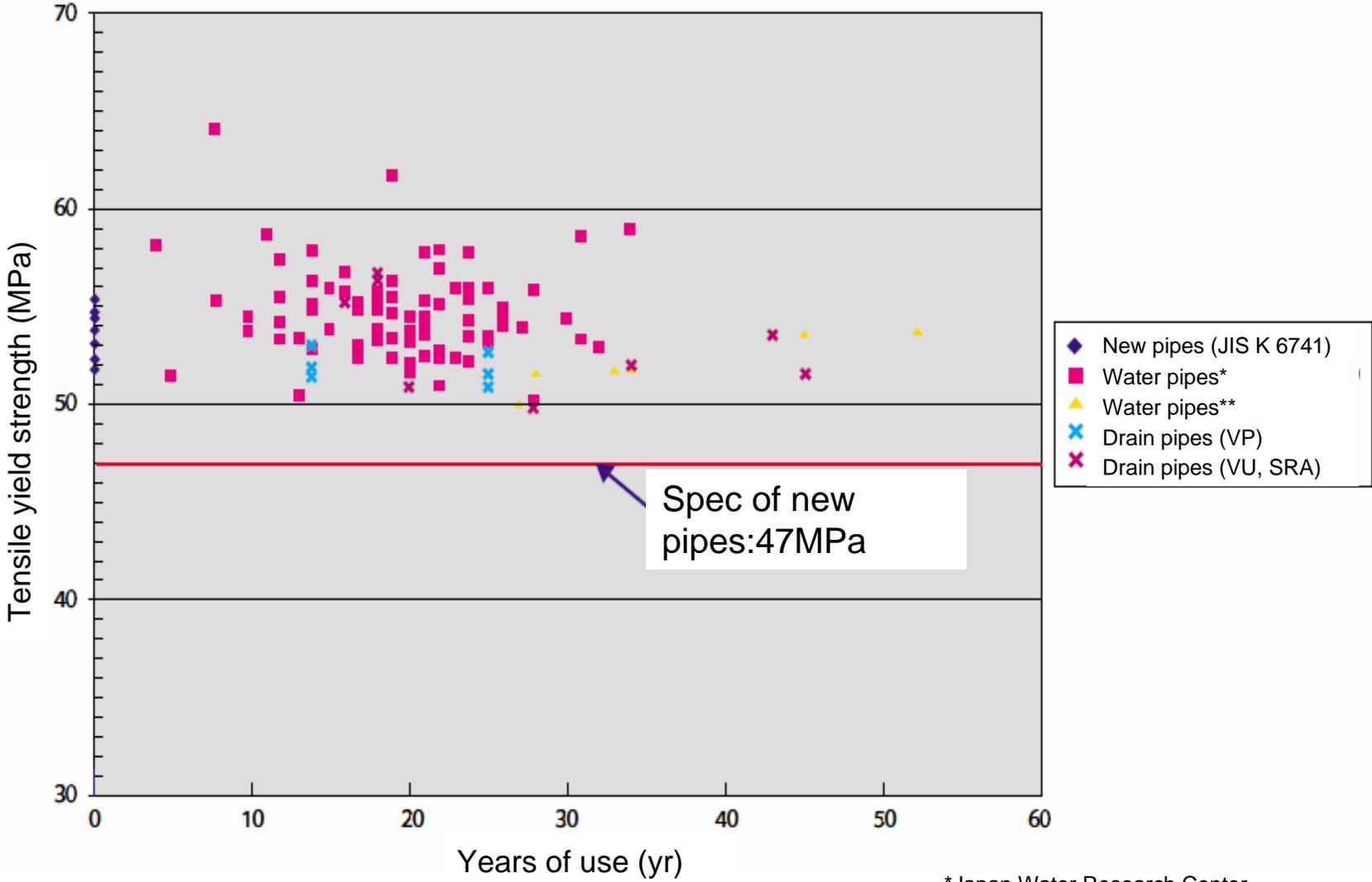
	<b>PVC cables</b>	<b>EM cables</b>
Dioxin	X <i>if inappropriately incinerated</i>	○ ~ △ may emit PAHs if inappropriately incinerated
Heavy metal	△ may release Pb if Pb compounds are used	○
Recycling	○ materially recyclable	○ mostly thermally recycled
Smoke in fires	○ ✓△ no substantial risk	X (albeit they can meet fire codes)
Acidity of gas when burned	○ ✓△ pH2~4.2	○ pH4.3
Resource availability	○ abundant (Carbon + natural salt)	△ Mg(OH) <sub>2</sub> supply may be constrained
price	○	X ~ △ 20-30% more expensive
Bent/	○	△
electric non-conductance	○	○ ~X decrease under high temp, or alkaline environment
UV resistance	○	○ ~X
Alkali resistance	○	X
NOx/ SOx	○	X become sticky
<b>Overall</b>	<b>Can be used for general purpose</b>	<b>For limited use</b>

