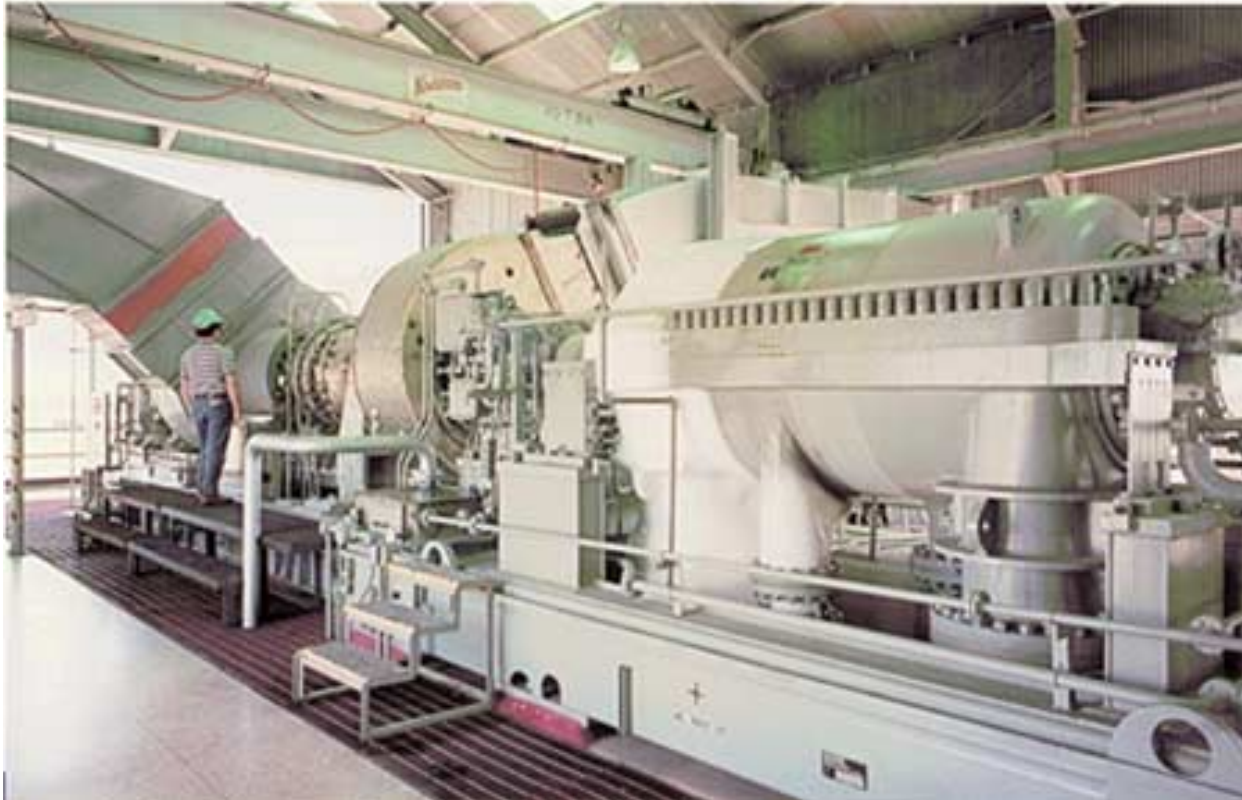

Optical Flame Detection

Applications Overview

Combustion Turbine Application



Combustion Turbine Application

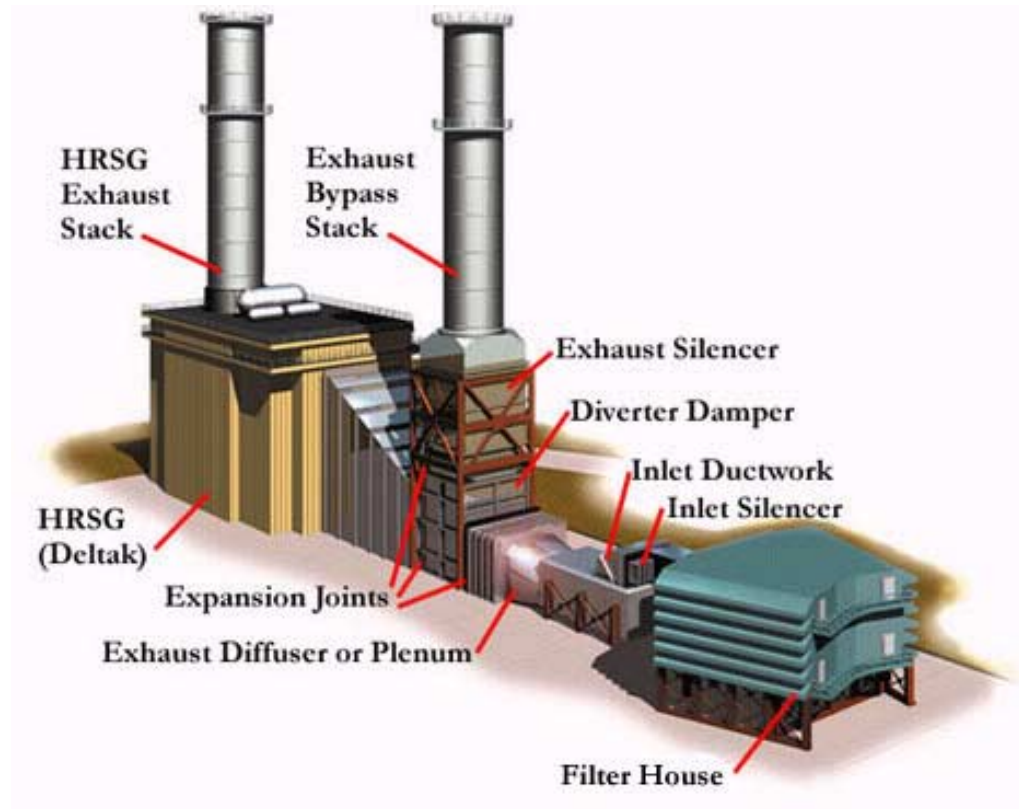
- Power ratings typical up to 16,000 kilowatts (22,000 hp)
- Two main types-
 - aircraft type, designed for aircraft propulsion
 - industrial type designed for stationary service
- Rapid expansion of combustion gases
- Internal flame sensors used for flameout condition
- External area monitoring provided by optical flame detectors and combustible/toxic gas detectors
- Automatic fire detection and suppression systems are typical

