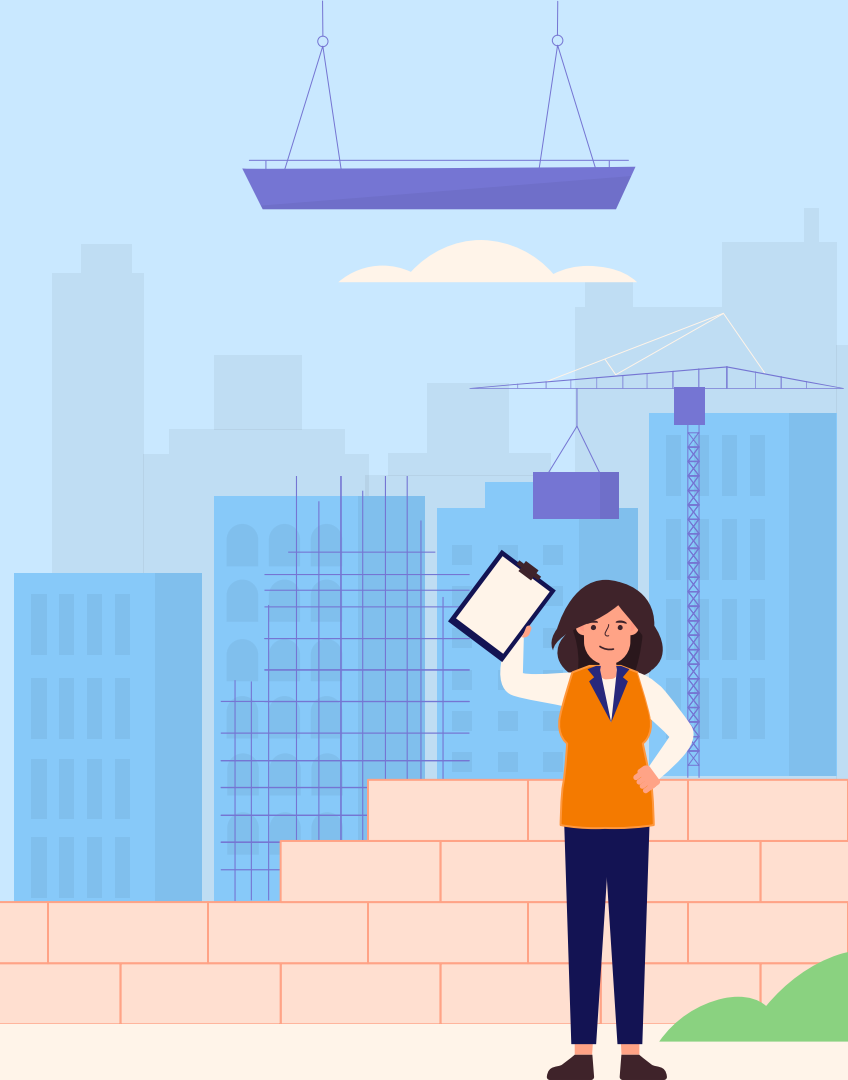


# ODOUR: SOURCES, CAUSES AND MITIGATION

Dr. Manoranjan Hota  
(Former Scientist G (MoEFCC), Member Governing Body  
(NORMI))





# Why Odour is a concern....?

- Odours are generally seen as a nuisance value and can directly and indirectly affect health and quality of life. Persistent exposure to odours could manifest adverse health effects.
- Odour, as a pollutant is often the most significant contributor to air pollution.

