Chapter 6

Graphic Arts

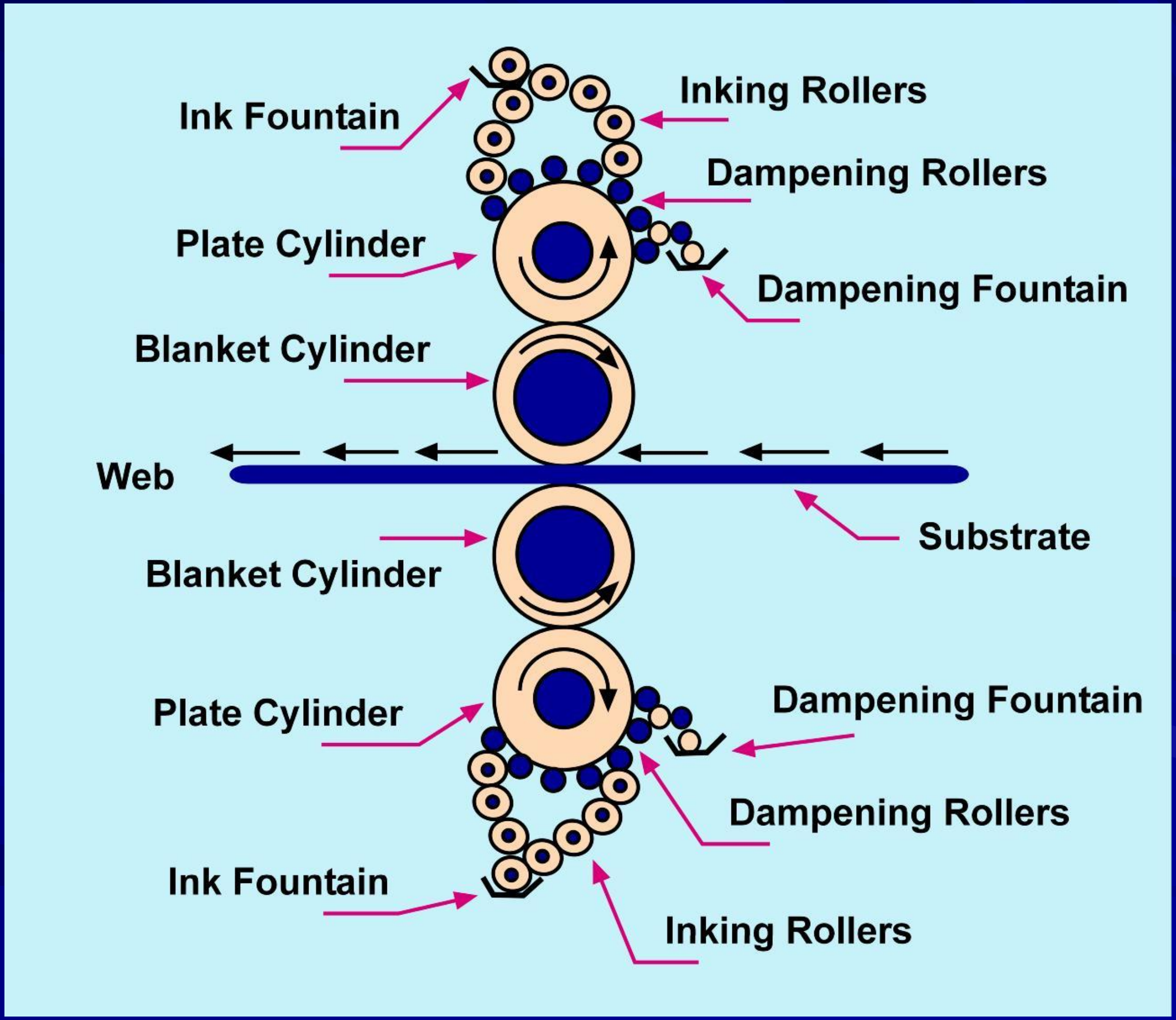
Printing Operations

- Offset lithography
- Flexography
- Rotogravure
- Screen

Offset Lithography

- Uses a planographic printing surface
- Printing unit components:
  - Inking system
  - Dampening system
  - Plate cylinder
  - Blanket cylinder
  - Impression cylinder

Offset Lithography Printing Unit



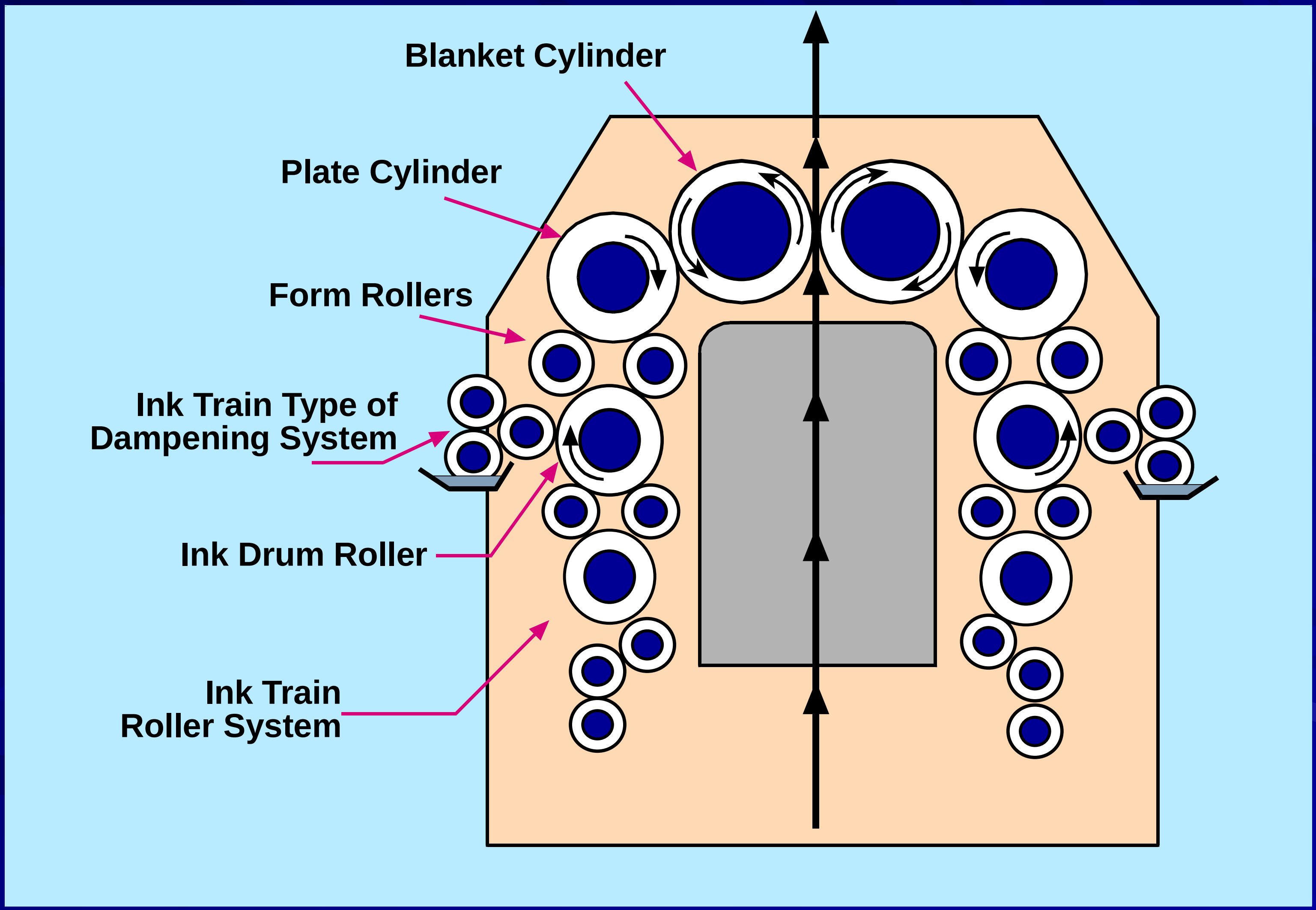
Offset Lithography Processes

- Nonheatset web printing
- Heatset web printing
- Sheetfed printing

Nonheatset Web Printing

- Prints on continuous web of paper
- Line speed 600-2100 fpm
- Uses semifluid inks
- Does not require heat for curing
- Fountain solution is >99.5% water and uses low volatility solvents