Emission of dioxin was reduced by 96% since 1997 = less than half of the target level



The peak was observed in 1970 and some 80 times higher than in 1997.  
Majority derived from pesticides (and PCB) in the 60s to early 80s.

# PVC pipes proved durable for scores of years



\*Japan Water Research Center

\*\*Japan PVC Pipes & Fittings Association

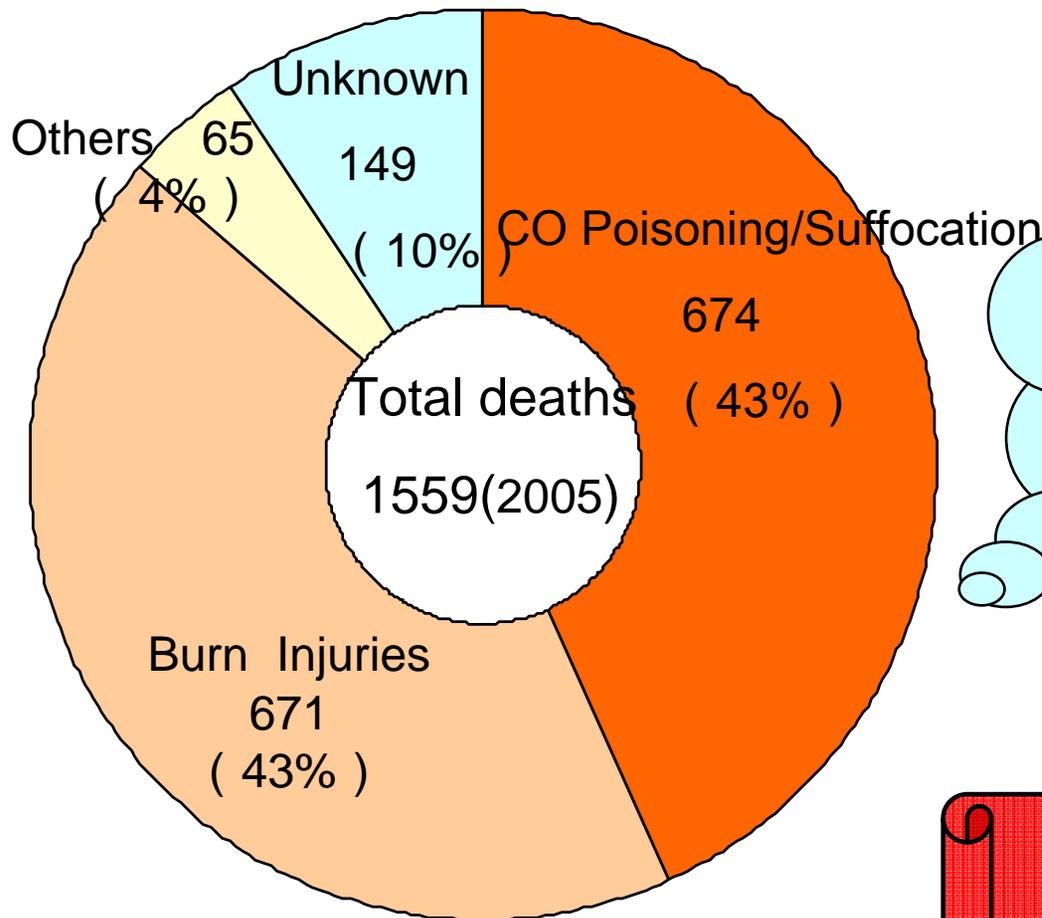
### 3. PVC reduces risks of fires and losses

- CO and Burn injuries are the main causes of fatalities
  - 43% fatalities caused by CO and suffocation, another 43% by burning in fires
  - CO concentration some 100 times higher than HCl in actual fires

Thus

- Prevention of fire essential to reduce losses
  - CO generation and burning unavoidable in any fire. Prevention of fire is essential .
  - PVC products can prevent catching/spreading fire, thus, reduce the risk of losses.

