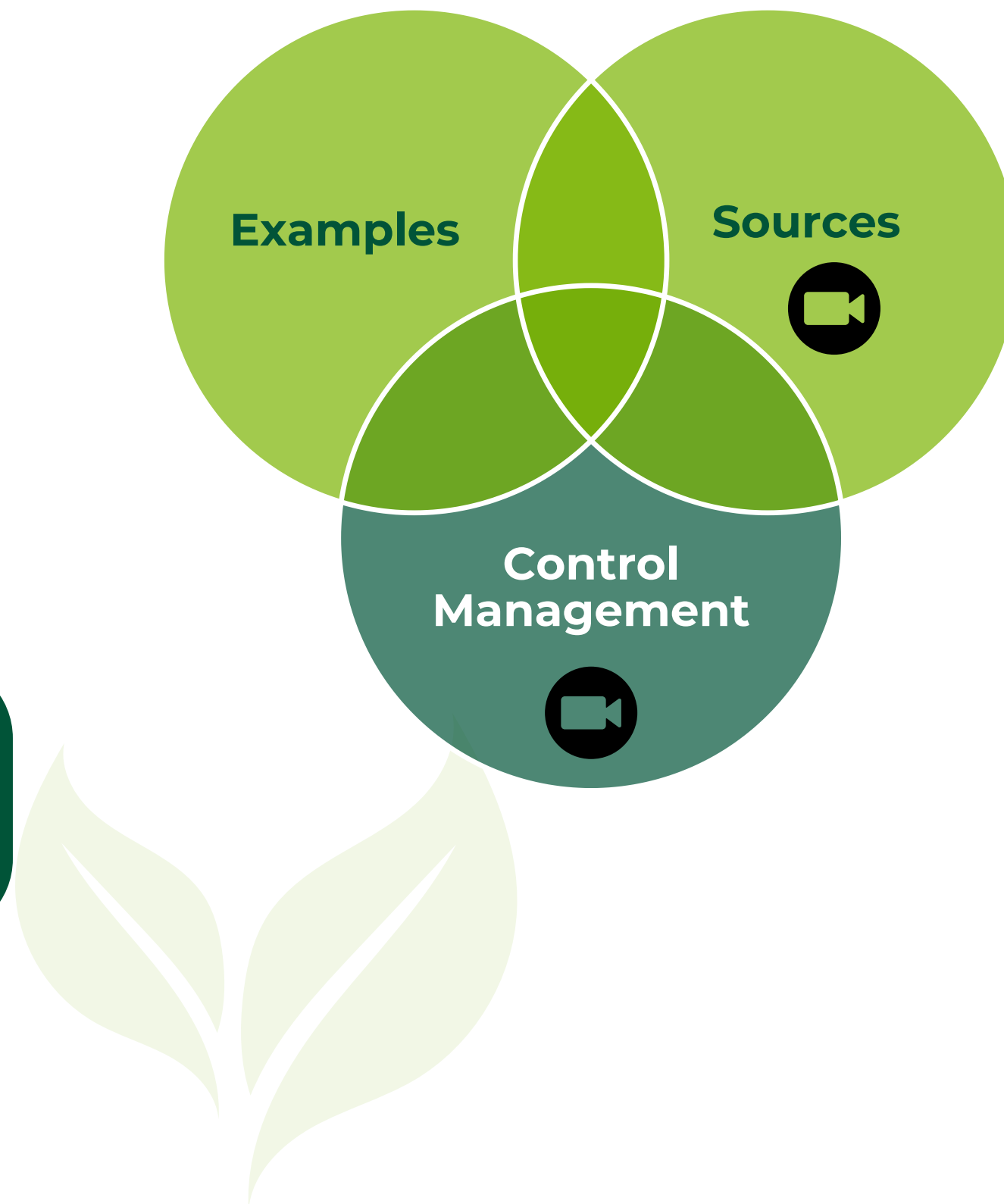# TOPIC 3
AIR EMISSION

Lesson Learning Outcomes:

In the end of lesson, you will learn:

- State examples of air emission wastes from oil and fat industry.

- Describe the sources of the air emission waste (Refer video).

- Explain control measures to manage each type of waste (Refer video).

Examples

Sources

Control Management

INTRODUCTION

Air emissions refer to the release of pollutants into the atmosphere from both natural and human-made sources. The oil and fat industry, which involves the extraction, refining, and processing of edible oils and fats, is a significant contributor to air emissions. The various stages of production, from seed crushing to oil refining, involve complex chemical and mechanical processes that result in the release of pollutants into the atmosphere.

Primary Pollutant

Emitted directly into the atmosphere.

Secondary Pollutant

Produced by numerous physical processes and chemical reactions between primary pollutants that occur in the atmosphere.

Main contributors to air emissions:

- Boiler Emission
- Solvent Extraction
- Odors from meal dryer and oil deodorization
- Process particulate matter.

These processes involve the use of energy, chemicals, and equipment that release pollutants into the atmosphere. These activities result in the release of greenhouse gases, VOCs, particulate matter, and other pollutants that can impact air quality, contribute to climate change, and pose risks to public health.

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EXAMPLES OF PRIMARY SOURCES:

Category	Processes	Emission
Combustion of Fuels	Boilers, heaters, and dryers used in seed crushing, oil extraction, and refining processes.	Carbon dioxide (CO_2), nitrogen oxides (NO_x), sulfur oxides (SO_x), carbon monoxide (CO).
Chemical Processes	Hydrogenation (addition of hydrogen to oils), deodorization (removal of odors and flavors).	Volatile organic compounds (VOCs), methane (CH_4), carbon monoxide (CO).
Solvent Evaporation:	Solvent extraction processes where hexane and other solvents are used to extract oil from seeds.	Volatile organic compounds (VOCs), particularly hexane vapors.
Storage and Handling	Tanks and silos used for storing raw materials and finished products.	Fugitive emissions of VOCs from evaporative losses, odors.
Particulate Matter (PM) Emissions:	Grinding, drying, and material handling activities.	Dust and fine particles (PM2.5 and PM10).
Waste Incineration	Incineration of process waste and by-products.	Dioxins, furans, particulate matter (PM), CO_2, NO_x.

EXAMPLES OF SECONDARY SOURCES:

Examples	Formation	Primary Sources
Ground-Level Ozone (O_3)	VOCs and nitrogen oxides (NO_x) emitted from the industry react with sunlight to form ozone	Emissions from fuel combustion and chemical processes.
Acid Rain	Sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emitted from fuel combustion can react with water vapor in the atmosphere to form acid rain.	Combustion of fossil fuels in boilers and heaters.
Secondary Particulate Matter (PM2.5)	Sulfur dioxide (SO_2) and nitrogen oxides (NO_x) from fuel combustion can react with other compounds in the atmosphere to form fine particulate matter.	Boilers, heaters, and waste incineration.
Photochemical Smog	A combination of VOCs and NO_x in the presence of sunlight can lead to the formation of smog.	Emissions from fuel combustion, solvent evaporation, and chemical processes.

Impact on the environment and human health

Air emissions play a significant role in climate change. It may impact the environment and human health as follow:

EMISSION	IMPACT
Carbon dioxide (CO_2) and methane (CH_4)	Trap heat in the Earth's atmosphere, leading to rising temperatures
Nitrogen oxides (NO_x) and sulfur dioxide (SO_2)	Formation of smog and acid rain, causing damage to ecosystems and posing risks to human health