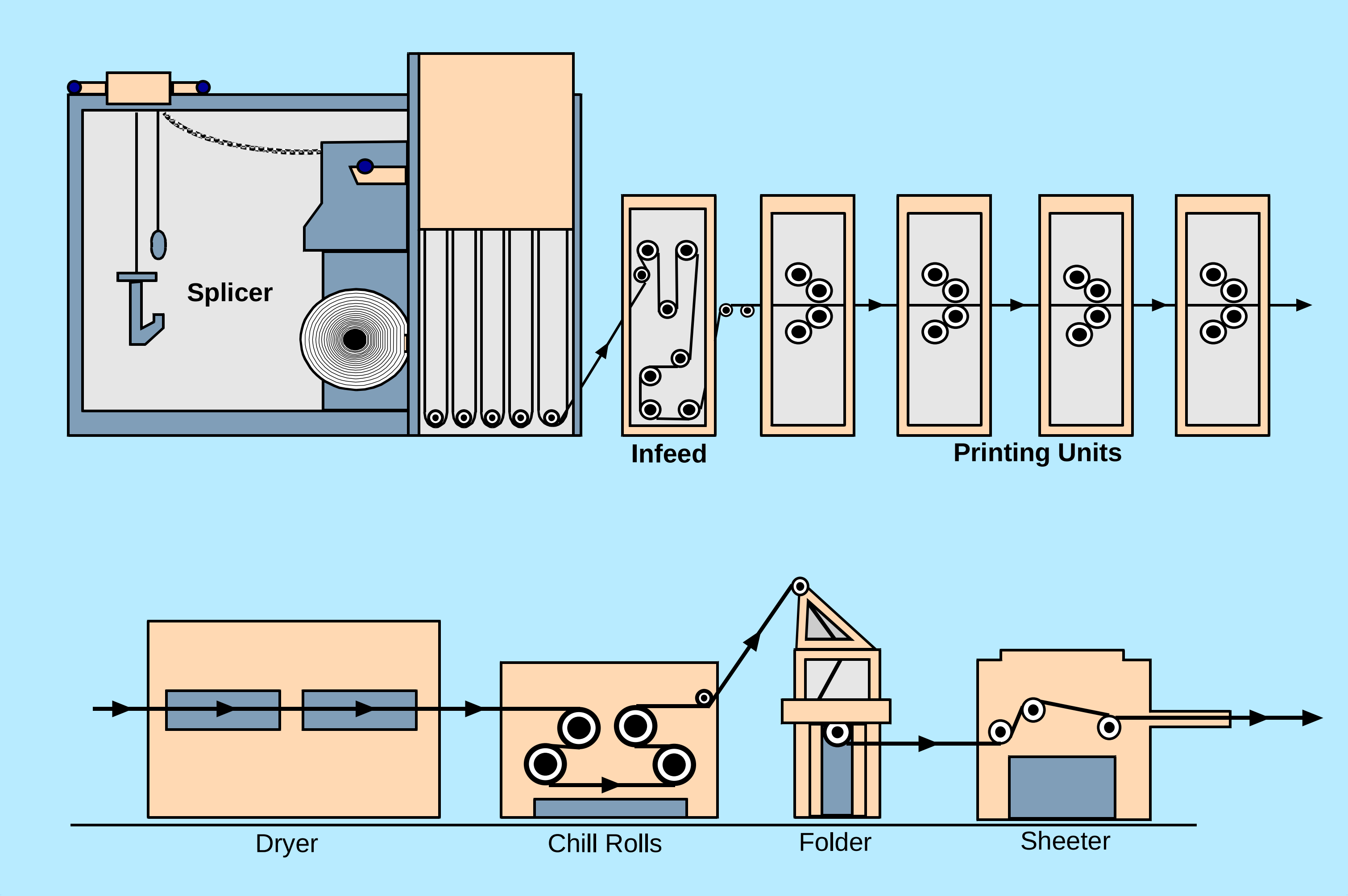
Nonheatset Web Printing Unit



Heatset Web Printing

- Uses fluid inks that dry by evaporation
- Some inks cure by chemical reaction
- Typical dryer temperatures are 225-325°F
- 40-90% of ink solvent evaporates in dryer
- Fountain solution is 5-20% IPA or 2-5% low volatility solvents
- 0-5% of fountain solution solvent remains in web
- Automatic blanket washers evaporate solvent in dryer during wash cycle

Heatset Web Printing Press



Sheetfed Printing

- Applies images to individual sheets
- Typically uses semifluid inks
- May use radiation curing inks
- Fountain solution is 5-20% IPA or 2-5% low volatility solvents
- Finishes are frequently applied

Emission Control Techniques

- Inks
- Fountain solution
- Press cleaning

Nonheatset Web Inks

- Formulated with low volatility solvents
- Guidelines suggest 5% of solvent emitted as fugitive emissions and 95% retained in paper
- Best control technique is ink reformulation

Heatset Web Inks

- Inks cure by evaporation in a dryer controlled with add-on equipment
- Guidelines suggest 80% of solvent is emitted in dryer and 20% retained in paper
- Control methods include incineration and condenser-droplet removal systems

Sheetfed Inks

- Formulated with low volatility solvents
- Guidelines suggest 5% of solvent emitted as fugitive emissions and 95% retained in paper
- Best control technique is ink reformulation

Fountain Solution

- Most volatile additive is IPA
- Use low volatility dampening agents
- Refrigerate fountain solution to 55-60°F
- For nonheatset and sheetfed printing, guidelines suggest 100% of solvent emitted as fugitive emissions
- For heatset printing, guidelines suggest 30% of solvent emitted as fugitive emissions and 70% emitted in dryer

Press Cleaning

- Reduce VOC content of cleaning solution
- Use less volatile solvents
- Add water and detergent to cleaning solution or use aqueous cleaner
- Put rags and wipes in sealed containers
- For heatset printers with automatic blanket washers, guidelines suggest 60% of solvent emitted as fugitive emissions and 40% emitted in dryer

Emission Regulation

Control of Volatile Organic Compound Emissions from Offset Lithographic Printing, Control Technique Guideline Document, EPA-453/D-95-001

Recommended standard:

- Reduce emissions from dryer of heatset press by 90%
- Use fountain solutions in nonheatset press with <3% by volume of non-alcohol additives
- Use fountain solutions in heatset press that have VOC contents equivalent to <1.6% alcohol by volume
- Use fountain solutions in sheetfed press that have VOC contents equivalent to <5% alcohol by volume
- Use cleaning solutions that have <30% by weight VOC

Offset Lithographic Printing, Alternative Control Techniques Document, EPA-453/D-94-054

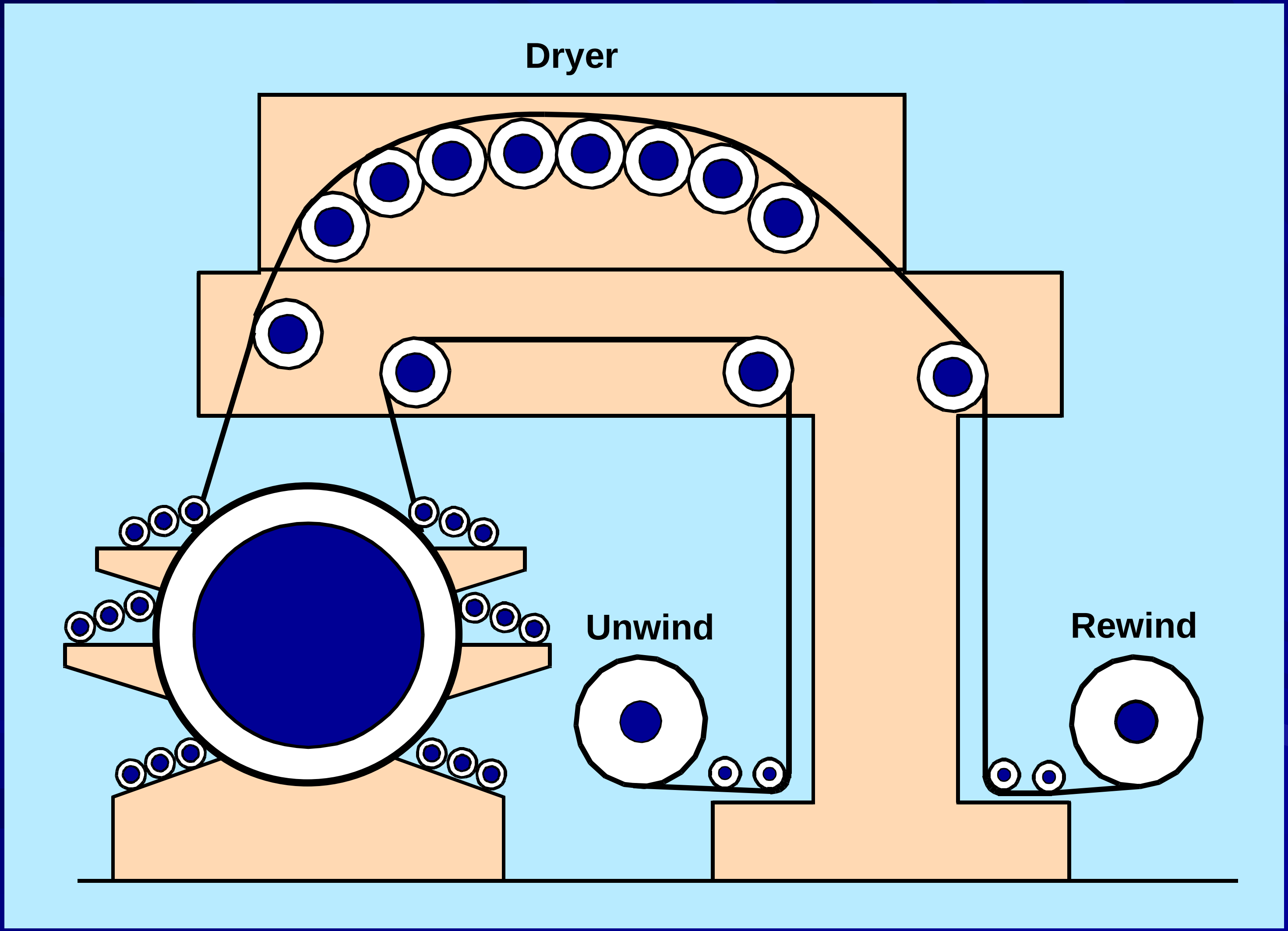
Additional Recommendations:

- An applicability cutoff of 15 pounds per day of actual VOC emissions without control devices for all printing activities
- Use fountain solutions that contain <5% by volume of alcohol substitutes
- Use cleaning solutions with a VOC partial pressure <10 mm Hg at 20°C
- Keep cleaning materials and used towels in closed containers

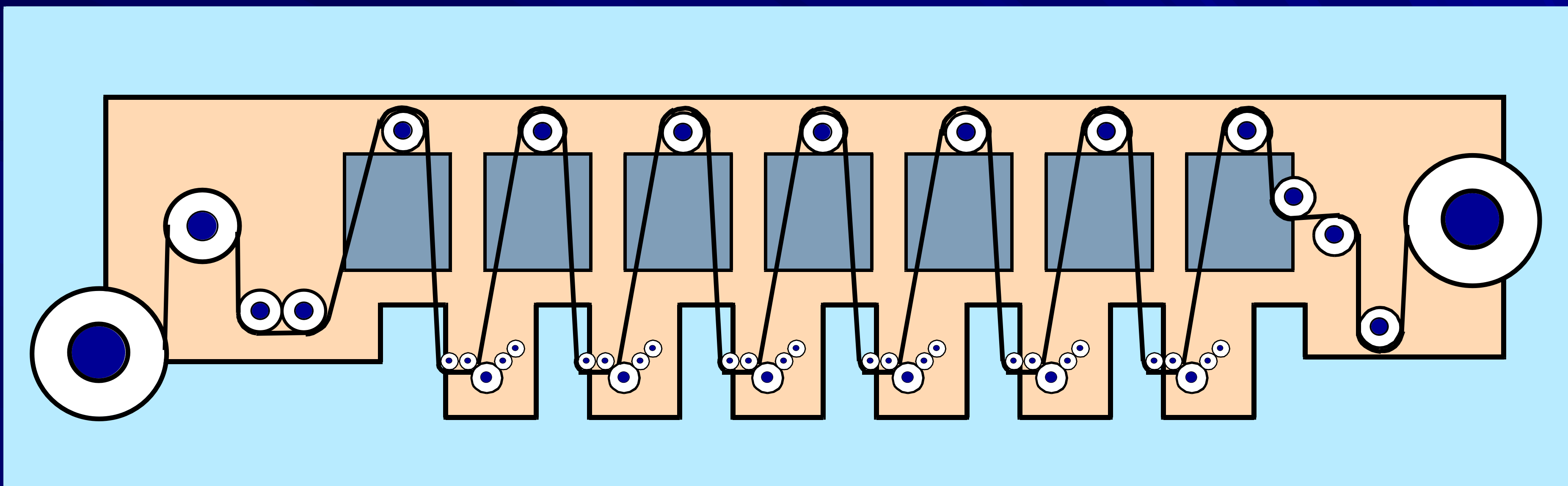
Flexography

- Uses raised image rubber printing plates
- Inks contain up to 75% solvent by weight
- Press designs:
  - Central impression
  - In-line
  - Stacked
  - Newspaper unit
  - Publication unit