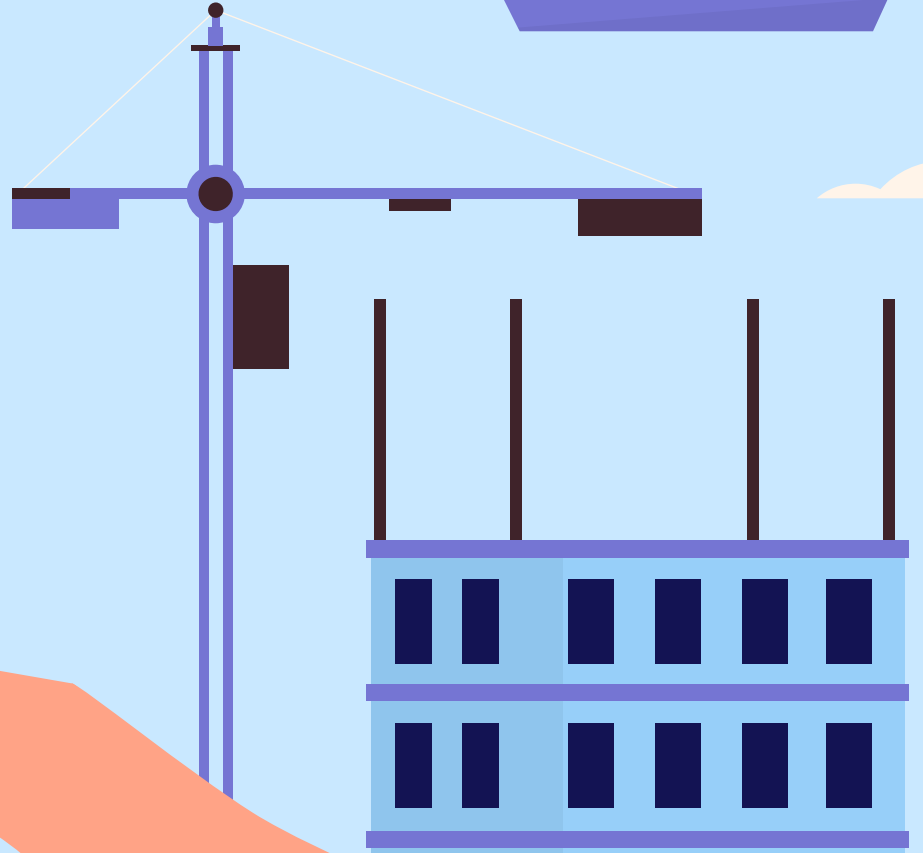
# What is ODOUR?

Odour can be defined as the “perception of smell” or in scientific terms as “a sensation resulting from the reception of stimulus by the olfactory sensory system”. Whether pleasant or unpleasant, odour is induced by inhaling air-borne volatile organics or inorganics.





# SOURCES OF ODOUR



# SOURCES OF ODOUR

## Point Sources

Confined emissions from vents, stacks and exhausts.

## Building Sources

Example: pig sheds and hog confinement chicken.

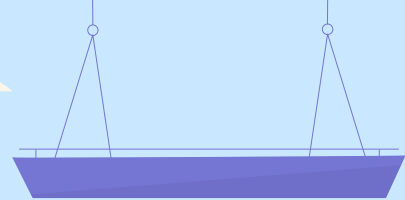
## Area Sources

Unconfined like sewage treatment plant, waste water treatment plant etc...

## Fugitive Sources

Emissions are of fugitive nature like odour emissions from soil bed or bio-filter surface.

# EFFECTS OF ODOUR



## Offensiveness

Interfere with a person's enjoyment of life

## Economic front

Loss of property value

01

02

03

04

## Secondary effects

Nausea, insomnia and discomfort

## Severe effects

Very strong odour can result in nasal irritation, trigger symptoms in individuals with breathing problems or asthma.

# ODOROUS COMPOUNDS

- Odorous substances include both inorganic and organic gases and particulate.
- May result from biological activity or are present in emissions from chemical processes.
- Compounds, such as the **mercaptans** and **organic sulfides**, tend to be the most odorous.
- Odorous substances derived from anaerobic decomposition of organic matter contain **sulfur** and **nitrogen**.
- These are gaseous under normal atmospheric conditions or at least have a significant volatility.

