What is a SLUG and How Should Collections and Treatment Staff Respond

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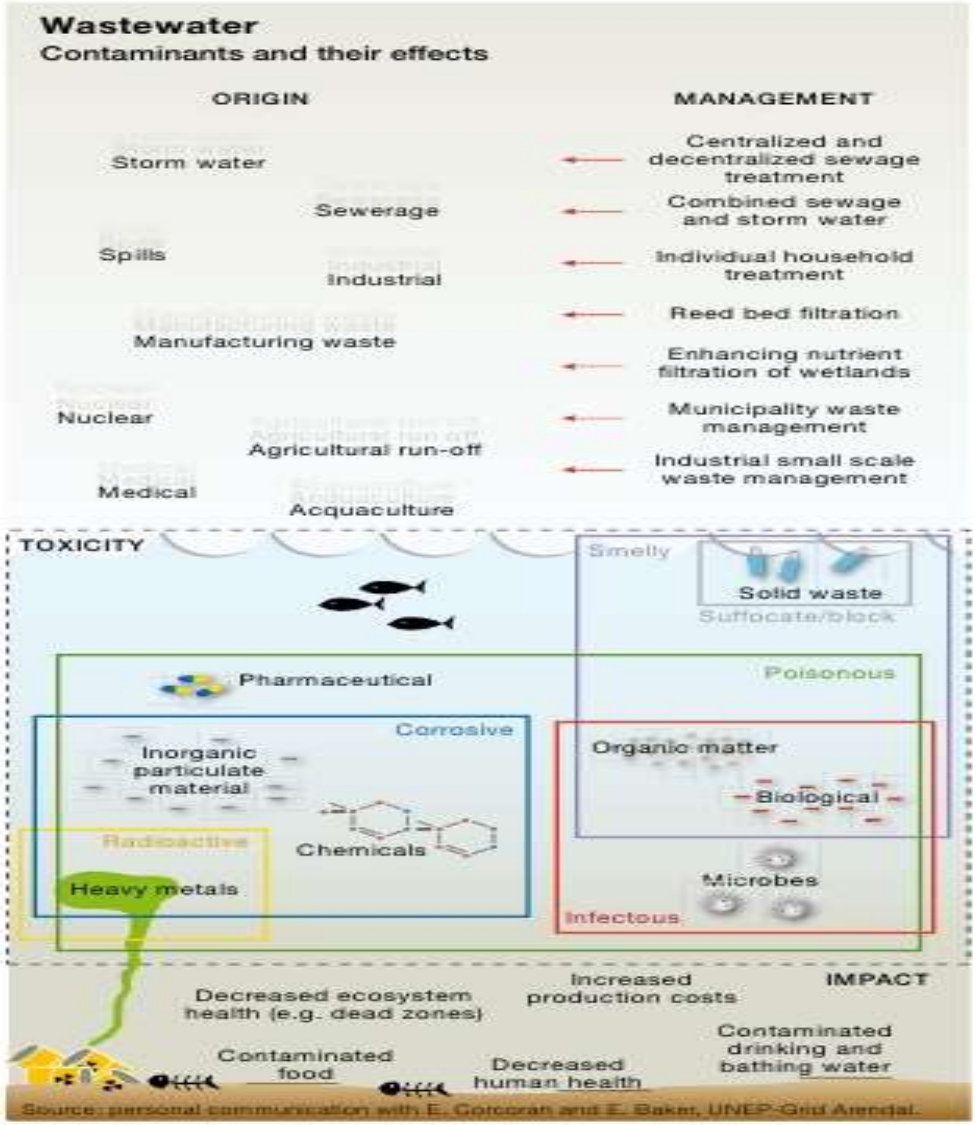
CITY OF BEND

Figure 5: The contaminants in wastewater come from many different sources and can have cumulative and synergistic effects requiring a multi-pronged response.



What is a slug?

- A slug discharge is any discharge including an accidental spill which has the potential to cause interference or pass through of a POTW.

- Interference
  - Toxic effects on POTW microbes
  - Inability for POTW to meet NPDES permit
  - Inability to utilize chosen sludge disposal method
  - Pass-through of pollutants into receiving stream

Effects on Collection System

- Hydraulic capacity problems
- Plugging
- Odors
- pH problems
- Flammables/explosions
- Temperature
- Corrosion

Control of Slug Loadings/PREVENTION!