Combustion Turbine Application

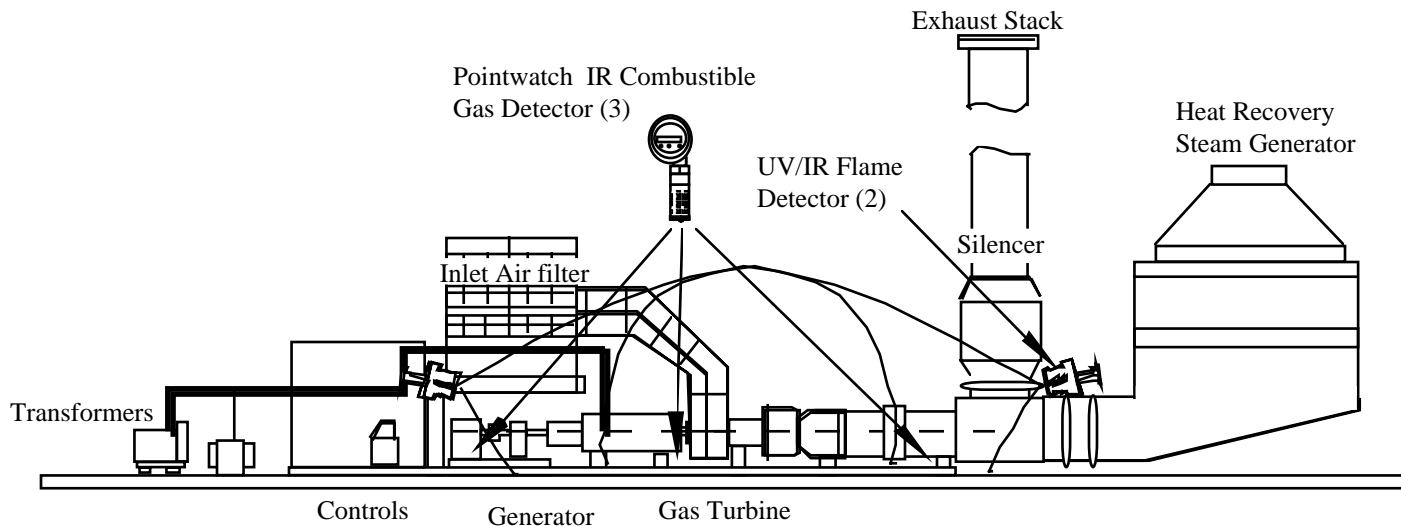
- Electric power generators
- Pipeline compressors
- Water/sewage pumping
- Oil/Gas wellhead re-injection