# How to Address Odour...?

- There are many approaches for management and mitigation so also challenges
  - What is the best option for controlling odour impacts?
  - Qualitative nature of odour perception vis-a-vis response.
- Through an Institution such as National Odour Research and Management Institute (NORMI).
- NORMI with its technical know-how, knowledge base will assist industries, municipal bodies, etc for controlling odour in more holistic and comprehensive manner.
- It will train young professionals, budding entrepreneurs like you and disseminate knowledge and information.



# About NORMI

- National Odour Research & Management Institute (Odour NORMI), a non-profitable and non-government public trust
- It is an advance unique technology-based Odour Research and Management institute comprising of expert team members who are working on odour research and management.
- NORMI is one of the first Odour Research and management Institute in South East Asia Aiming to collaborate at National and International level with reputed International Non-Governmental Organizations (INGOs, Institutes and Universities to provide value-based human resources through education, training & skill development programs.
- Besides advanced research and public awareness programs, NORMI will be committed to SDG Targets for 2030 especially by providing solutions for mitigation of odour.

# National Odour Research and Management Institute (NORMI)

## Our Vision

NORMI strives for global competitive, Innovative & solution based Scientific research on Odour for enhanced ecological and economical gains to the industries and society at a large.

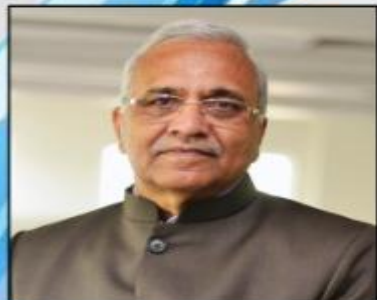
## Our Mission

Innovative R & D for monitoring of odour and management of the odour for clean and green environment. Global competitive human resource for odour management. Extensive policy research for developing local, regional and global regulatory measures for different sectors.

# Objectives

- To identify, predict, evaluate and manage the impact of odour on public health & its mitigation measures.
- To manage & deliver exclusive expertise on analysis techniques for odour management.
- To design and develop instruments for the monitoring & measuring of odour.
- To perform sampling, analysis, monitoring and management using analytical and sensory method.
- To sensitize and generate awareness among stakeholders about Odour including its adverse impacts and solutions thereof.
- To conduct scientific research, beneficial to industry, environment, public health as well as to the society.
- To achieve global competitiveness in research, innovation, technology and skill imparting.
- To provide competency-based accreditation to organization on skill development.

# Our Governing Body



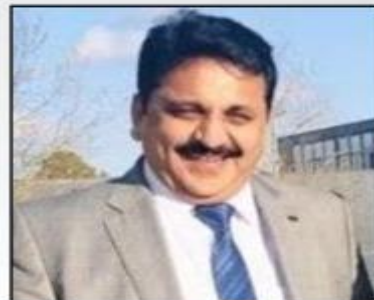
**Dr. Girdhar J. Gyani**  
*President, NORMI*

(DG - AHPI, Ex. Secretary General, QCI, India)  
Experience in Administration, Teaching, Training, R&D, QM,  
Accreditation & Standardization. Recognized as founder  
of healthcare quality in India.



**Mr. Gowrappan K**  
*Patron, NORMI*

(Former Member of EAC, MoEFCC, Chairman  
GWCO Technical Committee, Former Sr. VC &  
Advisor Ramco Cements Ltd.)



**Mr. P.K Taneja**  
*Vice President, NORMI*

(Environmental Professional - Expertise in ESG & DD, Odour  
Monitoring & Mitigation, EHS auditing, Management, Innovation,  
R&D. Key Expert in framing National Guidelines for  
Odour Monitoring & Mitigation for CPCB.)



**Dr. Ajay Garg**

*Secretary General, NORMI*  
(MA Eco, M Com & MBA, Corporate Lawyer  
and Registered Valuer at AGB & Partners  
Diversified Professional, Effective Speaker,  
Technical Author, Mentoring 56 Indian Startups)



**Dr. Manoranjan Hota**

*Executive Director, NORMI*  
(M.Phil, Ph.D., formerly in MoEFCC and CPCB.,  
Environmental Expert, OECD Expert Group on BAT,  
Member, Expert Group for suggesting Improvement  
in P&SWM, CPCB, Advising Skill Council for Green Jobs.)