# Causes of Fatalities by Fires: CO, Suffocation and Burn account for 86% of Deaths

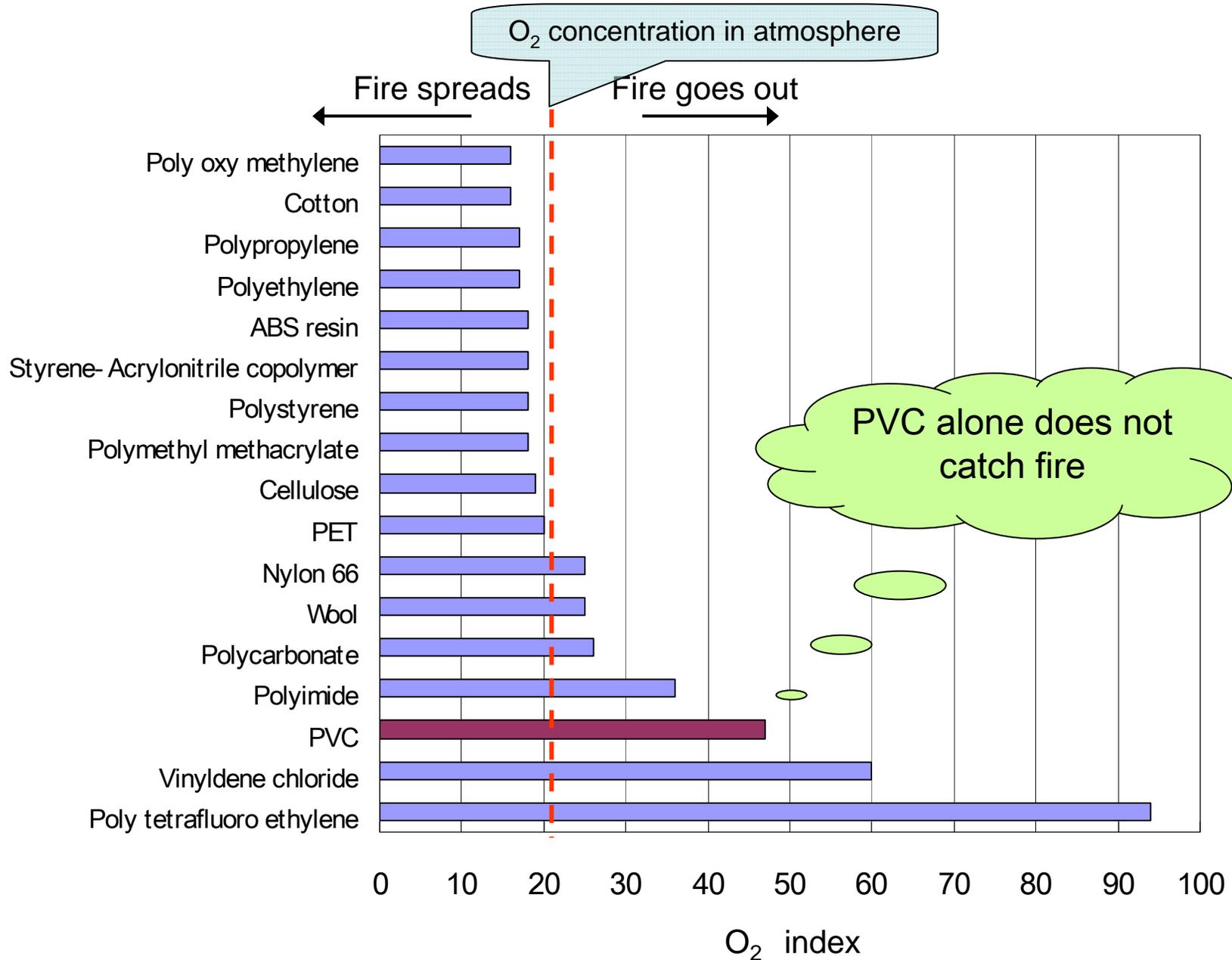


Many materials/articles inc. woods, papers, fibers, clothes, easily catch fire and generate poisonous CO gas.