Combustion Turbine Application

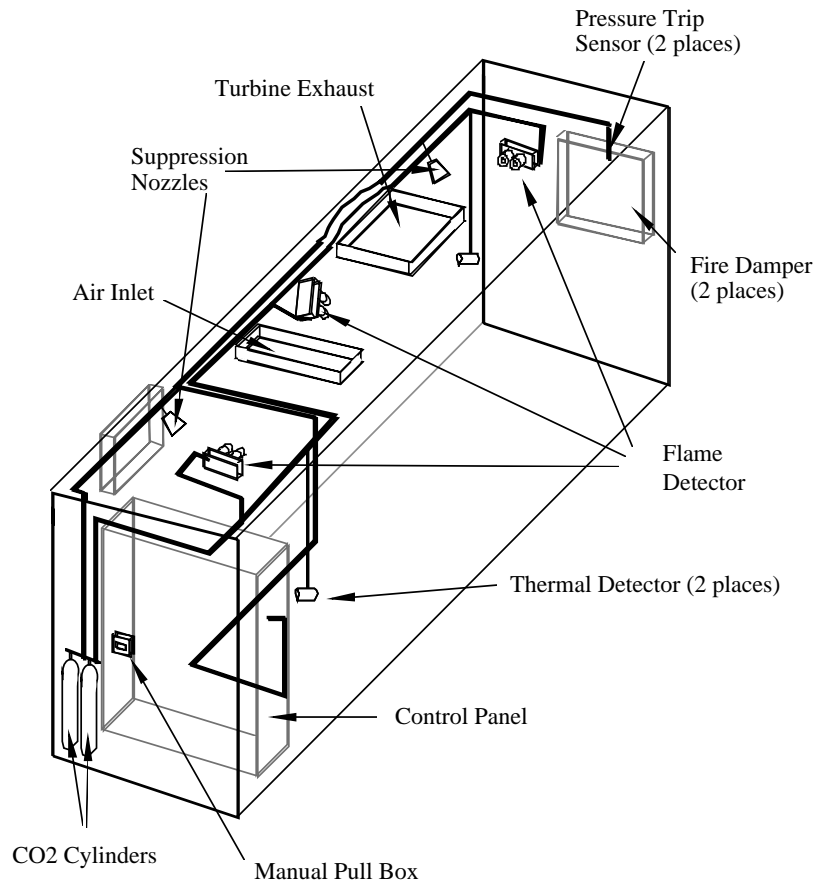
- Applicable Standards & Practices for Gas Turbines:
- USA
 - NFPA 37
 - API 616
 - ANSI B133
- UK
 - BGC IM24
 - IP 15



Combustion Turbine Application



Combustion Turbine Application



- Significant noise levels often require acoustic enclosures
- Decrease external decibel levels but increases disaster potential
- (3) X3300 Medium Flame Detectors
- (2) Thermal Detectors
- (3-4) Gas Detectors (not shown)

Combustion Turbine Hazards

- Combustion fuel delivery systems
 - Natural gas, naphtha, fuel oil
- Pipeline transmission products
 - Natural gas, oil
- lubricating and hydraulic control oil systems
 - Lube oil, hydraulic oil
- generator cooling systems
 - Hydrogen

Combustion Turbine Fire/Leak Risk areas

- Annular group of combustors
- Fuel delivery system with safety interlocks is used
- One-hundred or more fuel supply piping connections
- High-pressure (700 p.s.i. / 50 bar) combustion fuel
- Fuel leaks not uncommon (maintenance /overhaul)

Combustion Turbine Challenges

- Operating temperatures from 100-150 degrees F.
- Desert or tropical area temperatures may reach 230 degrees F. (110 degrees C.)
- High temp UV rated for 257 degrees F. (125 degrees C.).
- U7602E UV detector, U7698E IR detector, & U7652B unitized UV/IR detector withstand 257 degrees F. (125 degrees C.) up to 3 hours

