

# PAINTS & POLLUTION



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# Background

**Colours or Toxins ???????**

**What are you painting your home with?**

**White-washing with vibrant colours or ???**

**Are U aware of quality of paints & its long-term  
impact - health hazards?**

# SOME FACTS:-

- ❑ Paints are large contributors of VOC's & cover nearly 95% of room surface area
- ❑ Air quality testing show that Indoor VOC levels are consistently 10 times higher than outdoor levels,  
and up to 1,000 times higher immediately after a new coat painting [source: Pennock].
- ❑ Paint-related products are the second largest source of VOC emissions into the atmosphere after automobile pollutants , responsible for roughly 11 billion pounds every year [source: Pennock, Grafman].
- ❑ Painters / paint workers are regularly exposed to paint vapours & have an increased incidence of several types of cancers, impaired brain function, renal dysfunction and other health problems [source: International Programme on Chemical Safety].
- ❑ Generally VOCs are emitted by the use of oil-based paints
- ❑ Appox 9% of airborne pollutants creating ground level ozone comes from VOCs in paints –(Source – USEPA)

# Do you know ??

- Conventional paints consist of Volatile Organic Compounds (VOCs), formaldehyde and lead etc.
- Conventional paints are generally classified into two categories: latex (or water-based) paints and solvent (oil-based) paints.
- Water-based (Latex) paints are a better choice, since it doesn't release as many VOCs as oil-based paints.
- Water-based paints have extremely low VOC's content, mostly negligible & are referred to as 'green paints' or 'eco-friendly' paints, as they're much safer and don't pose any potential health hazards.
- However, Solvent-based paints deliver higher performance in comparison to water-based paints.
- But today trends are changing . .....

# Some Sources of VOC & Lead exposure



## Other Sources of Lead entry

- ❑ Impurities in Water
- ❑ Natural extenders,
- ❑ Mineral Oils,
- ❑ Phosphates
- ❑ Resins.

**These sources have up to 100 ppm lead as impurities.**

**Main contributor of VOC**

## **Some VOCs in paints are - to avoid :-**

- Petroleum distillates
- Mineral spirits
- Chlorinated solvents
- Methylene chloride
- Trichloroethylene
- Trichloroethane.
- Ammonia
- Crystalline silica
- Fungicides; and
- Biocides
- Titanium Dioxide (TiO<sub>2</sub>)



# The Core of the problem – LEAD - What is it?

- ❑ Lead is a soft, malleable, poor metal main-group element with symbol Pb (Atomic number-82).
- ❑ It is also counted as one of the heavy metal & toxic metal – neuro toxin
- ❑ Metallic lead has a bluish-white color after being freshly cut, but it soon tarnishes to a dull grayish color when exposed to air.
- ❑ Lead has a shiny chrome-silver luster when it is melted into a liquid.
- ❑ Research has shown that Lead exposure can cause serious harm to children and adults.
- ❑ Lead exposure can happen from lead contaminated air , soil, water