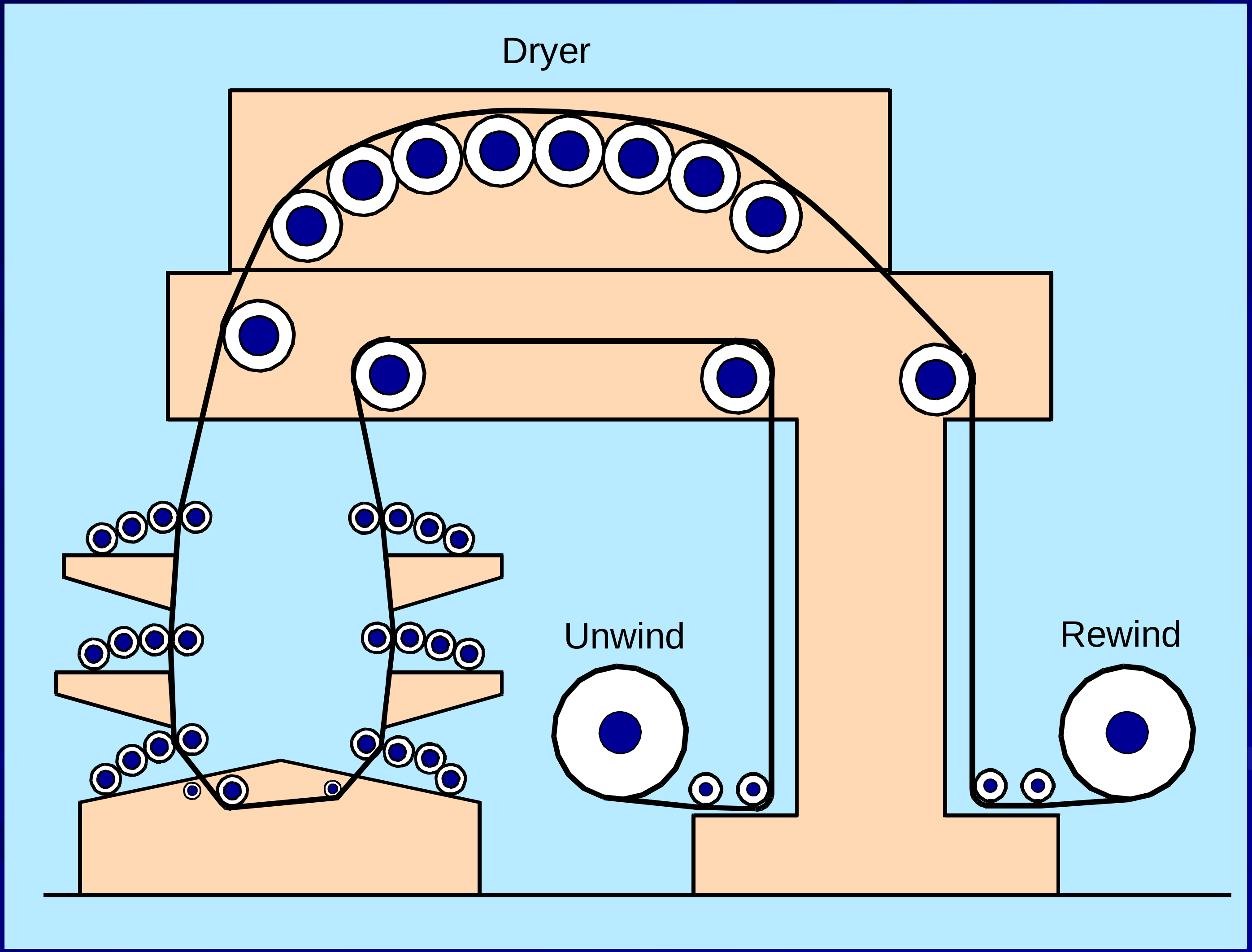
Central Impression Press



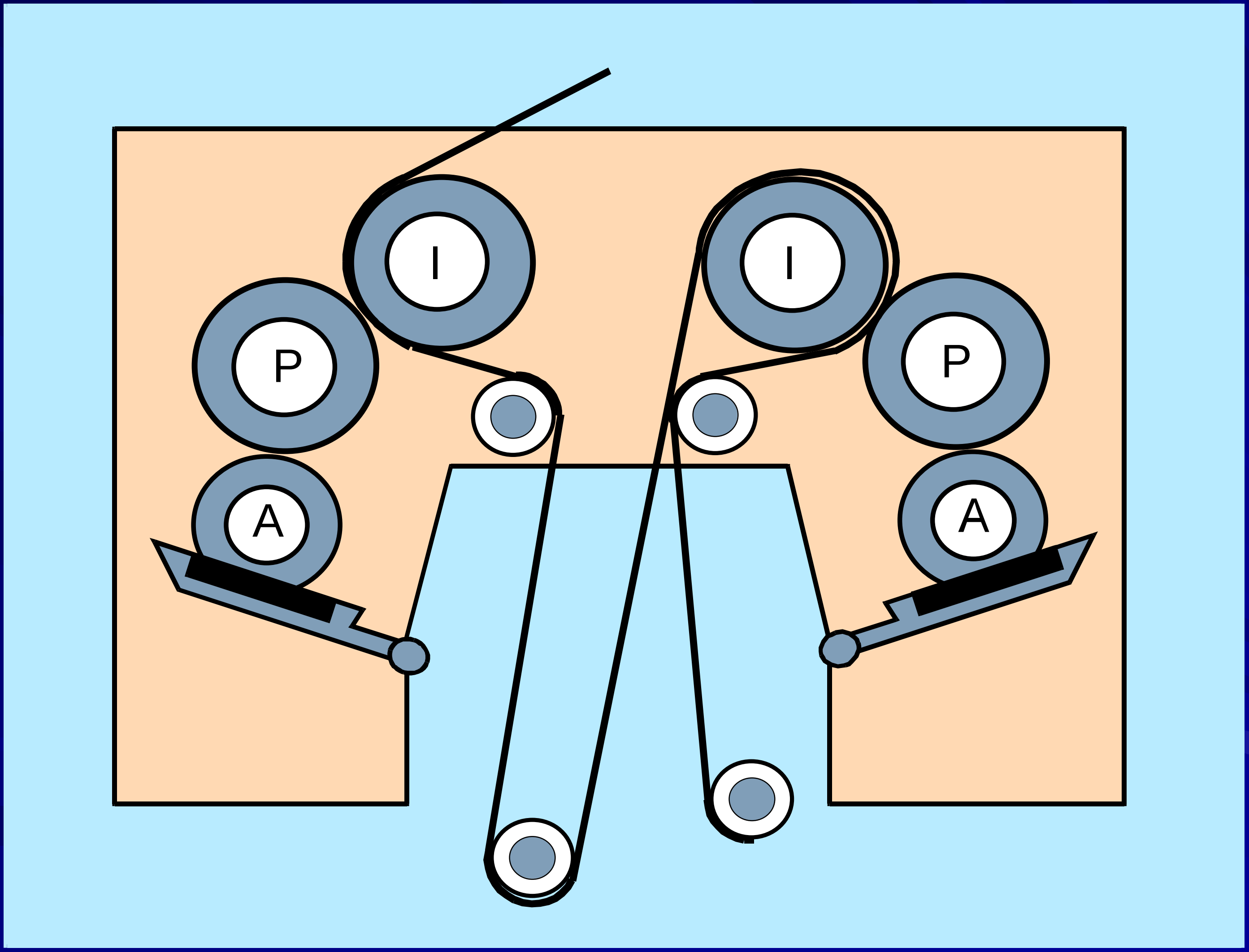
In-Line Press



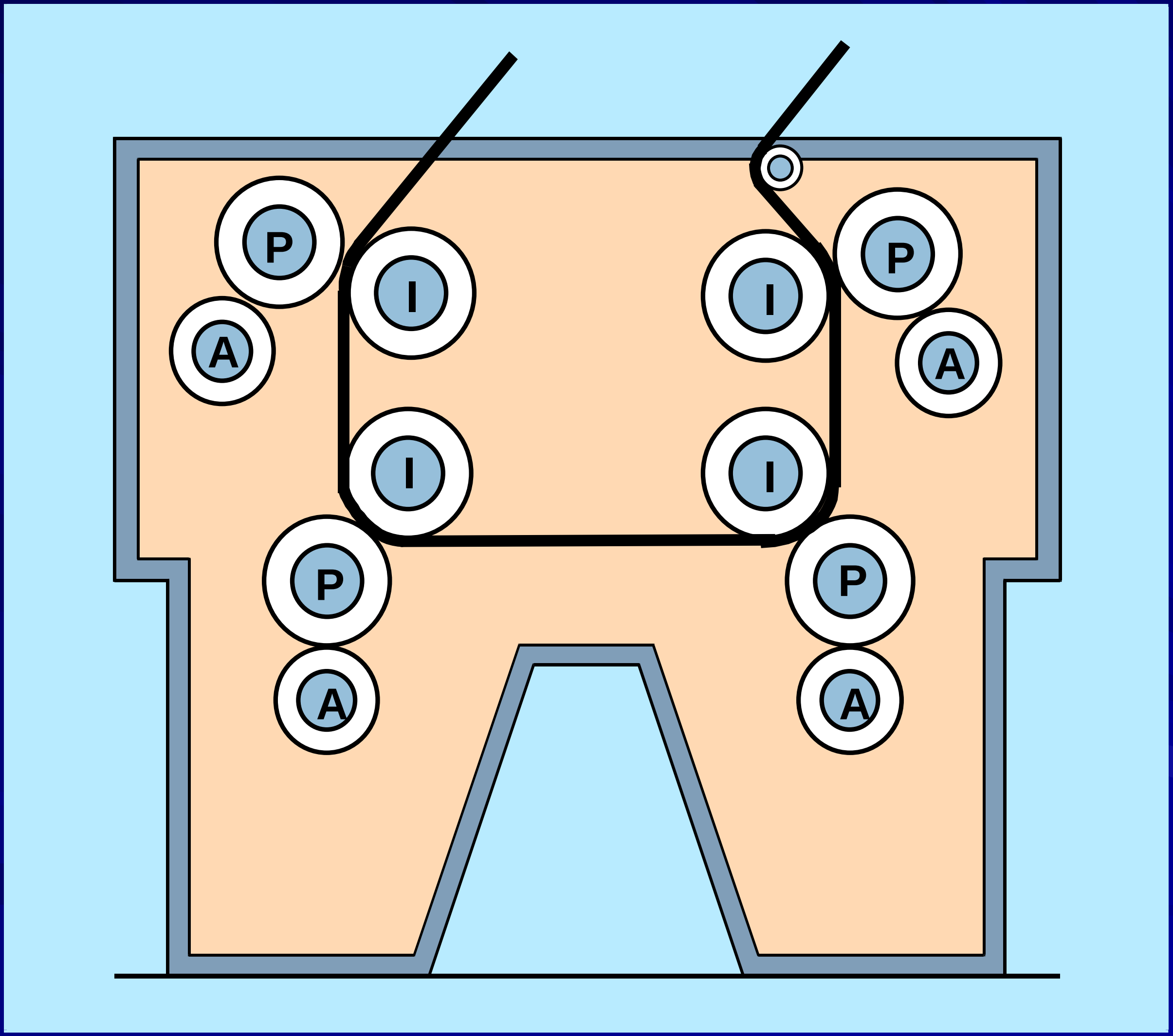
Stack Press



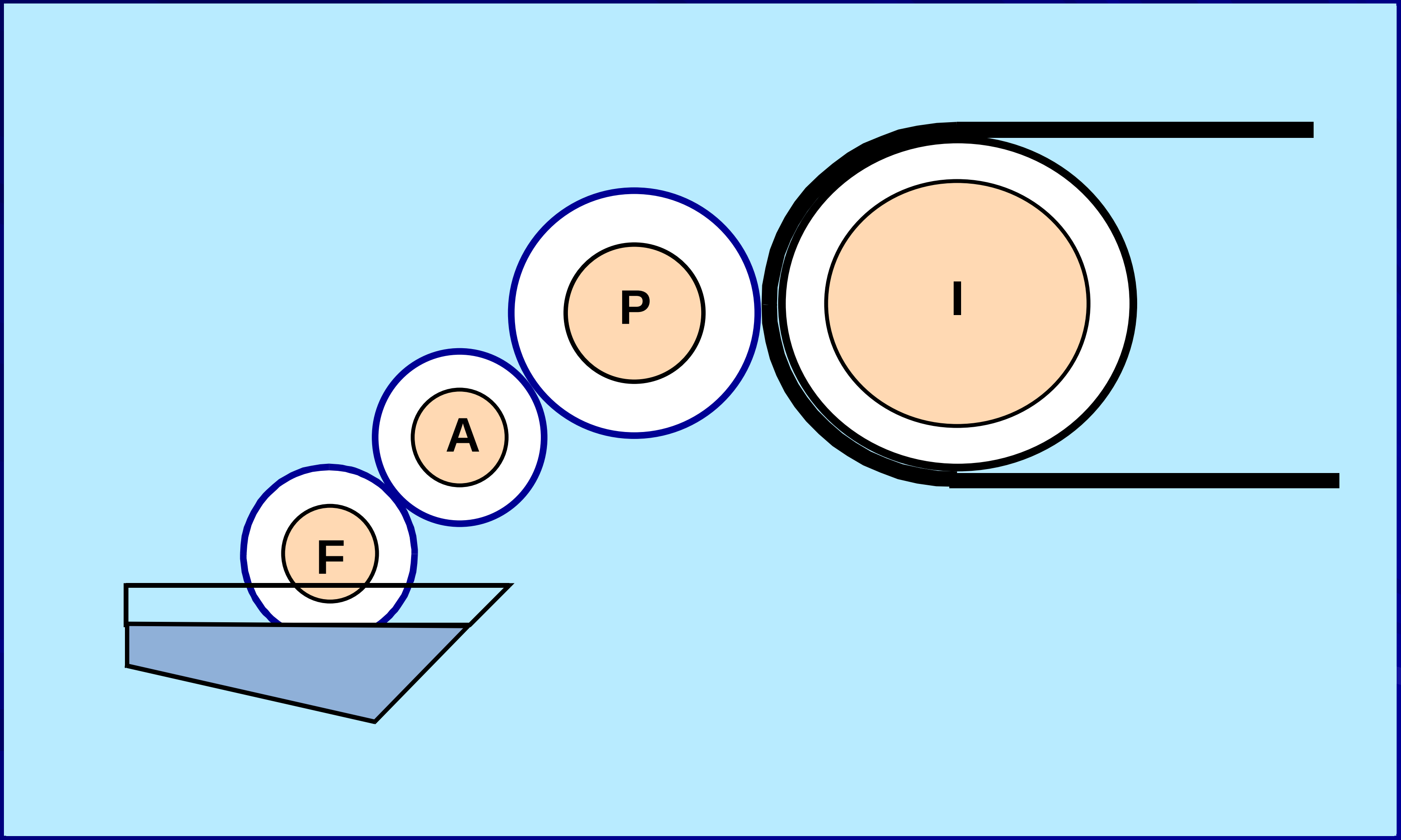
Newspaper Printing Unit



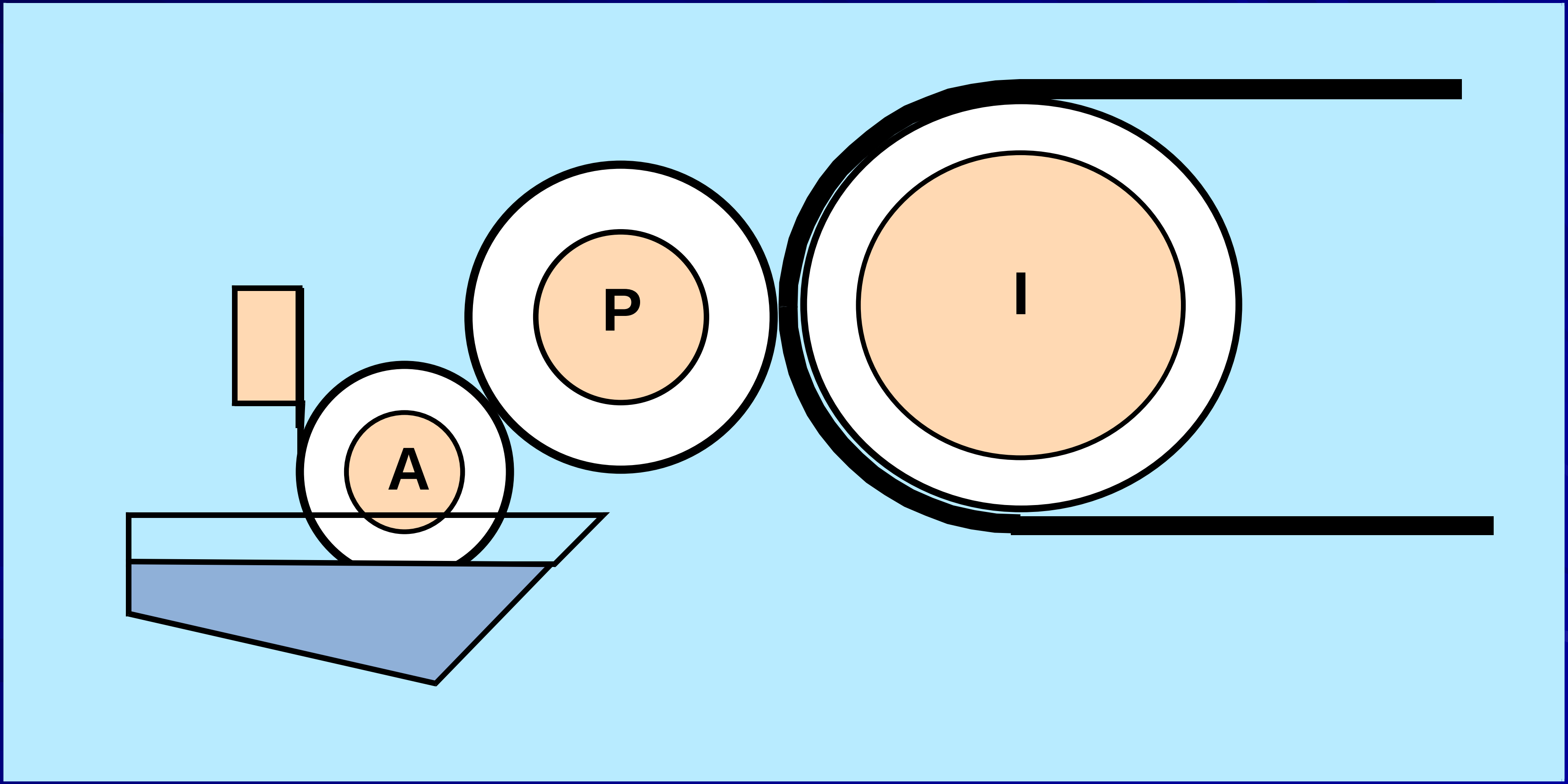
Publication Printing Unit



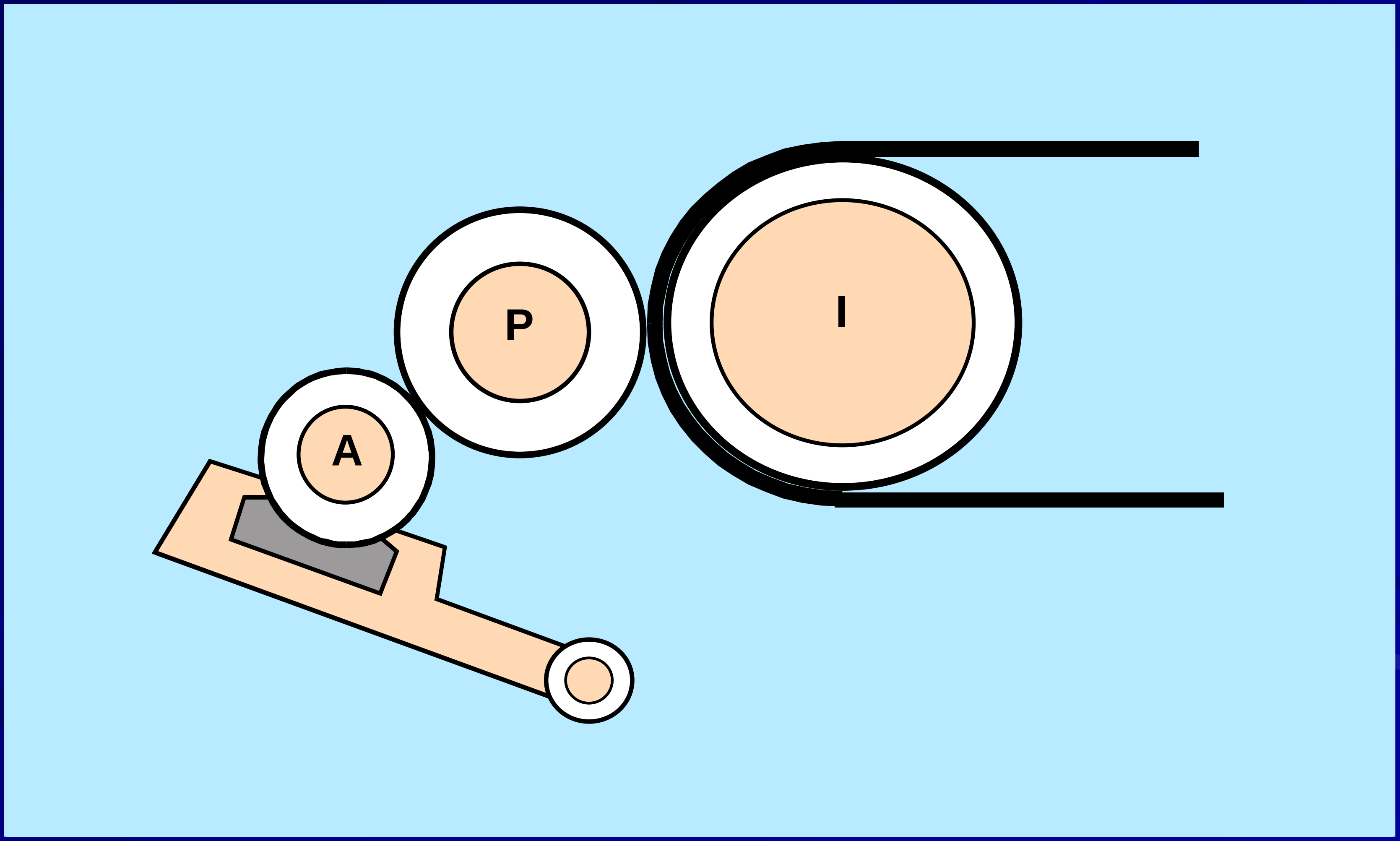
Fountain Roller Style Printing Station



Single Doctor Blade Style Printing Station



Double Doctor Blade Style Printing Station



Types of Inks

- Organic solvent based
- Water based
- Radiation curable

Emission Control Techniques

- Reduced-VOC ink
- Reduced-VOC cleaning
- Add-on control equipment
  - Incineration
  - Adsorption
  - Condensation

Emission Regulation

Control of Volatile Organic Emissions from Existing Stationary Sources--Volume VIII: Graphic Arts--Rotogravure and Flexography, Control Technique Guideline Document, EPA-450/2-78-033

Recommended standard:

Achieve an overall VOC reduction efficiency of 60%

National Emission Standards for the Printing and Publishing Industry, 40CFR63, Subpart KK

Applicability: Each new and existing facility that is a major source of HAP at which wide-web flexographic printing presses are operated