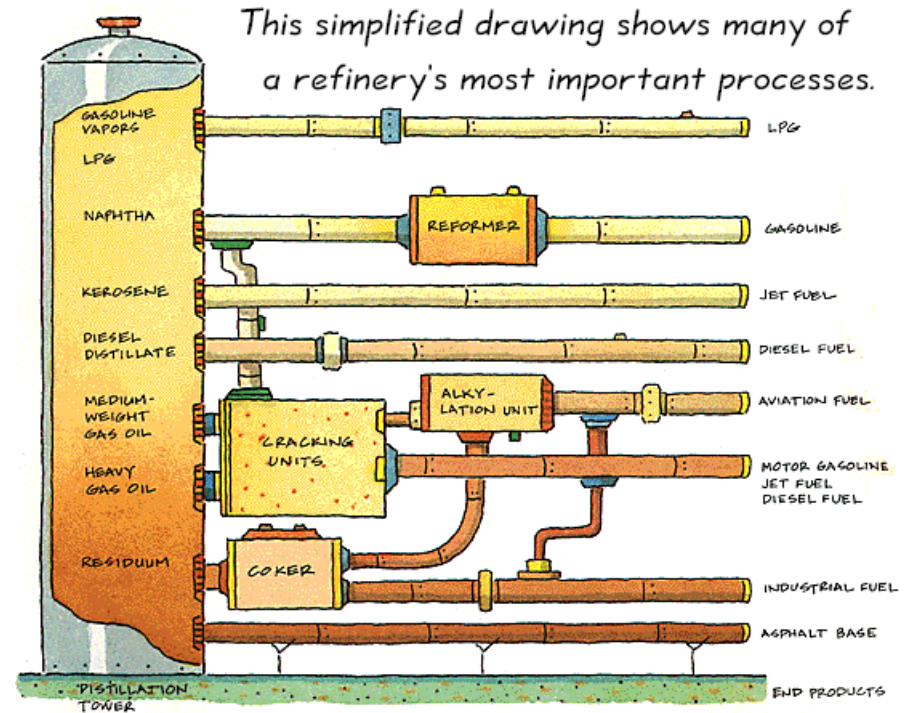
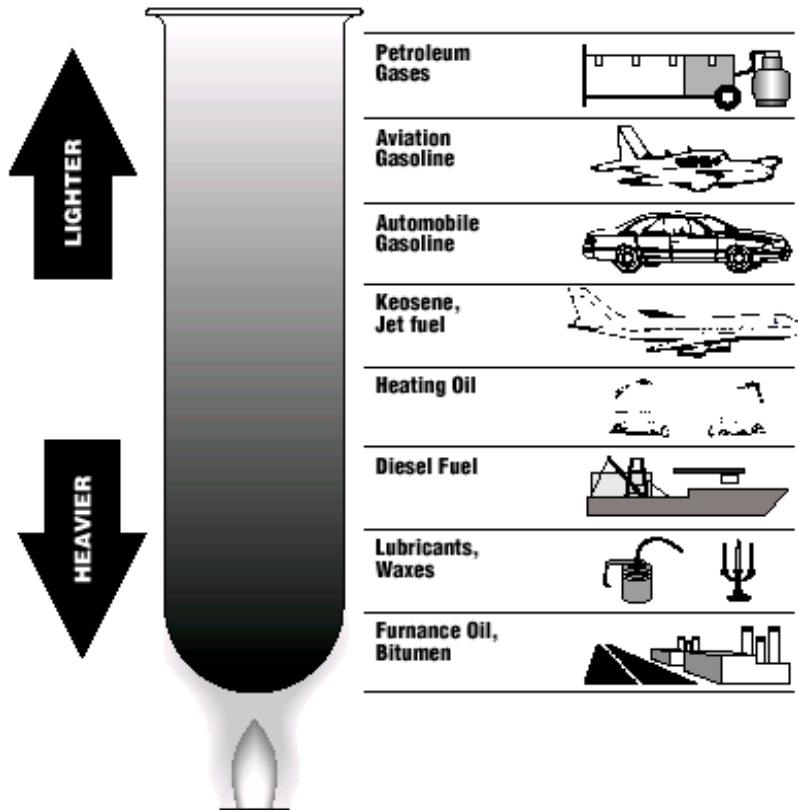
Petrochemical Applications



- Refineries, platforms, pipelines, storage tanks
- Hazards:
 - crude, diesel, gasoline
 - methane, LPG, ethane, propane, naphtha

Petroleum Products

REFINERY PRODUCTS



Petrochemical Applications

- Recover/process fractions of complex crude oil
- Very high volumes of flammable hydrocarbons
- Heating and Distillation processes common for:
 - separation of the desired products
 - breaking compounds by catalytic cracking
 - building desired products by reforming, alkylation, and isomerization

Petrochemical Applications

- **Offshore Platforms & Refineries**
 - Flammable Liquids, I.e. crude oil, naptha, gasoline, diesel
 - Gaseous fuels, I.e. natural gas, petroleum gas, hydrogen
 - High volumes of flammable materials
 - Confined space without escape
- **Other Petrochemical areas of fuel leakage & ignition**
 - Process Trains
 - Fuel headers and connections
 - Storage tanks
 - Control valves
 - Burner fronts



Piper Alpha Platform Fire



Floating Production and Storage (FPSO)



Other Petrochemical Applications

- **Tanker Loading Racks, Storage Tanks and Tank Farms:**

- Flammable Liquids, I.e. crude oil, naptha, gasoline, diesel
- Gaseous fuels, I.e. natural gas, petroleum gas, hydrogen
- Variety of Tanker types and nozzle locations
- Variety of tank configurations, I.e.fixed/floating roofs, spheres, etc.



- **Pipeline Compressors**

- Compressor maintains pipeline product pressure
- Can be installed singly or within a multi-unit station
- Typically hazards: natural gas hazard or flammable liquids
- Drivers include reciprocating engines & combustion turbines