# Contributors of Lead in Paints & their functions in paints

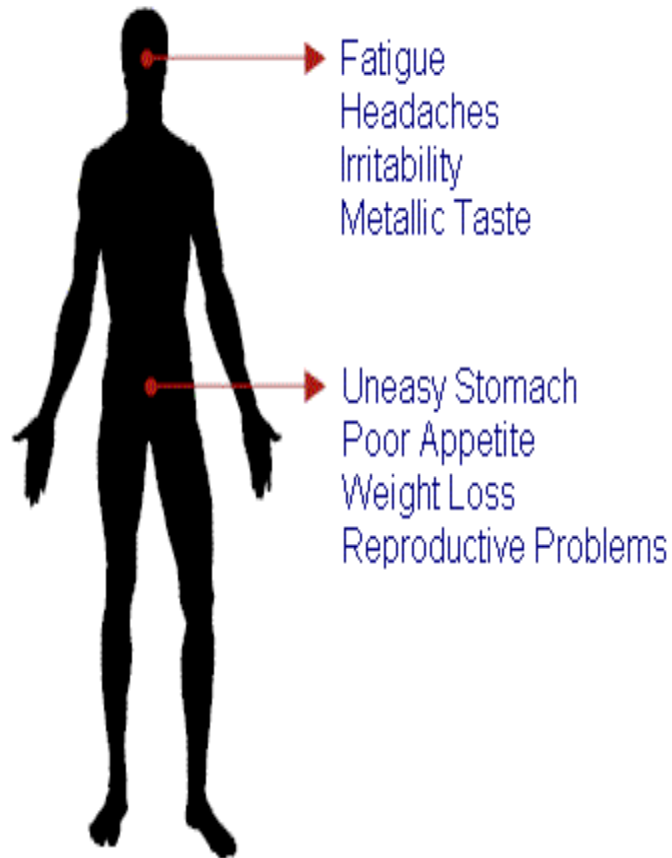
- ❑ Lead pigments: Lead chromates (Lemon, Middle, Primrose & Scarlet chromes)
- ❑ Lead based additives: Lead pastes (Retards the adsorption of lead driers on pigment surfaces),
- ❑ Lead oxides (as resin catalyst & anti corrosive agent in primers)
- ❑ Lead driers (Functions as through driers)

## Sources of lead containing RM & their function in paint

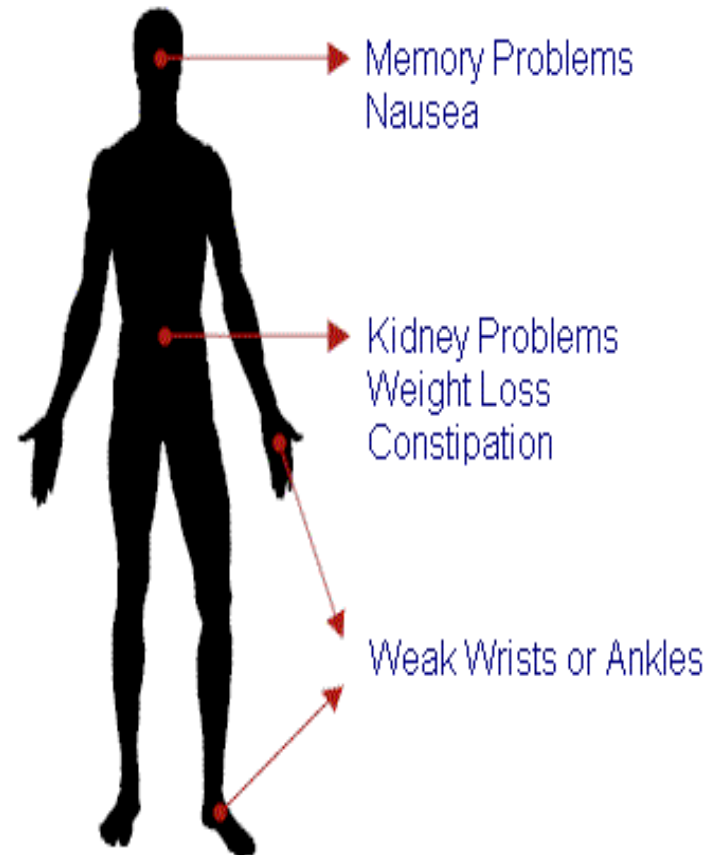
- ❑ Lead carbonate (white lead) - white inhibitive pigment
- ❑ Lead sulphate - white pigment
- ❑ Litharge- catalyst, drying aid, anticorrosive agent
- ❑ Red Lead- anticorrosive pigment
- ❑ Lead chromate- Lemon chrome, middle chrome as yellow and orange pigment for paint
- ❑ Lead molybdate -Scarlet chrome- red pigment
- ❑ Lead octoate/Lead naphthenate- As drier
- ❑ Lead Acetate - Alkyd cooking catalyst