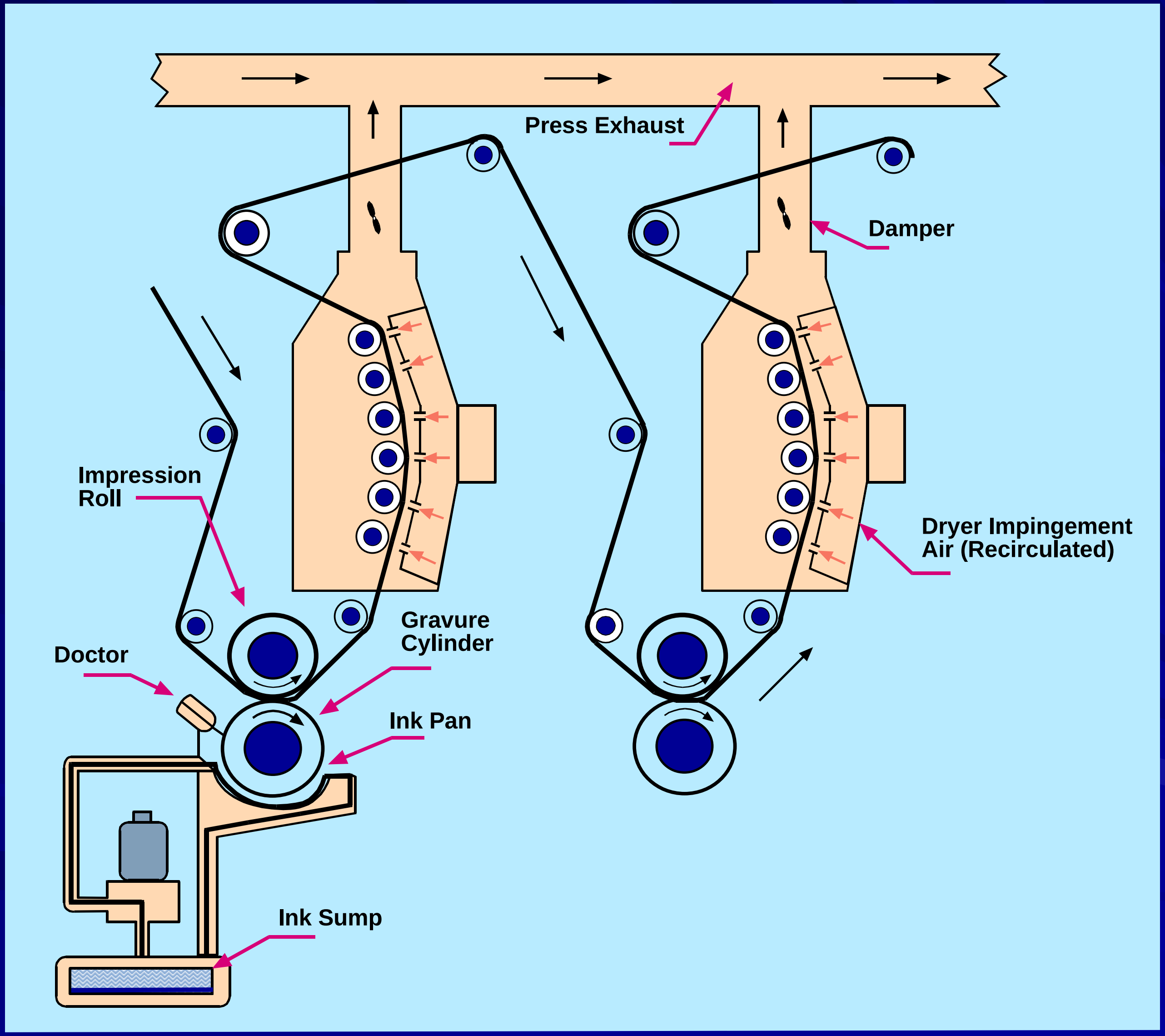
Standard:

- Limit emissions to <5% of the organic HAP applied; or
- Limit emissions to <4% of the total mass of inks, coatings, varnishes, adhesives, primers, solvents, reducers, thinners, and other materials applied; or
- Limit emissions to <20% of the mass of solids applied; or
- Limits emissions to a calculated equivalent

Rotogravure

- Uses engraved chromium plated printing plates
- Inks contain up to 75% solvent by weight
- Industry branches:
  - Publication rotogravure
  - Packaging rotogravure
  - Product rotogravure

Rotogravure Press



Emission Control Techniques

- Reduced-VOC ink
- Reduced-VOC cleaning
- Add-on control equipment
  - Incineration
  - Adsorption
  - Condensation

Emission Regulation

Control of Volatile Organic Emissions from Existing Stationary Sources--Volume VIII: Graphic Arts--Rotogravure and Flexography, Control Technique Guideline Document, EPA-450/2-78-033

Recommended standard:

- Achieve an overall efficiency of 75% for publication rotogravure
- Achieve an overall efficiency of 65% for packaging rotogravure

Standards of Performance for the Graphic Arts Industry: Publication Rotogravure Printing, 40CFR60, Subpart QQ

Applicability Date: October 28, 1980

Standard:

VOC emitted must be $\leq$16% of the total mass of VOC solvent and water

National Emission Standards for the Printing and Publishing Industry, 40CFR63, Subpart KK

Applicability: Each new and existing facility that is a major source of HAP at which publication rotogravure or product and packaging rotogravure printing presses are operated

Standard:

For publication rotogravure printing:

Limit emissions to <8% of the total volatile matter

For product and packaging rotogravure printing:

- Limit emissions to <5% of the organic HAP applied; or
- Limit emissions to <4% of the total mass or inks, coatings, varnishes, adhesives, primers, solvents, reducers, thinners, and other materials applied; or
- Limit emissions to <20% of the mass of solids applied; or
- Limits emissions to a calculated equivalent

Screen Printing

- Ink flows through screen with stencil bonded to it
- Types of inks:
  - Solvent based
  - Water based
  - UV curable
  - Plastisols

Drying Units

- Hot-air ovens
- Infrared radiation
- UV radiation

Screen Reclamation

- Ink residue removed
- Screen degreased
- Stencil remover applied
- Stencil removed with high-pressure wash
- Haze removers may be used

Emission Control Techniques

- Reduced-VOC ink
- Reduced-VOC cleaning
- Add-on control equipment
  - Incineration
  - Adsorption
  - Condensation

Emission Regulation

Process Inspection

- Review ink composition and consumption records
- Observe ink preparation
- Observe printing area
- Observe curing area

Review Ink Composition and Consumption Records

- Composition data evaluated to determine compliance with permit and regulations
  - Solvent content
  - Solids content
  - Water content
  - Solvent density
  - Ink density
- Consumption data evaluated to determine compliance with permit

Observe Ink Preparation

- Determine if area is ventilated
- Note if drums are kept closed
- Determine if solvents have changed
- Observe spill cleanup
- Get sample of “as applied” ink

Observe Printing Area

- Determine if area is ventilated
- Note changes in printing method
- Determine changes in application rate
- Determine if control system is adjusted
- Observe spill cleanup

Observe Curing Area

- Check physical integrity of oven
- Check oven temperatures
- Determine changes in line speed
- Determine if control system is adjusted

Chapter 7

Calculating the VOC Content of Coatings and Inks

VOC Calculations

Using the calculation method for determining VOC content of coatings and inks is more convenient, and often more reliable, than it is to measure VOC emission directly.

Calculation Information

- Form of emission limitation
- Data on the properties and compositions of coatings and inks
- Transfer efficiency and performance specifications
- Production rates and coating or ink usage

Forms of Emission Limitations for Surface Coating

- Weight of VOC per volume of coating less water and exempt solvents
- Weight of VOC per area of surface covered
- Weight of VOC per volume of solids
- Weight of VOC per volume of applied solids

Forms of Emission Limitations for Graphic Arts

- Volume percent VOC in volatile fraction
- Volume percent water in volatile fraction
- Volume percent solids in ink less water

Coating and Ink Data

- Standard methods
- Data sheets
- Material safety data sheets (MSDS)

Standard Methods

- Method 24
  - Weight fraction of volatile matter
  - Weight fraction of water
  - Volume fraction of solids
  - Coating density

- Method 24A
  - Weight fraction of VOC
  - Coating density
  - Solvent density

Manufacturer Data Sheet

Coating Manufacturer ____________________

Coating Identification ____________________

Batch Identification ____________________

Supplied to ____________________

A. Coating Density (Dc)s ____________ Lbs/gal of coating
ASTM D 1475 ( )
Other ________ ( )

B. Total Volatile Content (Wv)s ____________ Lbs/lb of coating
ASTM D 2369 ( )
Other ________ ( )

C. Water Content (Ww)s ____________ Lbs/lb of coating
ASTM D 3792 ( )
ASTM D 4017 ( )
Other ________ ( )

Water Content (Vw)s ____________ Gals/gal of coating
Calculated ( )
Other ________ ( )

D. Organic Volatiles (Wo)s ____________ Lbs/lb coating
E. Nonvolatiles Content (Vn)s ____________ Gals/gal of coating
F. VOC Content (VOC)s ____________ Lbs/gal less water
____________ Lbs/gal of solids

Signed: ____________________ Date: ____________

User Data Sheet

Coating Manufacturer ______________________________
Coating Identification ______________________________
Batch Identification ______________________________

User ______________________________
User's Coating Identification ______________________________

A. Coating Density (Dc)a ____________ Lbs/gal of coating
ASTM D 1475 ( )
Other ________ ( )

B. Total Volatile Content (Wv)a ____________ Lbs/lb of coating
ASTM D 2369 ( )
Other ________ ( )

C. Water Content (Ww)a ____________ Lbs/lb of coating
ASTM D 3792 ( )
ASTM D 4017 ( )
Other ________ ( )

Water Content (Vw)a ____________ Gals/gal of coating
Calculated ( )
Other ________ ( )

D. Dilution Solvent Density (Dd) ____________ Lbs/gal solvent
(Weighted Average)
ASTM D 1475 ( )
Handbook ( )
Formulation ( )

E. Dilution Solvent Ratio (Rd) ____________ Gal solvent/gal coating
F. Organic Volatiles (Wo)a ____________ Lbs/lb coating
G. Nonvolatiles Content (Vn)a ____________ Gals/gal of coating
H. VOC Content (VOC)a ____________ Lbs/gal less water
____________ Lbs/gal of solids

Signed: ______________________ Date: ______________

Coating and Ink Data

- Standard methods
- Data sheets
- Material safety data sheets (MSDS)