Loading Racks

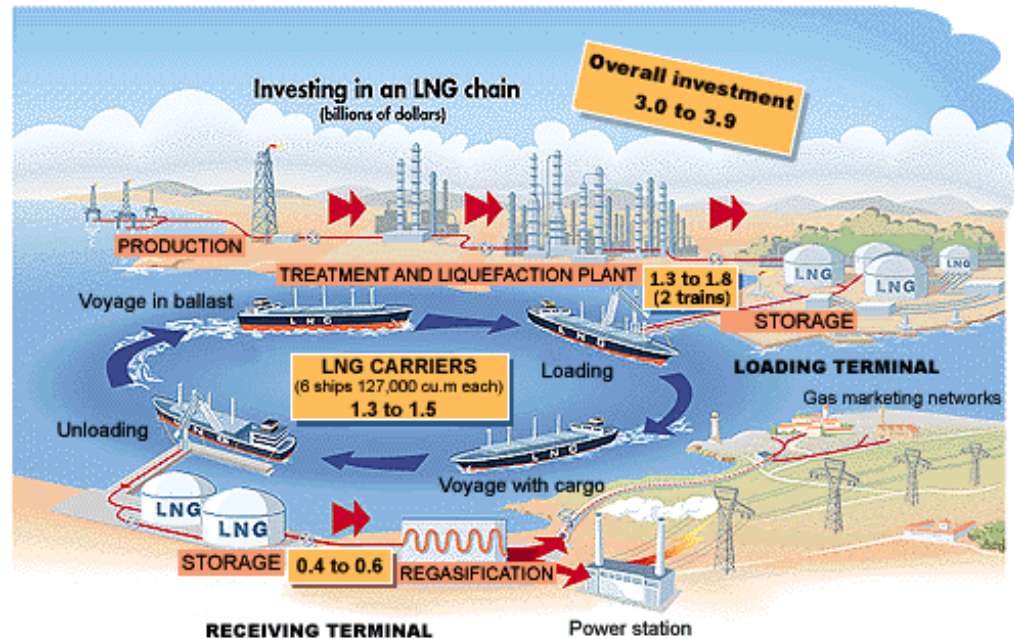
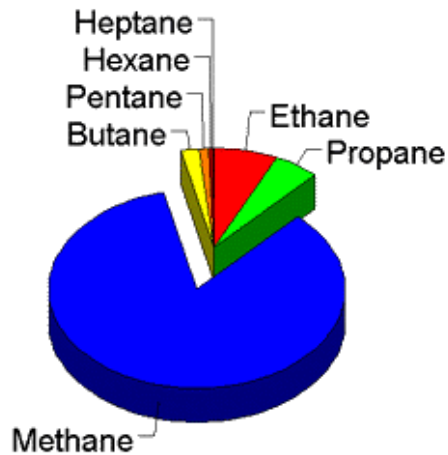


Petrochemical Applications

- Recommended Flame Detectors
 - X3300 Triple IR
 - U7698E SFIR
 - U7652 UV/IR



Natural Gas

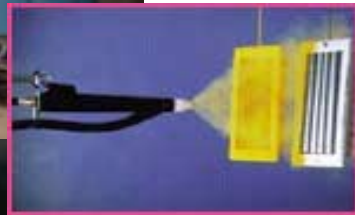


Floating Roof Storage Tanks



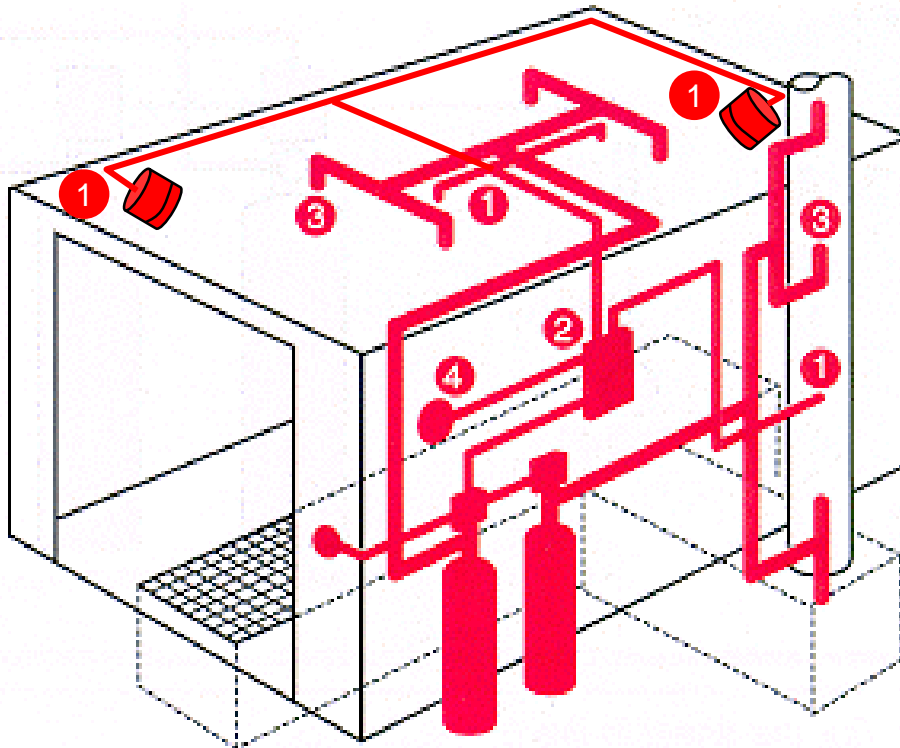
- Floating Roof (pan) used to minimize vapor space
- Rim seal perimeter = high risk
- Cone Roof covers pan
- Flame detection for rim seal fire
- Gas detection for O₂, flammables