# Effect of Lead Poisoning

## Early Symptoms of Lead Poisoning



## Later Symptoms of Lead Poisoning





**Table 3. Health effects of paint components**

**Type of metals and compounds used in paints**

**Possible health effects**

Water-based – ethylene glycol (glycol ether)

Ethylene glycol, a known teratogen can cause birth defects, skeletal malformation in rats, albuminuria, tremors, cyanosis, anuria and the presence of oxalic acid in the urine. Acrylic paints may release **methyl methacrylate** to cause eye and mucous membrane irritation and drowsiness; linked with anorexia, they are suspected of causing carcinogenesis and mutagenesis

Alcohol/oil-based – turpentine, mineral spirits

Turpentine and mineral spirits are moderately toxic by all routes of entry; they're irritants and narcotics

Organic and inorganic pigments like **cadmium, lead, chromium** and **nickel** of which lead compounds are preferred hiding agents; Titanium dioxide (TiO<sub>2</sub>)

Exposure to chromium compounds can lead to increased risk of lung cancer. Inhalation of chrome dust or spray may lead to irritation of the bronchial tubes, ulceration of the mucous membranes of the nose and cornea, allergic contact dermatitis and irritation of eyes.<sup>11</sup> Cadmium remains stored in the kidneys, resulting in reduced kidney function. Lead affects the nervous system, inhalation of lead dust may result in lead poisoning followed by memory failure, muscular weakness, etc.



Mildewcides; organic mercury-based preservatives, water-based paints use styrene-acrylic; vinyl acrylic (or 'PVA' – polyvinyl acetate); oil paints use a binder based on drying oil linseed; soya, formaldehyde

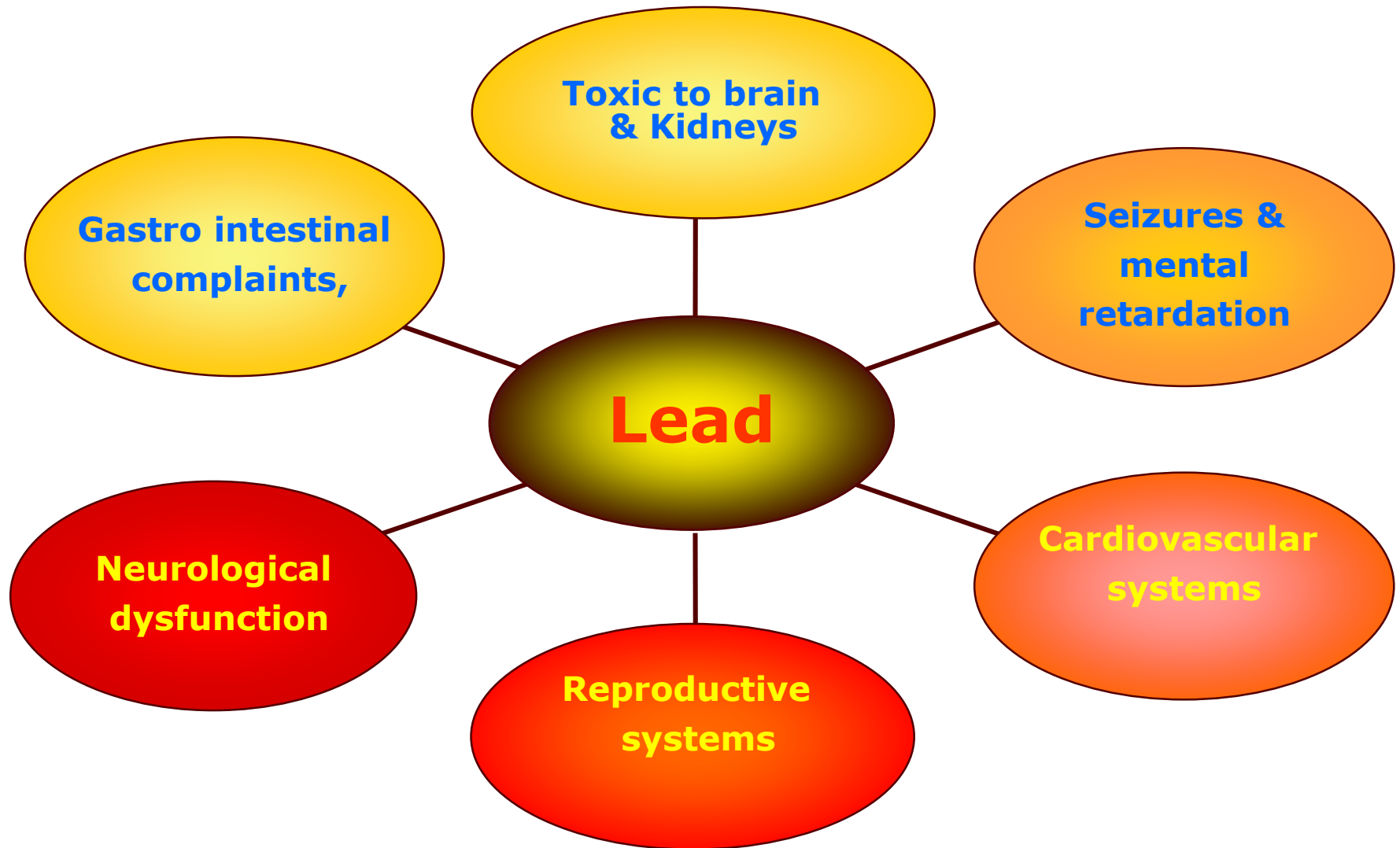
Alkyds, polyesters, emulsion polymers, epoxy resins, polyurethanes, polyesters, melamines; paraffin/ polyethylene (PE) blends