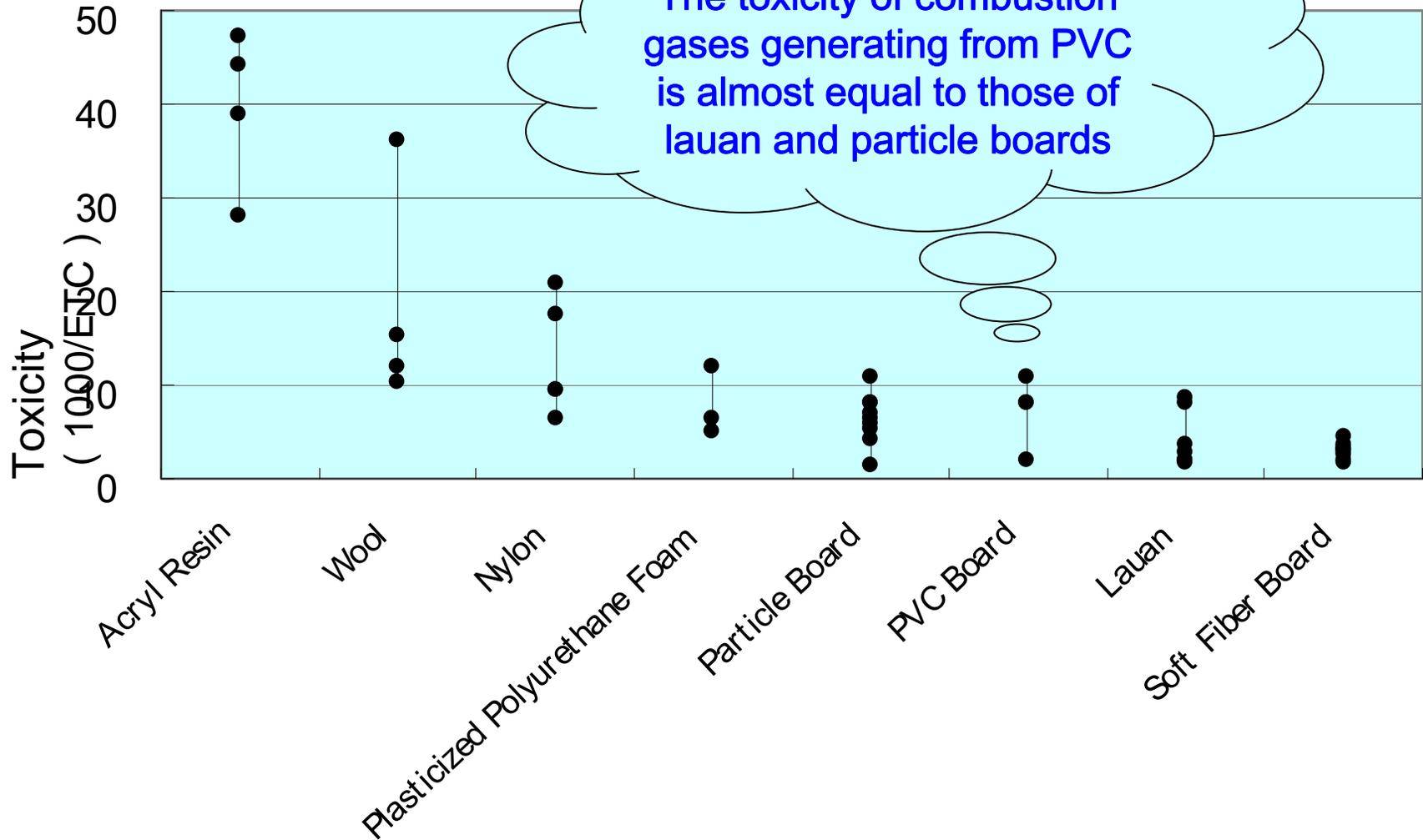


Prevention of fires  
essential to reduce  
losses by fires

# PVC can reduce risks of fires



# PVC products are safer than many other materials in case of fire.



ETC; Effective Concentration Time: the concentration exposed to mice multiplied by the time duration until mice lose their mobility

PVC products generate HCl gases when burnt. But HCl is not considered fatal in actual fires.

Gas concentrations at fire sites  
(max figure)

CO	50,000 ppm
HCN	350
HCl	50
SOx	117
NOx	50
CO <sub>2</sub>	80,000

Toxicity of HCl is comparable to CO. But its concentration in actual fires is much lower than CO. HCN is some 10 times more toxic than HCl and its concentration in actual fires goes beyond lethal levels.