Coating/Spraying Operations



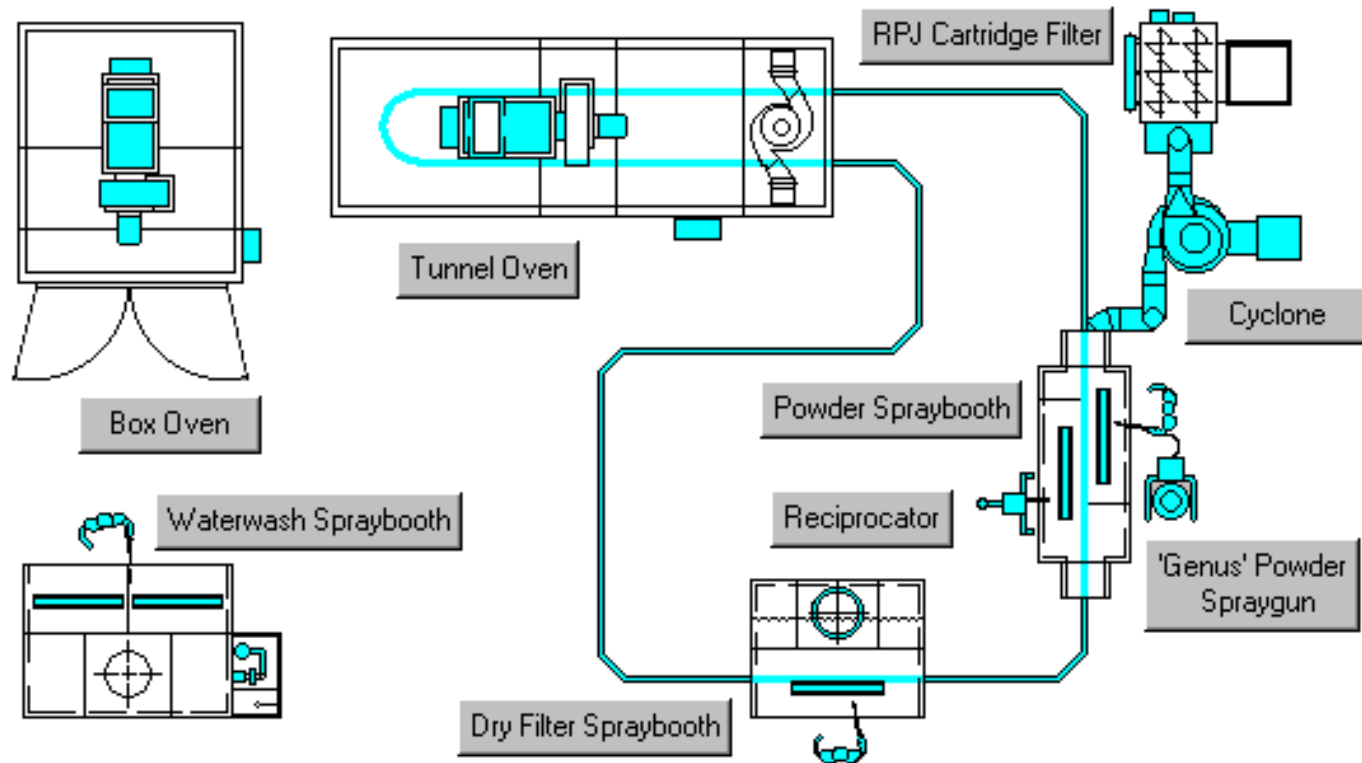
- Spray Coatings include paint & epoxy powder
- Production Booths used for containment, reclamation (powder)
- Electrostatic energy applied to paint for maximum adhesion and minimal overspray
- Solvent-based paints provide fire hazard
- U.S. Booth Safety regulations:
 - NEC 516
 - Uniform Fire Code (UFC 4500)
 - NFPA 33
 - Uniform Mechanical Code (UMC 1107)
 - state and local agencies
 - OSHA

Spray Booth Fire Suppression



1. Fire Detectors sense fire heat in work area, plenum or duct... a signal is sent to the Control Panel
2. Control Panel electrically activates Cylinder Control Head, which opens cylinder valve.
3. Dry Chemical is propelled by stored pressure through Discharge Pipes and Nozzles into the protected area
4. Fire is suppressed as Control Panel sounds alarm, notifies fire authorities and shuts down airflow in hazard area