Mercury is a neurotoxin. Exposure to organic mercury may lead to birth defects

Formaldehyde can cause a high level of irritation of the mucous membrane and may cause inflammation of the respiratory system and skin ailments. It is also a known carcinogen.

**Polyurethanes**, made from **isocyanates**,<sup>12</sup> are sensitising chemicals which can cause lung irritation or lung damage. Released as monomers from both water- and organic solvent-based polyurethane varnishes, they are known to emit VOCs. Pregnant women are at greatest risk from inhaling their fumes. Epoxy resins are organic solvent-based and contain aromatic hydrocarbon solvents such as xylene or toluene, which can lead to headache, convulsions, central nervous system damage, respiratory irritation, dizziness, kidney and liver damage, fatigue, hallucinations, dermatitis, carcinogenesis, teratogenesis and mutagenesis.

# Effect of Lead



# ill effects of Lead based Paints

## In children, lead can cause:

- ☐ Nervous system and kidney damage.
- ☐ Learning disabilities, attention deficit
- ☐ disorder, decreased intelligence.
- ☐ Speech, language, and behavior problems.
- ☐ Poor muscle coordination.
- ☐ Decreased muscle and bone growth.
- ☐ Hearing damage.

## In adults, lead can cause:

- ☐ Increased chance of illness during pregnancy.
- ☐ Harm to a fetus, including brain damage or death.
- ☐ Fertility problems (in men and women).
- ☐ High blood pressure.
- ☐ Digestive problems – kidney damage
- ☐ Nerve disorders.
- ☐ Memory and concentration problems
- ☐ Muscle and joint pain



# Regulations on Lead

- Lead based paint was defined as paint , varnishes ,lacquer or applied coating having containing lead in excess of 1mg / sq cm or 5000 ppm.
- Countries that banned or restricted the use of white lead for paint are :
  - France, Belgium and Austria in 1909
  - Tunisia and Greece in 1922
  - Czechoslovakia in 1924
  - Great Britain / Sweden and Belgium in 1926
  - Poland in 1927
  - Spain and Yugoslavia in 1931
  - Cuba in 1934

# Various International Organizations

## Authorities that control the usage of hazardous materials in paints

### - US

- EPA (Environment protection agency)
- OSHA (Occupational Safety and Health Administration)
- HUD (Housing and urban development council)
- CPSC (Consumer product safety commission)
- ACGIH (American Conference of Governmental Industrial Hygienists)
- NIOSH (National Institute for Occupational Safety and Health)
- CDC (Centers for Disease Control and Prevention)