**Prof. Mukesh Khare**

*Executive Director, Normi*  
(Ph.D. from Newcastle University, UK  
Professor Emeritus, IIT Delhi.  
Former Member, EAC, MoEFCC.  
Specialization in AQ modelling & editorial activities.  
Serving as a member in HLTF at PMO.)



**Mr. Ranjan Sahai**  
Executive Member  
Former controller General,  
Indian Bureau of Mines



**Dr. Chandra Shekhar Dubey**  
Executive Member  
(Vice Chancellor - K R Mangalam  
University, Gurugram)



**Dr. Nandini, N.**  
Executive Member  
(Prof., Bangalore University, Member,  
EAC, Thermal and coal Project, Ex-Member,  
EAC, Industry-2, MoEF)



**Dr. Nabarun Bhattacharyya**  
Executive Member  
(Ex. Senior Director & Centre Head -  
C-DAC, Kolkata)



**Dr. Deepa Taneja**  
Executive Member  
(Founder Director & First President of REIAI)



**Dr. RA Pandey**  
Executive Member  
(Ex-Chief Scientist & Head, Environmental  
Biotechnology Division CSIR-NEERI, Nagpur)



**Dr. Sharvari Deshmukh**  
Executive Member  
(Expertise in the field of  
sensors & machine learning)



**Dr. Jitendra Yadav**  
Executive Member  
(Ph. D. (Environmental Science)  
Expert in CECA, Odour Monitoring &  
Mitigation, Instrumentation)