Powder Booth Operations

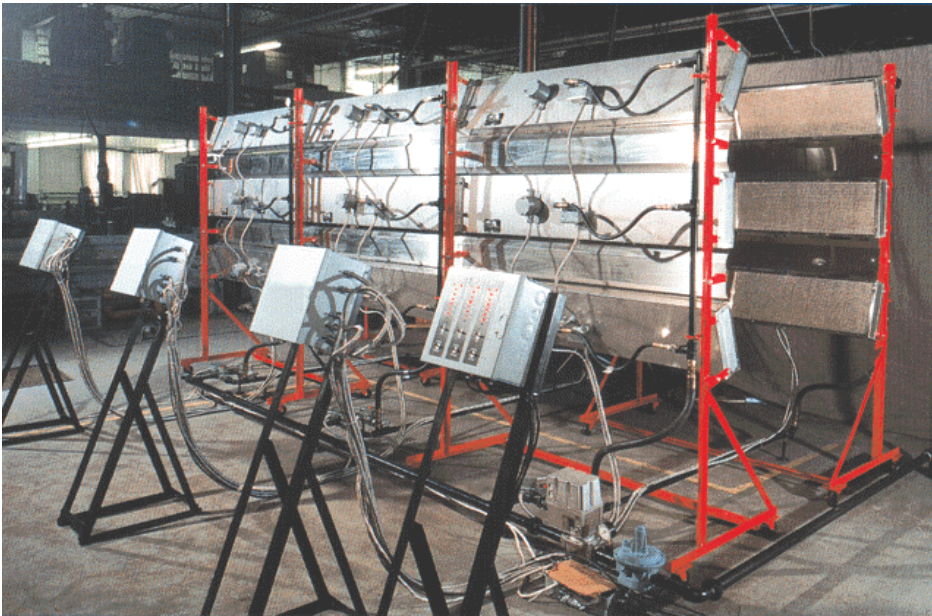


Automotive Manufacturing



- Paint lines
- Drying ovens
- Engine test cells
- Fuel/solvent storage
- Environmental testing
- Other areas & processes

Automotive Infrared Bake Ovens



- Bake Ovens provide heat for curing spray coating on object
- Possible fire ignition area
- Possible false alarm source

Automotive Manufacturing

- Typical hazards:
 - solvents, paints, gasoline, alcohol, plastics
- Recommended solutions:
 - X3300/U7698E for paint lines/booths
 - X3300 for drying ovens
 - X3300 for test cells
 - X3300/U7698E for flammable liquid storage areas

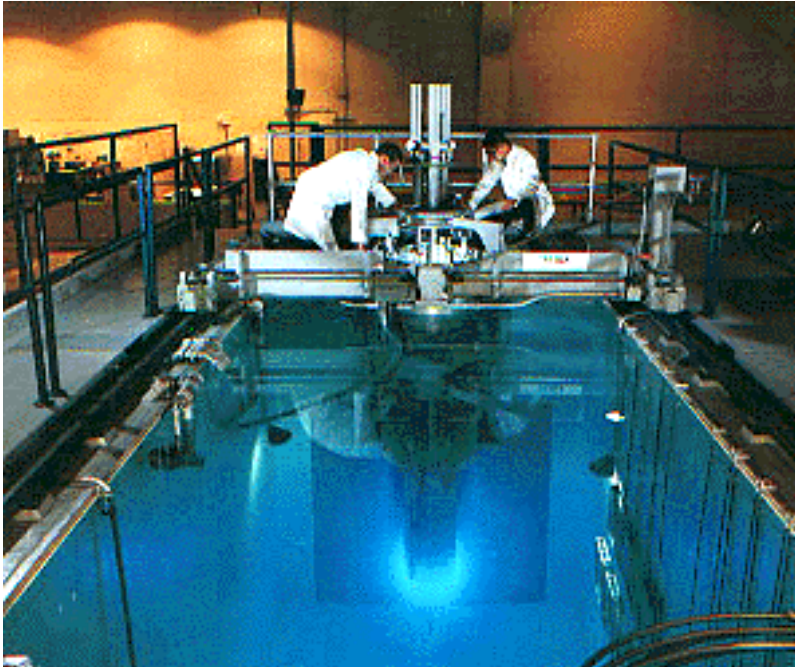
Power Plants

- Applications include-
 - boilers/burners
 - pumps, valves
 - storage tanks
 - steam turbine decks
 - transformers, battery rooms
 - combustion turbines
- Flammable hazards include:
 - natural gas, fuel oils, coal, hydrogen, lube oils



Power Plants

Recommended solutions:

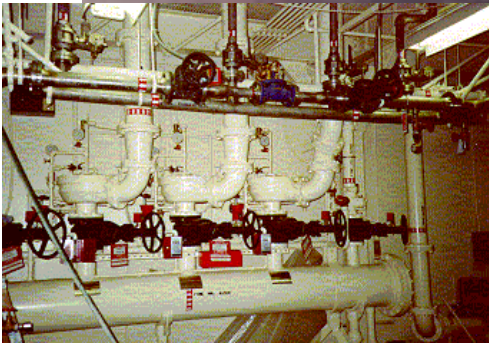


- X3300 for burner fronts
- X3300/U7698E for pumps & valve trains, fuel storage
- X3300/U7698E for steam & combustion turbines
- U7602E for hydrogen cooling systems
- X3300/U7698E for flammable liquid storage areas
- U7602E for battery/UPS rooms

Aircraft Hangars and Facilities



- maintenance/paint hangars, refueling areas, loading gates, concourses, heliports
- typical hazards include:
 - aircraft fuels
 - paint & solvents