### - Europe

- REACH (Registration evaluation Authorization and restriction of chemicals)

### - India

- MOEF (Ministry of Environment & Forest)
- CPCB (Central Pollution Control Board)
- BIS (Bureau of Indian Standards)
- NIOH (National Industrial & Occupational Health Association)

# Regulations on Lead in various countries

Country	Regulation/ year	Includes	Excludes	Lead Level
USA	EPA 1978	Banned lead paint on toys, furniture, int. ext. surface of housing, bldg structure for use by consumers	Indl products not directly used by consumers	600 ppm
USA	PL 110-314 Section 101-2008	Total lead content in paint and consumer product designed or intended for children of 12 yrs of age or younger will be banned	Components, parts not accessible to a child through normal use & abuse	300 ppm (effective 14-Aug-2009)
USA	PL 110-314 Section 101-2008	Lead content std. for surface paint in furniture, toys & other children products to be used by children of 12 yrs of age or younger will be banned	Paint applied to appliance, fixture or household items.  Paint for indl & comm. Use	90 ppm (effective 14-Aug-2009)

Country	Regulation/ year	Includes	Excludes	Lead Level
Canada	Amend. to item 2, sch. 1 of the Hazardous Product Act 2005	Surface coating applied to furniture, toys & other articles for use by children	NA	90 ppm
Brazil	11.762-2008	Housing, paint / varnish intended for children and schools	Paint / varnish for agricultural, indl, traffic signs, auto, air plane, ships, rails, home appl, met. Furniture	600 ppm
China	GB6675-2003	Paint for toys, school supplies, children, art material, wooden ware & int. architectural	NA	90 ppm (soluble lead)

Country	Regulation/ year	Includes	Excludes	Lead Level
Mexico	NOM-015/1-SCFI/SSA-1994	Paint and ink coatings of items intended for toys and school supplies	Paint for objects which do not pose risk of contact with child	100 ppm (soluble lead)
Australia	2007	Lead paint for domestic application is restricted		Max. 1000 ppm (total lead)
South Africa	2008	Lead in household paint		600 ppm (effective Mar-09)
Thailand		No regulation, only voluntary initiative		
India		No regulation, only voluntary compliance		Eco mark limit is 1000 ppm

# BIS Limited Guidelines on lead

- BIS has 64 product specifications out of which 27 has lead restriction clause. 13 specs. have lead limit upto 1000 ppm and the rest between 1000 ppm to 4.18%
- 16 products are covered under Eco mark scheme for which voluntary lead limit is 1000 ppm.
- Guidelines -
  - Proposed definition of lead free paint should be paint, varnish, lacquer having lead total lead content (as metallic lead) not exceeding 90 ppm.
  - **Specs. for which lead limit will be below 90 ppm**
    1. All enamel paints for interior use (IS 133)
    2. Aluminium paint
  - **Specs. for which lead limit will be below 300 ppm**
    1. All emulsion paints – limit should be 300 ppm since these are highly filled with extender
    2. Primer for interior use
  - **Specs. for which lead limit will be below 1000 ppm**
    1. IS 2932 / 2933
    2. IS 8662
    3. IS 2074
    4. IS 104
  - **All other paints for industrial use should not have lead limit**