**Mr. Sunil Dixit**  
Executive Member  
(Environmental Laws and  
Due Diligence Expert)



**Dr. Karuna Sharma**  
Executive Member  
Former Zoology Lecturer



**Dr. Meenal Mategaonkar**  
Executive Member  
(Head of Department Civil Engineering,  
NMIMS, Mumbai)



**Mr. Surendra Yadav**  
Executive Member  
(Odour Expert, Trained Field Analyst)



# Our Advisory Body



**Dr. Satish Wate**  
Former Director, CSIR-NEERI



**Dr. Devendra Kumar Agrawal**  
Former Expert Member, National Green Tribunal,  
Principal Bench, New Delhi



**Mr. Bharat P. Jain**  
Member Secretary  
Gujarat Cleaner Production Centre (GCPC)



**Dr. U. Sridharan**  
Ex. Advisor MOEFCC, New Delhi



**Mr. Pankaj Kumar Satija**  
Chief Regulatory Affairs in Tata Steel Ltd



**Mr. S.V. Venkatesh Murthy**  
CEO, Advisor to Spl.,  
Com. (SWM&H), BBMP Bengaluru



**Dr. P.K. Bahera**  
Ex- Additional Director,  
CPCB, New Delhi

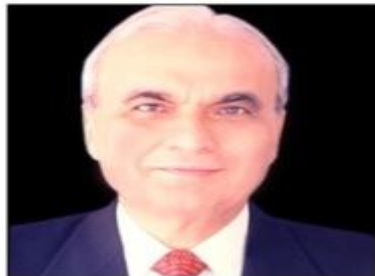


**Mr. S. Suresh**  
Ex. Regional Director, Bangalore,  
CPCB, New Delhi



**Dr. K. Karthikeyan**

*Ex – Director & Member Secretary, TPCB*



**Mr. M.A. Pathan**

*(Former Chairman of IOCL)*



**Dr. Prashant Bhalla**

*(President of Manav Rachna Edu. Inst.  
(MREI), Faridabad)*



**Prof. R. S. Singh**

*Professor, Department of Chemical  
Engineering & Technology, IIT (BHU)*



**Prof. S. Sankar**

*HOD, EHE, Sri Ramachandra Institute,  
Chennai, Tamil Nadu*



**Mr. Rajiv Mathur**

*CEO - Skill Ed. India*



**Dr. Sunil Gulia**

*Sr. Scientist, CSIR-NEERI, New Delhi*



**Ms. Upasana Arora**

*(Director - Yashoda Super  
Spe. Hospitals, GZB)*



**Mr. Sachin Dhawan**

*Senior Research Fellow, IIT Delhi*



**Mr. Anuj Kumar Sharma**

*Ex. Director Trilok Navigation Pvt. Ltd.*

# What NORMI does.....?

- Identified the key sources of Odour
- Develop Odour sensors
- Develop inhouse Odour control technologies
- Partner with domestic and international technologies developer
- Interact with state Central and State regulatory bodies and provide solutions
- Interact with Industries and provide solutions





# **ODOUR CONTROL TECHNOLOGIES**

# Identified Important Sources of Odour Pollution and Odorous Compounds Emitted

Sources	Sections	Odorous Compounds
Pulp & Paper	Digester	CH <sub>3</sub> SH
	Black Liquor Storage Tank	CH <sub>3</sub> SH, CH <sub>3</sub> ·S
	Evaporator	H <sub>2</sub> S, CH <sub>3</sub> ·S <sub>2</sub> , CH <sub>3</sub> ·S
	Recovery Boiler	CH <sub>3</sub> SH, CH <sub>3</sub> ·S
	Smelt Dissolving Tank	H <sub>2</sub> S, CH <sub>3</sub> SH
	Lime kiln	CH <sub>3</sub> SH, SO <sub>2</sub>
Fertilizers	Nitrogenous Phosphatic	NH <sub>3</sub> , SO <sub>2</sub> , F <sub>2</sub>
Pesticides		CH <sub>3</sub> CHO, NH <sub>3</sub> , H <sub>2</sub> S
Tanneries	Raw hides and skins storage / waste fleshing	Putrifaction of Hides & Skins
	Beam house operation	NH <sub>3</sub> , H <sub>2</sub> S
	Finishing operation	Volatile organic compounds
	ETP: Collection Tanks	H <sub>2</sub> S
	ETP: Primary Treatment Units	H <sub>2</sub> S
	ETP: Sludge Dewatering System	H <sub>2</sub> S
	ETP: Anaerobic Lagoons	H <sub>2</sub> S, CH <sub>4</sub>
Sugar & Distillery	Bio-methanation	H <sub>2</sub> S
	Aeration Tank	NH <sub>3</sub>
Chemical	-	NH <sub>3</sub> , H <sub>2</sub> S, Cl <sub>2</sub> , Mercaptans & Phenols
Dye & Dye Intermediates	-	NH <sub>3</sub> , H <sub>2</sub> S, SO <sub>2</sub> , Mercaptans,
Bulk Drugs & Pharmaceuticals	Biological extracts and wastes spent termination liquors	H <sub>2</sub> S, SO <sub>2</sub> , Mercaptans,
Waste Water Treatment Plant	Anaerobic decomposition	H <sub>2</sub> S & Mercaptans
Municipal Solid Waste	Anaerobic decomposition	H <sub>2</sub> S, Mercaptans
Slaughter Houses	By-product / Waste Storage ETP	CH <sub>4</sub> , H <sub>2</sub> S, Mercaptans