- Evaluate the need for a slug control program
- Develop an Industrial pretreatment program that requires industries to develop and implement slug control plans
- Identify industries and potential pollutants of concern.
- Implement a slug control program

  Regularly review industry slug control plans

  monitor and inspect industrial users
- Develop and implement slug response procedures

Industrial SLUG impact on collections

Industry	Pollutants	Impact
Grain processing	Hexane	Explosion
Pharmaceuticals	solvents	Corrosion/odor
Metal Finishing	Acids	Corrosion
Adhesives	Glue	Plugged sewers
Water Treatment	High/low pH	Corrosion
Gasoline station	gasoline	explosion
Brewing	Low pH/H_2S	Corrosion

Risks to collections workers and damage to system

Sewer explosions

Illegal hexane release into the sewer from Ralston Purina soybean plant in Louisville Kentucky 1981

1992 Guadalajara sewer explosion

A CASE STUDY ON **GUADALAJARA SEWER EXPLOSION(1992)**



Prepared by:
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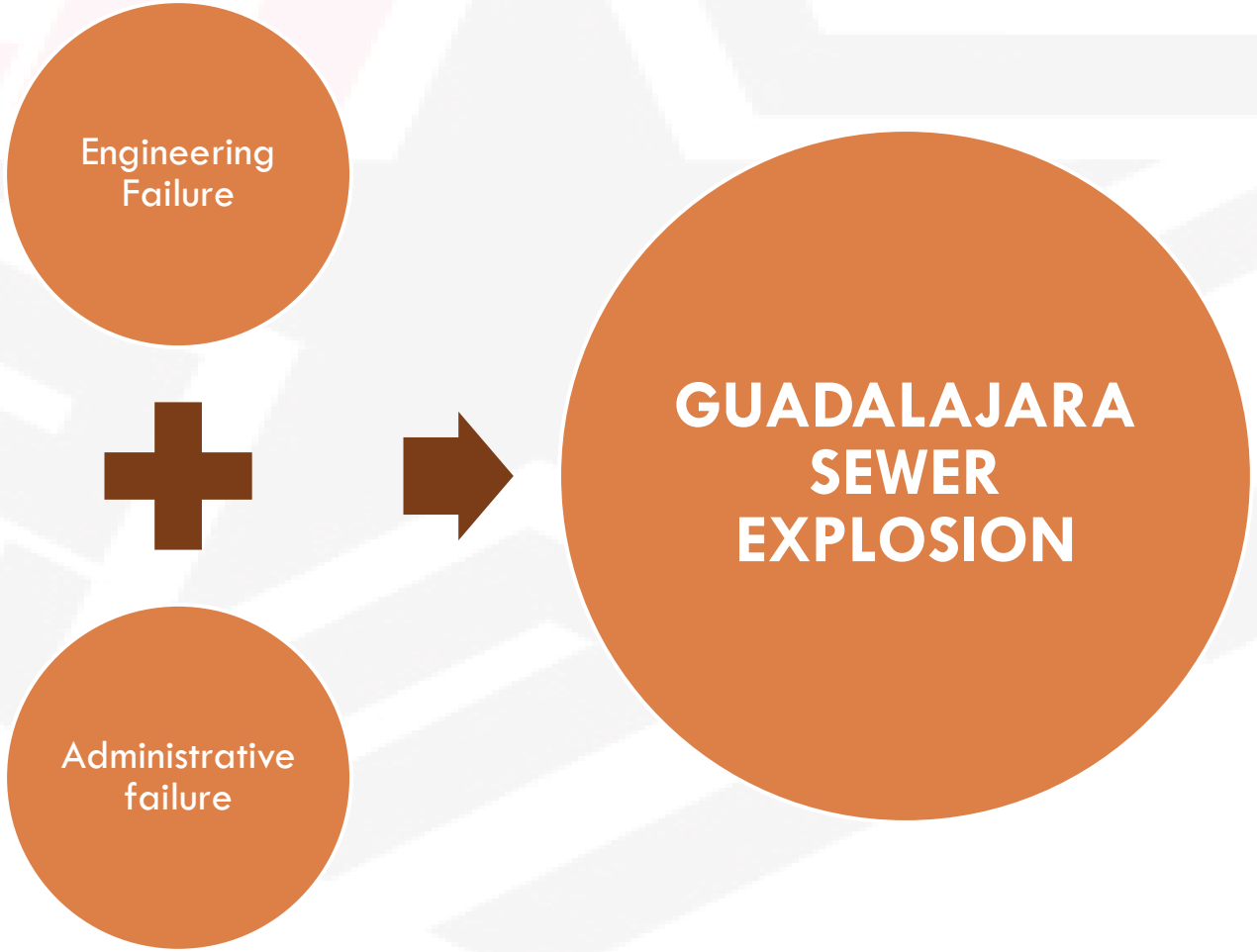
INTRODUCTION

- One of the most catastrophic corrosion disaster till date.
- Happened on Wednesday 22, April 1992 at 10:09 pm in Analco district of Guadalajara city, Mexico
- Led to a series of explosions for a duration of 4 hours.
- Followed by two more explosions on the next day at early morning.
- The explosions were occurred due to the ignition of accumulated gas in a 3.50 m diameter sewer drain that was buried 8m below the roadway.

FIRST IMPRESSION



THE TIMELINE

April 19, 1992

- Residents report strong smell of gas and presence of white smokes from the sewers.

April 21, 1992

- Workers from City Council and Protection Civil made revisions in Gante street.
- They announced that it is not necessary to evacuate the area even though they found strong levels of gas among other hydrocarbons.