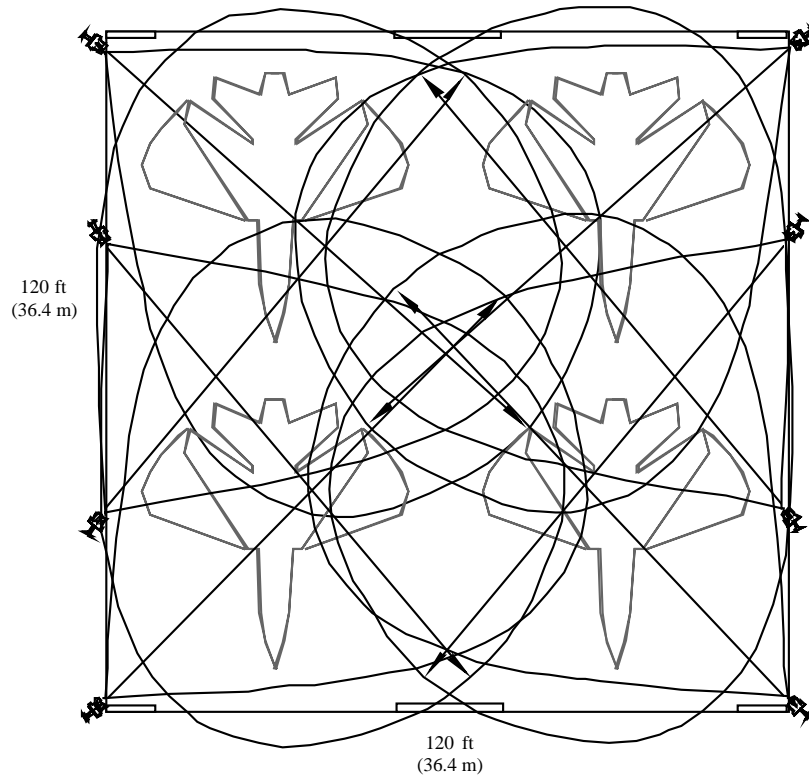


Aircraft Hangars

- A Boeing 747-400 can carry 57,000 gallons (204,350 l.) of fuel weighing more than 160 tons (40% of the plane's authorized takeoff weight)
- For just one plane, a "full tank" of jet fuel can cost \$45,000...

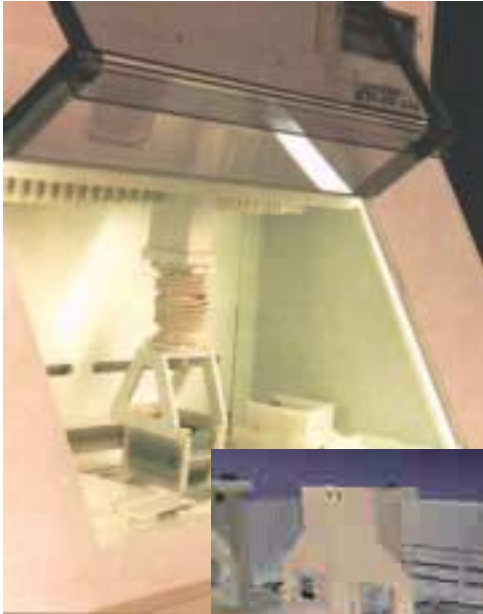


Aircraft Hangars and Facilities



- recommended solutions:
 - X3300 (Best)
 - U7652

Semiconductor Manufacturing



- includes wet benches, clean rooms, gas (silane/hydrogen) cabinets
- typical hazards include:
 - solvents, alcohol, silane, acids
- recommended solution:
 - PM5MP+

Semiconductor Manufacturing

Industry Losses by Engineering Peril 1990 - July 2000

<u>Engineering Peril</u>	<u>No. losses</u>	<u>Gross loss-2000\$*</u>
Escaped liquids	44	US\$ 97.6
Earth movement	4	68.1
Fire	39	62.6
Miscellaneous	28	60.3
Service interruption	23	34.7
Electrical breakdown	37	24.1
Impact	3	14.3
Sprinkler leakage	13	7.0
Mechanical breakdown	7	4.2
Water damage	7	4.0
All others	27	6.4
 *million	 232	 US\$383.3

Paper Mills



- Hazardous Applications-
 - lumber de-barking, chippers
 - boilers, kilns
 - chemical tanks
 - paper machines, power plants
- Typical Flammable hazards include-
 - lumber, paper
 - coal, oil, gas
 - toxic chemicals and gases
 - battery rooms

Paper Mills

- Recommended solutions:
 - X3300 for burner fronts
 - X3300/U7698E for pumps & valve trains, fuel storage
 - X3300/U7698E for steam & combustion turbines
 - X3300/U7698E for flammable liquid storage areas
 - U7602E for battery/UPS rooms

Aerosol Filling Processes & Storage

- Hazardous Applications-
 - bulk transport
 - transfer & storage
 - container gassing
 - charged container storage
- Typical Flammable Hazards include:
 - DME, ethers, propane, isobutane, butane, others
- Recommended Solutions:
 - U7698E SFIR
 - U7602E UV
 - X3300 (storage areas only)



Other Applications

- Foundries
- Explosives/Munitions Manufacturing
- Space Vehicle Payload Preparation and Launch Areas
- Paint and Solvent Storage Warehouses
- Recycling Plants/Waste Incinerators
- Rocket Motor Test Areas