# Odour Control from Area Sources

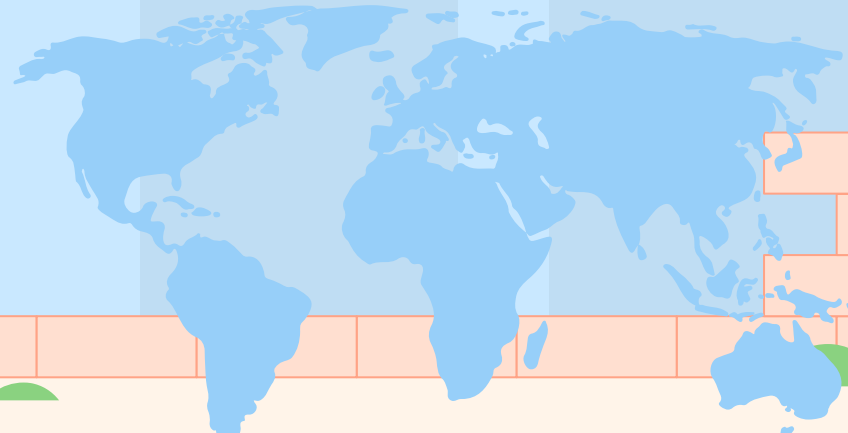
## ● Excluding development close to the site

- ✓ Development close to the site is to be excluded.
- ✓ A reasonable “buffer zone” around the area sources has to be determined.
- ✓ The size of the zone depends upon a number of factors, including
  - the size of the area from which odour emanates,
  - the intensity of the odour being emitted,
  - the duration and frequency of the odour emissions,
  - the actual process being undertaken,
  - the topography of the site,
  - the weather conditions that prevails at the site.
- ✓ Green belt development in buffer zone.

# Odour Control from Area Sources

- **Ensuring that the operation is carried out under the best management practices**

Best management practices (BMP) vary depending upon the industry producing the odour. For all new developments, BMPs starts with the site selection and the building of the facilities.



# Odour Control from Area Sources

- **Nozzles, sprayers and atomizers that spray ultra-fine particles of water or chemicals can be used along the boundary lines of area sources.**

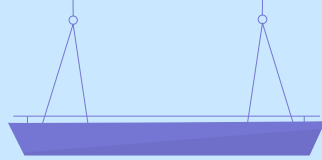


# Odour Control from Point Sources

- An array of treatment technologies is available for control of odour from gas streams collected through process ventilation systems.

These include :

- i) Mist filtration
- ii) Thermal oxidation/ Incineration
- iii) Catalytic oxidation
- iv) Biofiltration
- v) Adsorption
- vi) Wet scrubbing/Absorption
- vii) Condensation
- viii) Green belt development



## Mist Filtration

Aerosols in the fumes may also cause odour issues. Mist filters can be used for their control. Mist filters can also remove solids and liquids from gas stream.



# Incineration

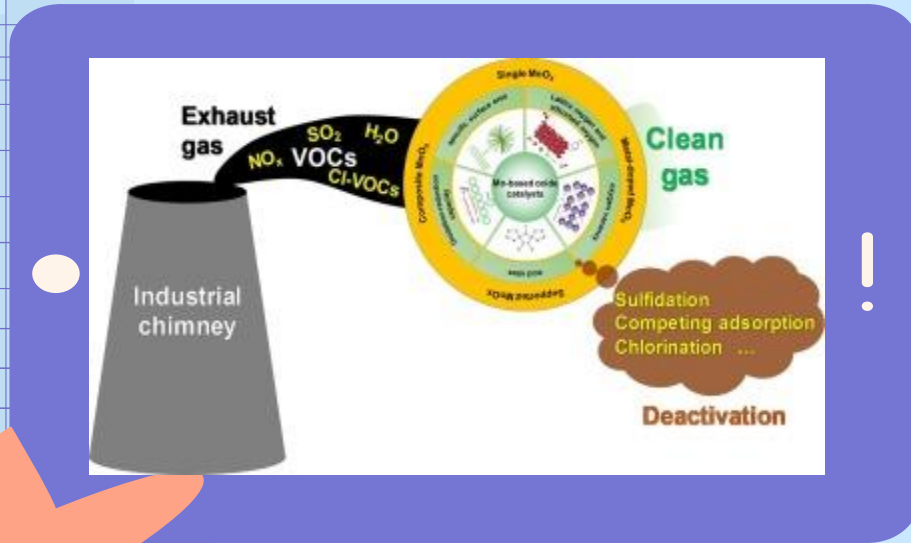
Incineration is the oxidation of the odour into carbon dioxide and water by the combustion of the odour with fuel and air.