April 22, 1992

- **GUADALAJARA GAS EXPLOSIONS**

April 25, 1992

- Strong smell of gas was still present, residents of the neighborhoods were instructed not to light any flames. Evacuation was undergoing.

HOW DID IT REALLY HAPPENED?

- Galvanic corrosion between galvanized iron(water pipeline) and reinforced steel(gasoline pipeline).
- Followed by localized pitting on both materials.
- Diffusion of gas at higher pressure towards the sewage drain due to the pressure and concentration gradient.
- Blocking of leaked gas at distinct sites within the sewage drain due to the U-shaped sections in the sewage line.
- Pressure and temperature raised, flash point of gasoline was reached and thus exploded.

THE ROOT CAUSE

- Galvanic corrosion between water pipeline made of galvanized iron and gasoline pipeline made of reinforced steel.
- Diffusion of gasoline into the sewage line through porous soil.
- The gasoline was directed to the sewage lines owing to the gradients in concentration and pressure.
- Explosions took place at 10 different locations due to the gas-lock occurred inside the sewage line.(The sewage line has to take the U shaped sections in order to accommodate the newly established suburban metro).

Examples of Interference From Industrial Discharges

Source	Pollutant	Effect on Treatment System
Metal finishing Circuit board manufacturing	Heavy Metals	Decrease or stop biological removal rates for secondary and anaerobic treatment
	Chlorinated Solvents	Same effects as above
		Exposure of operators to toxic gas
	Acids	Destroy microbes, stopping treatment, upset Anaerobic digester, corrode structures
Food Processing, Breweries, Wineries, Dairies	BOD/COD (soluble and insoluble	Increase oxygen demand in secondary treatment May cause settling problems in secondary treatment
		odors
Pharmaceuticals	Acetone, Methylene chloride, Isopropanol	Increase oxygen demand, decrease or stop biological removal rates for secondary and aerobic treatment
Auto shops, machine shops, industrial laundries	Oil	Interferes with settling
		Toxic to anaerobic bacteria in large quantities
		Explosive when using pure oxygen sludge system.

The Importance of an Industrial Pretreatment Program

- Protection of POTW workers
  - Knowledge of chemicals in industries and potential to discharge
  - Flashpoint, LEL, pH testing throughout the collections system
  - Identify possible gas vapor/toxicity problems
  - Require industries to manage hazardous wastes correctly

Responsibilities of POTWs Preventing Hazardous Waste Discharges

- If a POTW receives hazardous waste even unknowingly, it may be liable under RCRA and CERCLA for any releases that may cause harm to the environment
- Violations of RCRA requirements can lead to civil and criminal penalties
- If a POTW receives hazardous waste from an industry which is not in compliance with pretreatment standards, the POTW may be in violation of RCRA requirements.
- Example – PCBs found in several SC treatment plants. Greenville/Spartanburg area, traced back to illicit discharge by septic hauler into a restaurant interceptor.

Preventing Discharge of Hazardous waste to POTW

- Ordinances
- Waste tracking systems for industries and septic haulers
- Physical barriers
- Permits

Types of Slugs (Spills and Uncontrolled discharges)

- Transportation accidents
- Industrial accidents
  - Require Industrial Users to notify POTW
- Storage tank and transfer pipe leaks
- Midnight dumpers
- Warehouse fires

What to do when notified of a potential SLUG

Document call

Gather as much information as possible

Collect a sample as soon as possible and preserve for future analysis

If the spill as the potential to cause fire or explosion, call 911 immediately

Notify appropriate POTW staff immediately

Protect human health and safety, warn persons that may be impacted and report to state DEQ if there is potential for adverse effects to environment

How operators identify a SLUG

- Observation
  - surface appearance of clarifiers
  - amount and color of foam on aeration basins
  - Sludge and recycle flow appearance at each process step
  - Unusual colors or odors
- Instrumentation
  - Changes in pH, temperature D.O
- Wastewater monitoring
  - Sampling of influent, effluent, sludge and important process streams
- Note deviations from baseline monitoring and preserve samples

Procedures for SLUG Response/POTW

- Have a SLUG Response Plan and appropriate forms available to operators
- Notify Industrial Pretreatment Program Manager immediately
- Record time, date and observations
- Collect sample, using appropriate safety equipment
- Take field measurement of pH, DO, Temperature

SLUG response from Industry

- Date and time of discharge
- Discharge location
- Concentration, volume, waste type, chemical name and harmful characteristics or effects of the material (e.g. explosive, flammable)
- Response measures being taken
- Name of agencies or contractors contacted
- Cause of the incident
- Specific details of the incident
- Remedial measures taken
- Preventive mechanism to avoid reoccurrence of similar incidents

Resources

- EPA *Guidance Manual for Preventing interference at POTWs*
- EPA *Control OF Slug Loadings To POTWs*
- Environmental Engineering *Effects of Industrial Wastewater*

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