Source: Tokyo Fire Department; average of maximum figures measured from 13 fire sites

Lethal concentration (ppm) of gases  
(Lethal concentration after 30-60 min exposure to rats)

HCN	HCl	CO	NH <sub>3</sub>
100~240	1,000~2,000	1,500~2,000	2,500~4,500

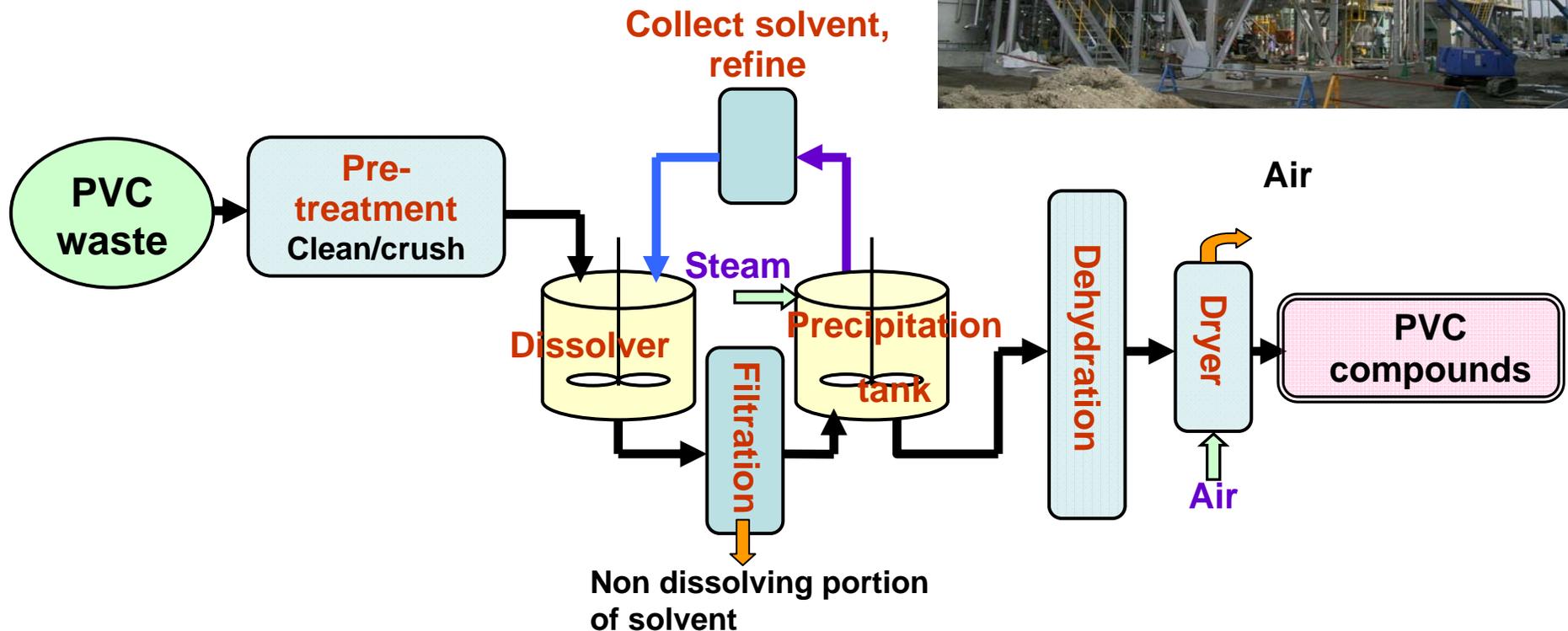
Lethal concentration of HCl is comparable to CO.

## 4. VEC starts a new initiative for recycling

- VEC commits to invest in PVC recycling  
(minimum 2 billion yen = 17m USD in 5 years)
  - Development of recycling technologies
  - Establishment of recycling systems
  - Supporting demonstrations

# Example of Recycling 1: Vinyloop

Plant: constructed in Chiba Prefecture  
Joint Venture: Kobe Steel and Solvay  
Treats: agro-films, pipes, cables  
Capacity: 26,000t/y  
Subsidy: from MOE and local government  
Operation: started in April 2006