In this regime, the destruction efficiency is almost 100%, assuming adequate oxygen supply.





# Catalytic oxidation



Reduced energy input is required. Catalytic systems are more favorable where auto-thermal operation is not practical and heat cannot be economically used elsewhere. A number of transition and precious metal catalysts can be used in catalytic oxidizer to destroy various VOCs over a wide range of process conditions.

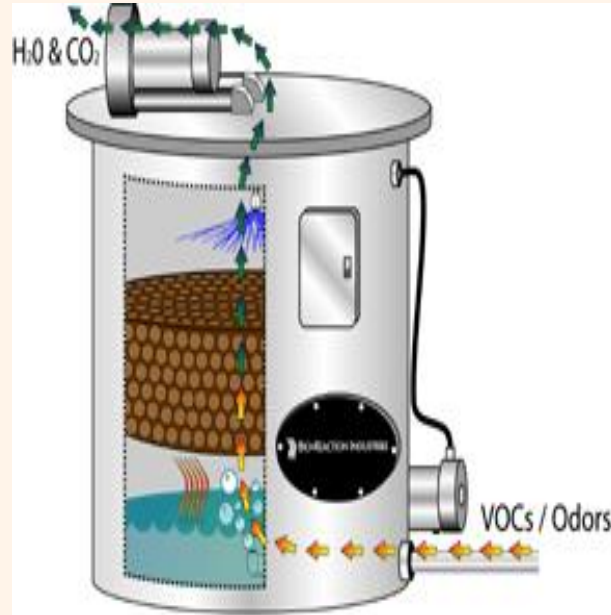
# Bio-filtration

An acceptable and successful way of reducing odours from biological process.

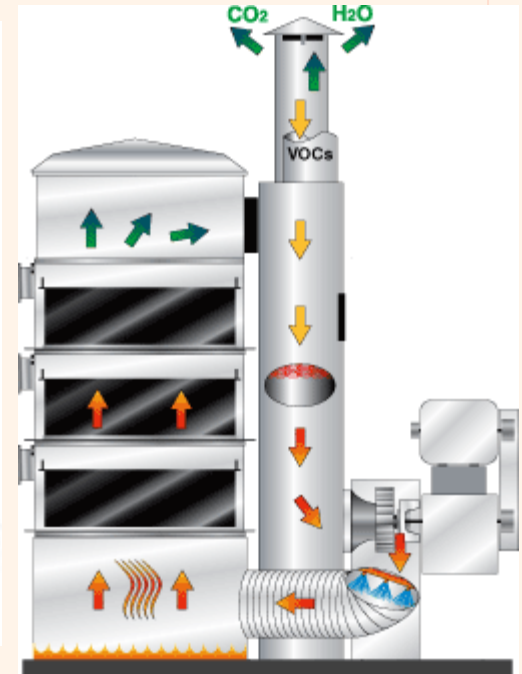
Natural process (occurs in the soil) that has been adopted for commercial use.

Contains micro-organisms that break down VOC's and oxidize inorganic gases and vapors into non-malodorous compounds such as water and CO<sub>2</sub>. Process is self sustaining.

Constructed by using materials such as compost, straw, wood chips, peat, soil, and other inexpensive biologically active materials.