# Global VOC Scenario

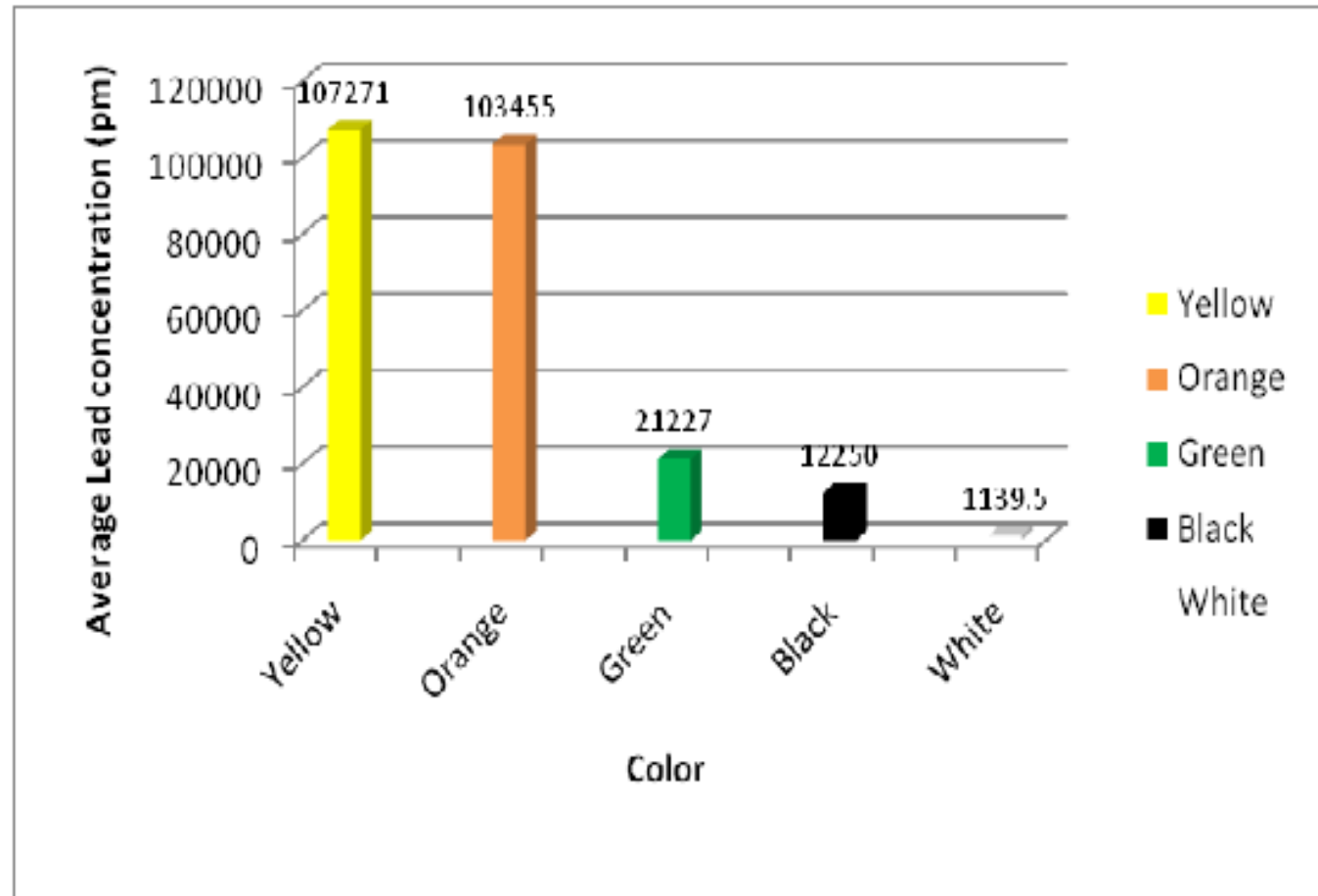
Markets	Regulatory Standards for VOC	Current Operational Standards	Leading organized brands are below regulatory standards and are setting the benchmarks for lowering VOC levels in the near future
America	California: <50 g/l	<50 g/l	
	Rest of America: <100 g/l	<50 g/l	
W. Europe	<75 g/l currently	<50 g/l	
	<30 g/l from 2010		
China	<100 g/l	<75 g/l	
S E Asia	<75 g/l currently	<70 g/l	
	<30 g/l from 2010		
<b>INDIA</b>	<b>No set norms</b>		