Transfer Efficiency

- Baseline transfer efficiencies are specified in some CTG documents and NSPS
- Enhanced transfer efficiencies are determined under actual operating conditions

Capture and Control Efficiencies

- Claimed efficiencies can be determined from manufacturer's information
- Actual efficiencies are determined by performance testing on the specific source

Process Records

- Coating formulation and analytical data
- Coating consumption data
- Capture and control equipment performance data
- Transfer efficiency data
- Process information

Emission Calculations

Consider the following coating:

Solids content	35% by weight
Water content	10% by weight
Solids density	29.7 lbs/gal
Solvent content (by volume)	83.3% xylene 16.7% MEK

Calculation of Mixed Solvent Density

$$\left(7.5\,\frac{\text{lbs xylene}}{\text{gal xylene}}\right)\left(0.833\,\frac{\text{gal xylene}}{\text{gal solvent}}\right)=6.25\,\frac{\text{lbs xylene}}{\text{gal solvent}}$$

$$\left(6.7\,\frac{\text{lbs MEK}}{\text{gal MEK}}\right)\left(0.167\,\frac{\text{gal MEK}}{\text{gal solvent}}\right)=1.11\,\frac{\text{lbs MEK}}{\text{gal solvent}}$$

$$\text{Solvent density}=6.25\,\frac{\text{lbs xylene}}{\text{gal solvent}}+1.11\,\frac{\text{lbs MEK}}{\text{gal solvent}}$$

$$=7.36\,\frac{\text{lbs solvent}}{\text{gal solvent}}$$

Calculation of Coating Density

Solvent content = 100 lbs coating - 35 lbs solids - 10 lbs water = 55 lbs

$$\frac{35 \text{ lbs solvent}}{29.7 \frac{\text{lbs solids}}{\text{gal solids}}} = \textbf{1.18 gal solids}$$

$$\frac{10 \text{ lbs water}}{8.34 \frac{\text{lbs water}}{\text{gal water}}} = \textbf{1.20 gal water}$$

$$\frac{55 \text{ lbs solvent}}{7.36 \frac{\text{lbs solvent}}{\text{gal solvent}}} = \textbf{7.47 gal solvent}$$

Calculation of Coating Density
(Continued)

1.18 gal solids + 1.20 gal water + 7.47 gal solvent = 9.85 gal coating

$$\textbf{Coating density} = \frac{100 \text{ lbs coating}}{9.85 \text{ gal coating}} = \mathbf{10.15} \frac{\text{lbs coating}}{\text{gal coating}}$$

Coating composition by volume:

Solids	**12.0%**
Water	**12.2%**
Solvent	**75.8%**

Calculation of VOC Emissions on the Basis of Coating Volume

$$\text{Emissions} = \left(7.36\,\frac{\text{lbs solvent}}{\text{gal solvent}}\right)\left(0.758\,\frac{\text{gal solvent}}{\text{gal coating}}\right) = 5.58\,\frac{\text{lbs solvent}}{\text{gal coating}}$$

$$\text{Emissions} = \left(0.55\,\frac{\text{lbs solvent}}{\text{lb coating}}\right)\left(10.15\,\frac{\text{lbs coating}}{\text{gal coating}}\right) = 5.58\,\frac{\text{lbs solvent}}{\text{gal coating}}$$

Calculation of VOC Emissions on the Basis of Coating Volume
(Continued)

$$1\frac{\text{gal coating}}{\text{gal coating}} - 0.122\frac{\text{gal water}}{\text{gal coating}}$$

$$\frac{1\,\text{gal coating} - 0.122\,\text{gal water}}{\text{gal coating}}$$

$$\frac{(1-0.122)\,\text{gal coating less water}}{\text{gal coating}}$$

Calculation of VOC Emissions on the Basis of Coating Volume (Continued)

$$\text{Emissions} = \frac{\left(7.36\,\dfrac{\text{lbs solvent}}{\text{gal solvent}}\right)\left(0.758\,\dfrac{\text{gal solvent}}{\text{gal coating}}\right)}{\dfrac{(1-0.122)\,\text{gal coating less water}}{\text{gal coating}}} = 6.35\,\frac{\text{lbs solvent}}{\text{gal coating less water}}$$

Calculation of VOC Emissions on the Basis of Solids Volume

$$\text{Emissions} = \frac{\left(7.36\,\frac{\text{lbs solvent}}{\text{gal solvent}}\right)\left(0.758\,\frac{\text{gal solvent}}{\text{gal coating}}\right)}{0.12\,\frac{\text{gal solids}}{\text{gal coating}}} = 46.49\,\frac{\text{lbs solvent}}{\text{gal solids}}$$

or

$$\text{Emissions} = \frac{\left(0.55\,\frac{\text{lbs solvent}}{\text{lb coating}}\right)\left(10.15\,\frac{\text{lbs coating}}{\text{gal coating}}\right)}{0.12\,\frac{\text{gal solids}}{\text{gal coating}}} = 46.52\,\frac{\text{lbs solvent}}{\text{gal solids}}$$

Calculation of VOC Emissions on the Basis of Solids Volume
(Continued)

Assume a transfer efficiency of 75%:

$$\text{Emissions} = \frac{46.49 \dfrac{\text{lbs solvent}}{\text{gal solids}}}{0.75 \dfrac{\text{gal solids applied}}{\text{gal solids}}} = 61.99 \frac{\text{lbs solvent}}{\text{gal solids applied}}$$

Graphic Arts Calculations

Consider the following ink:

Solids content	10% by volume
Water content	70% by volume
Solvent content	20% by volume

Volume Percent VOC in the Volatile Fraction

$$\text{VOC content} = \frac{0.20\,\dfrac{\text{gal solvent}}{\text{gal ink}}}{\dfrac{(1-0.10)\,\text{gal volatiles}}{\text{gal ink}}} = 0.222\,\frac{\text{gal solvent}}{\text{gal volatiles}} \text{ or } 22.2\%\text{ of the volatiles}$$

Volume Percent Water in the Volatile Fraction

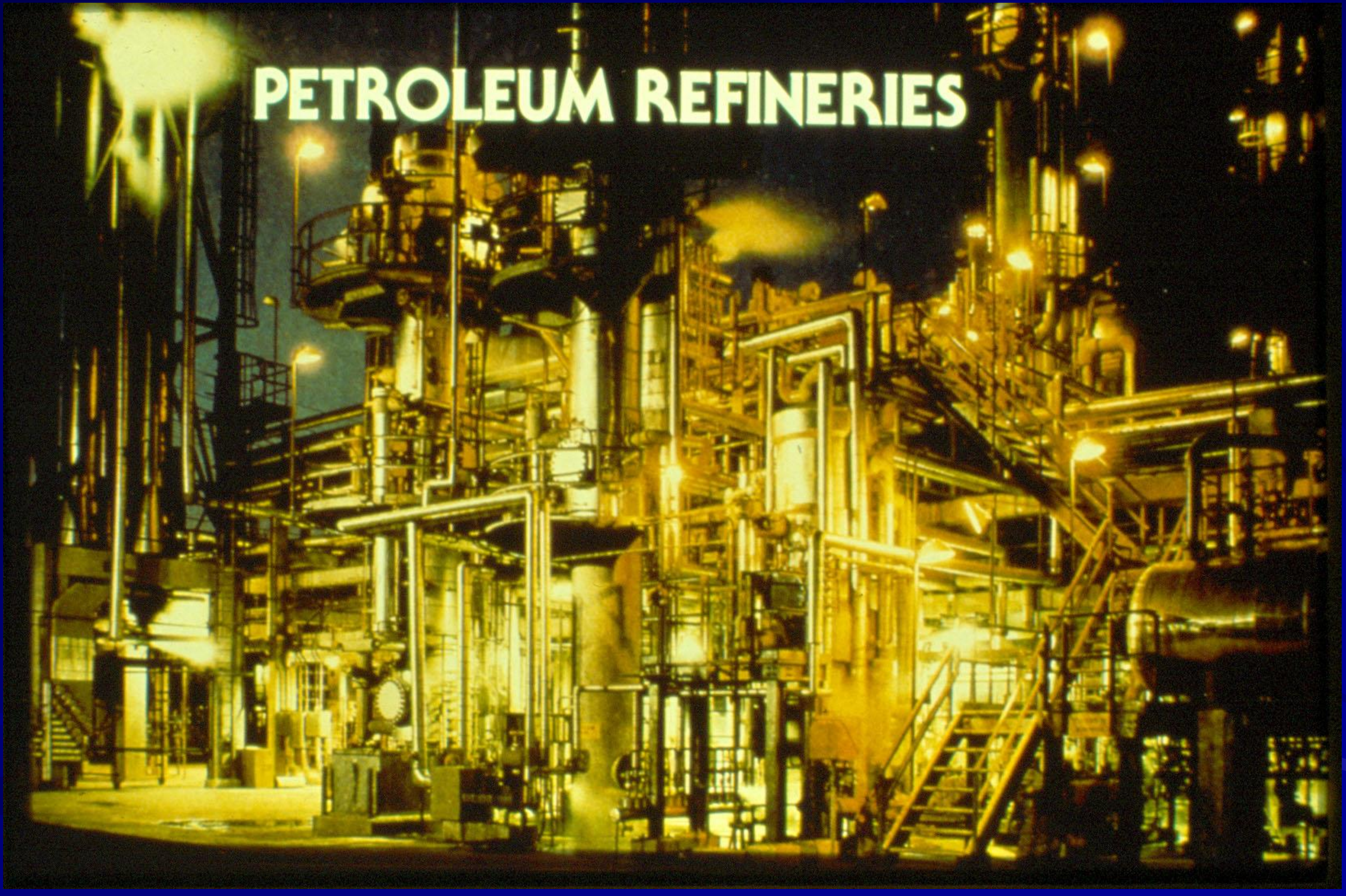
$$\text{Water content} = \frac{0.70\,\dfrac{\text{gal water}}{\text{gal ink}}}{\dfrac{(1-0.10)\,\text{gal volatiles}}{\text{gal ink}}} = 0.778\,\frac{\text{gal water}}{\text{gal volatiles}} \ \text{ or } \ 77.8\%\ \text{of the volatiles}$$