(A)



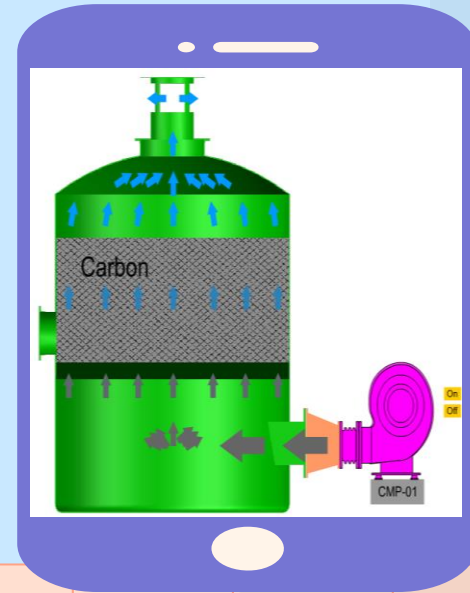
(B)

# Adsorption

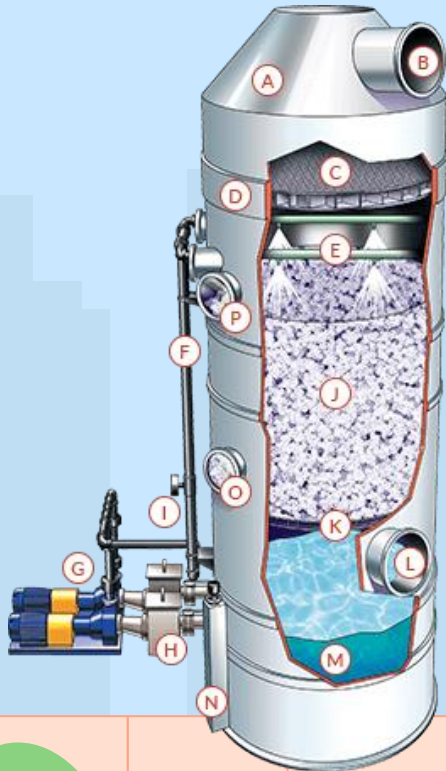
Controls odour even at low concentrations by activated carbon.

Activated alumina impregnated with potassium permanganate are also used for adsorption.

The contaminated air stream must be free from dusts and particulates.



# Wet scrubbing/ Absorption



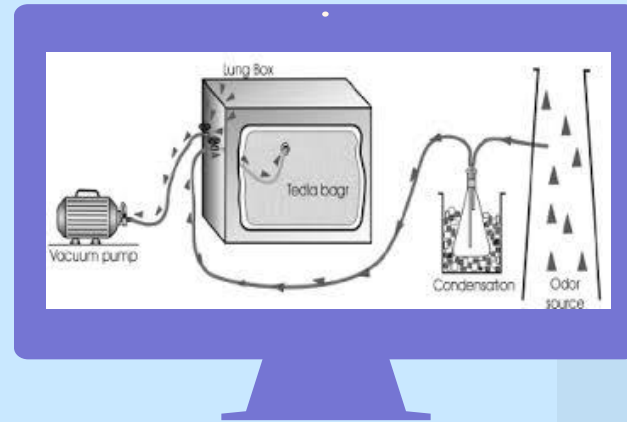
Wet scrubbing of gases to remove odour involve either absorption in a suitable solvent or chemical treatment with a suitable reagent.

Hot, moist streams are cooled before they contact scrubbing solutions.

# Condensation

Condensers are simple, relatively inexpensive devices that normally use water or air to cool and condense a vapour stream.

Condensers are typically used as pretreatment devices in order to reduce the cost of the control system. They can be used ahead of adsorbers, absorber and incinerators to reduce the total gas volume to be treated.



# Green Belt Development

Leaves with their vast area in a tree crown, sorbs pollutants on their surface, thus effectively reduce their concentrations in the ambient air and source emissions. While making choice of plant species for green belts, weightage has to be given to the natural factor of bio-climate.



# Odour neutralizing products

These products are vaporized (no water needed) and sprayed into the air near or around odor sources.

- Natural approaches can get easier buy-in
- Additives do not change qualities of products
- No costly disposal of toxic chemicals
- No harmful emissions released into the air
- No masking agents, which just make smells worse



# How you will be benefitted..?

- There will be requirement of huse skilled manpower for the following activities:
  - Research,
  - testing,
  - monitoring and
  - Mitigation
- You may choose any one of these as Career Option





# Thank you!