## **CENTRAL PUBLIC WORKS DEPARTMENT – CPWD 's VOC benchmark**

- Acrylic distemper 1st quality , having VOC content less than 50 gm/litre
- Acrylic emulsion , having VOC content less than 50 gm/litre
- Premium acrylic emulsion of interior grade, having VOC content less than 50 gm/litre
- Synthetic enamel paint , having VOC content less than 150 gm/litre
- Ready mixed pink or grey primer on wood work (hard and soft wood) having VOC content less than 50 gms/litre
- Ready mixed red oxide zinc chromatic on steel/ iron work, having VOC content less than 250 gms/litre .
- Water thinnable cement primer for interior wall surface, having VOC content less than 50 gms/litre

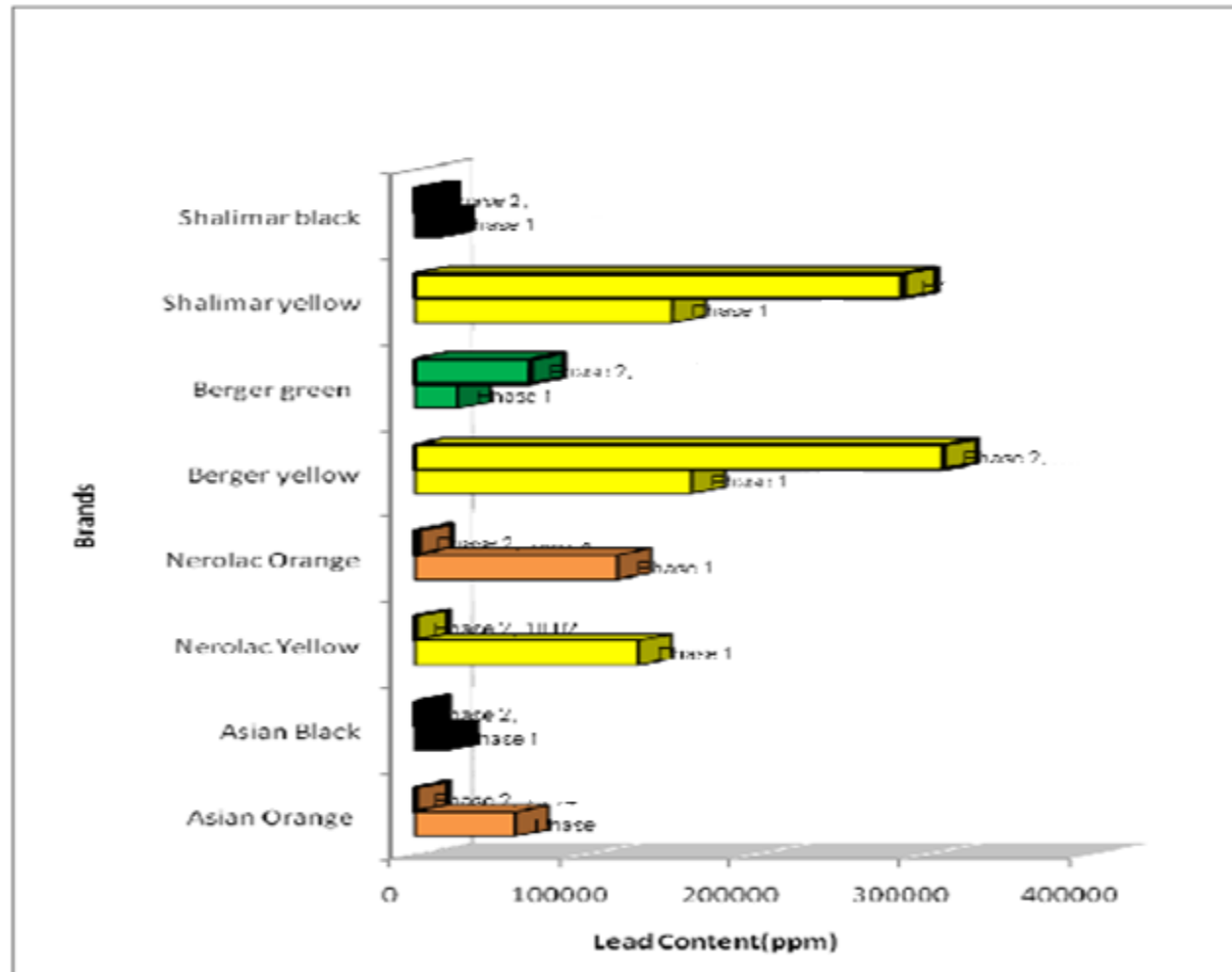


Figure1: Average lead content in enamel paints of various colours of different brands