# Example of Recycling 2: JFE Steel

## Conversion of PVC into Coal Substitute for Blast Furnace

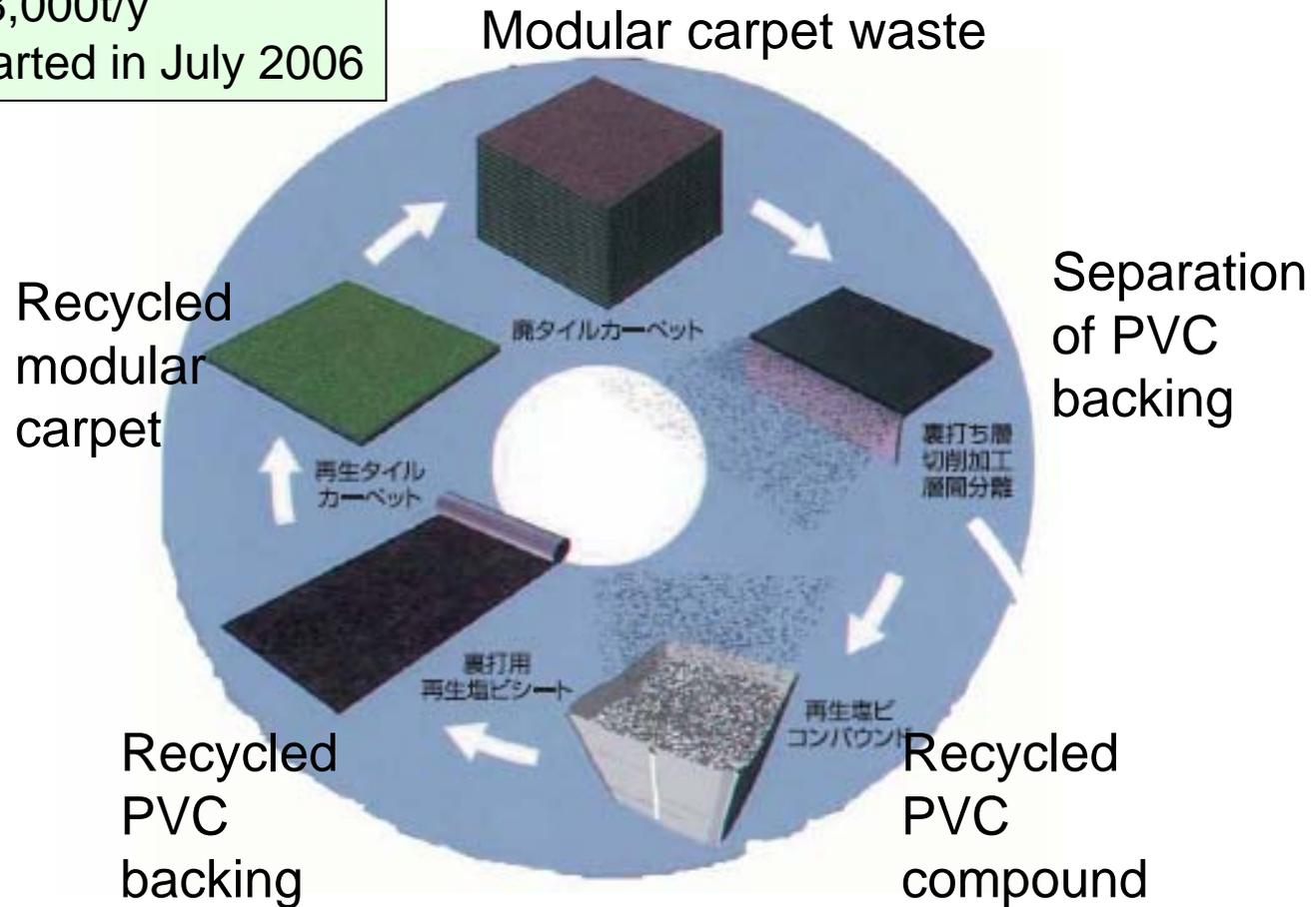
Plant: constructed in Kanagawa Prefecture  
Treats: agro-films, pipes, wallcovering  
Capacity: 6,000t/y  
Operation: started in May 2003



# Example of Recycling 3:

## Modular Carpet Recycling

Plant: constructed in Chiba Prefecture  
Treats: modular carpet  
Capacity: 18,000t/y  
Operation: started in July 2006



## And, users have become more positive than in the past

- Governments' procurement codes revised to accept PVC use in cables
  - Ministry of Land, Infrastructure and Transport (September 2006)
  - Tokyo Metropolitan Government ( June 2007 )
- Many companies acknowledge the advantages of PVC derived from its unique properties and show interests in recycling.

Thank you!

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