**Yellow > Orange > Green > Black > White**

**Figure 2 Comparison of lead content in paints of different colors of different brands at two different time periods (Phase1 and Phase 2)**



**Note:**

BIS limit for Lead limit (IS 5489:2004) -1000 ppm

US New Paints Lead Limit - 600 ppm

# IGBC's - New Initiatives in India

## Green Building Requirement

The Green Buildings rated by US Green Building Council (USGBC) & Indian Green Building Council (IGBC) for LEED (Leadership in Energy & Environment Design) Certification use paints with VOCs as shown in the table. Low VOC paints are manufactured and sold by numerous companies.

### VOC requirement for LEED rated buildings

Coating Type	VOC in grams/ litre of product minus water
Non-flat	150
Flat	50

## LEED rated green buildings in India with low VOC paints

- CII - Sohrabji Godrej Green Business Centre, Hyderabad
- ITC - Green Centre, Gurgaon
- WIPRO Technologies-Gurgaon Development Centre , Gurgaon
- Grundfos Pumps (India ) Private Ltd, Chennai
- Technopolis, Kolkata

# LOW VOC PAINTS - WHAT IT IS ??

- ☐ Low VOC paints use water as a base, rather than a petroleum-based solvents because harmful emissions from water-borne surface coatings are significantly lower than solvent-borne surface coatings.
- ☐ These paints have either no, or very low levels, of heavy metals and formaldehyde.
- ☐ Although, the amount of VOC's varies among different "low-VOC" products, and is listed on the paint can.
- ☐ Therefore while conventional paints may not contain VOCs in excess of 200 grams per liter, low VOC paints usually contain around 25 grams/liter of VOC's. Low VOC paints also still emit an odor until it dries.

# ZERO VOC PAINTS - WHAT IT IS ??

- ❑ Any paint with VOC's in the range of 5 grams/liter or less can be called "Zero VOC", according to an EPA standard.
- ❑ While some manufacturers may claim "Zero-VOC's", the paint may still use colorants, biocides and fungicides with some VOC's. Also adding a color tint may bring the VOC level up to 10 grams/liter, which is still quite low.
- ❑ Zero VOC paints are the safest for one's health and for the environment.

# !!!!!! Buying Tips !!!!!!



## Water-borne vs solvent-borne

### **Latex or water-based paints**

- ▲ Identified by words on labels such as *latex, vinyl, acrylic, or water based*
- ▲ The liquid is water
- ▲ Dries much faster
- ▲ Clean up requires soap and water
- ▲ Better exterior durability
- ▲ Better colour retention and resistance to cracking

### **Solvent-based paints**

- ▲ Identified by words on labels such as *alkyd, oil-based, urethane, epoxy, varnish*
- ▲ The liquid solvent is mineral spirit
- ▲ Dries slower than latex, takes 24 hours
- ▲ Clean up requires turpentine or paint thinner
- ▲ Less exterior durability
- ▲ Not very good colour retention or resistance to cracking

# Conclusion

- TPL , as a leading manufacturer of coating products should work pro-actively to eliminate lead from its paint products considering the adverse implications on children, even in absence of regulations.
- Should support the UNEP-WHO initiative on global alliance for elimination of lead paint
- The working definition of lead free paint should be paint having total lead not exceeding 90 ppm
- Max. limit for the residential products in the decorative segment should be 300 ppm and [products intended for use by children (toys, children jewellery, furnitures) to be within 90 ppm]