Volume Percent Solids in the Ink Less Water

$$\text{VOC content} = \frac{0.10\,\dfrac{\text{gal solids}}{\text{gal ink}}}{\dfrac{(1-0.70)\,\text{gal ink less water}}{\text{gal ink}}} = 0.333\,\frac{\text{gal solids}}{\text{gal ink less water}} \text{ or } 33.3\%$$

Chapter 8

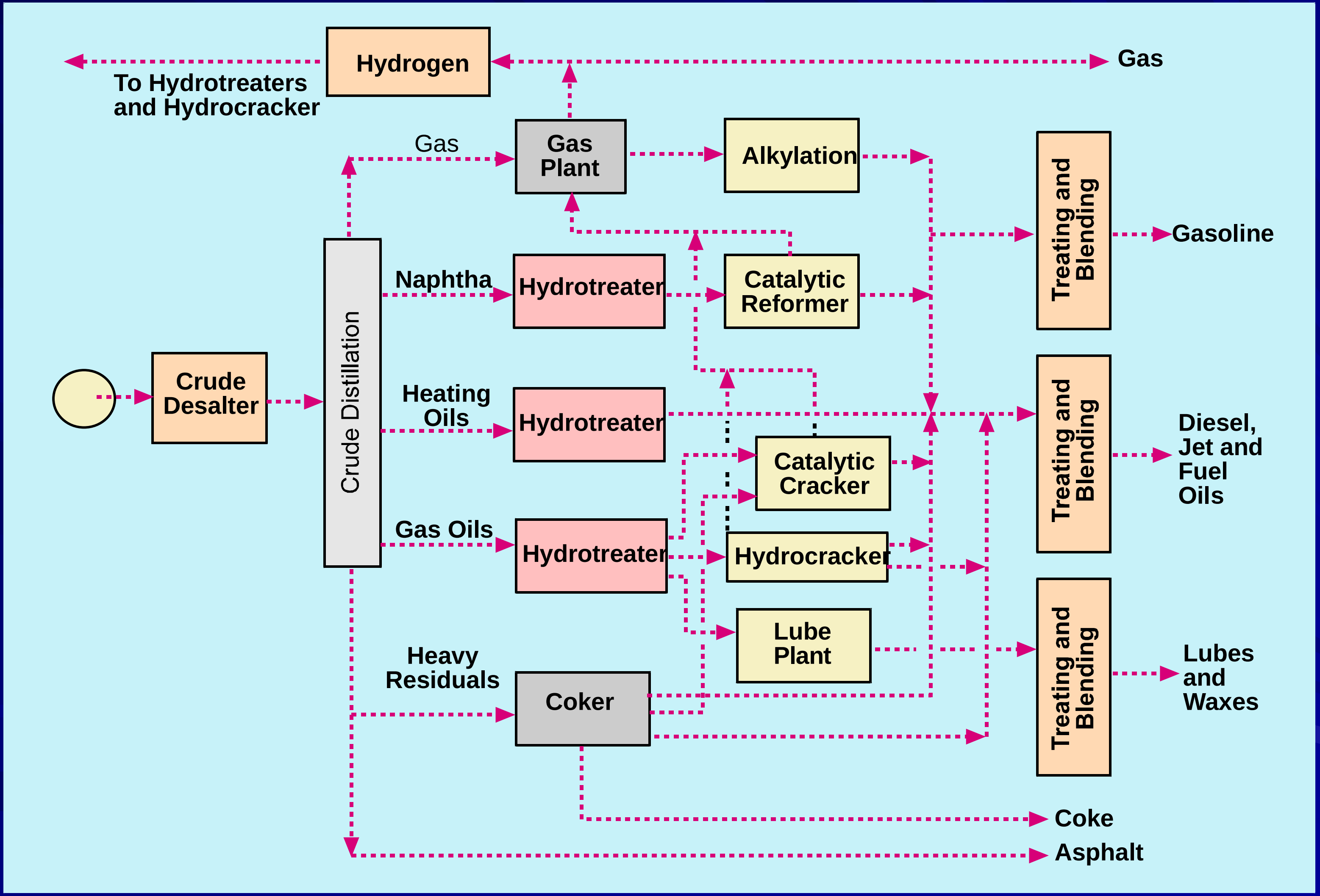
Petroleum Refining


PETROLEUM REFINERIES

Categories of Refining Operations

- Separation processes
- Conversion processes
- Treatment processes
- Auxiliary processes

Typical Processing Steps



Separation Processes

- Desalting
- Distillation
- Deasphalting

Desalting

- Electrical desalting

  Crude, water and demulsifier heated under pressure and subjected to electrostatic field. Salt-containing water droplets agglomerate, settle and are removed.

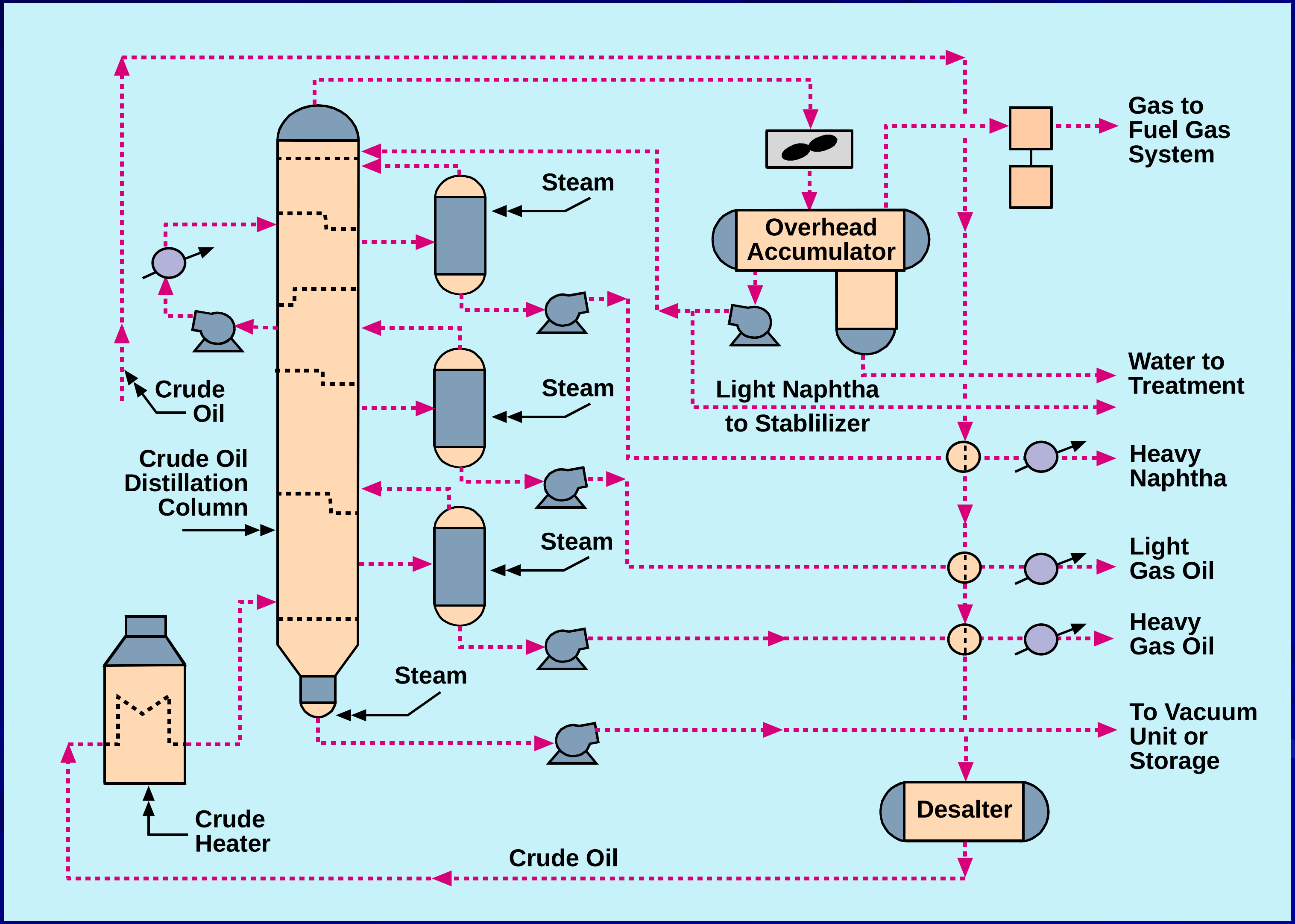
- Chemical desalting

  Crude, water and demulsifier heated under pressure. Salt-containing water droplets agglomerate, settle and are removed.

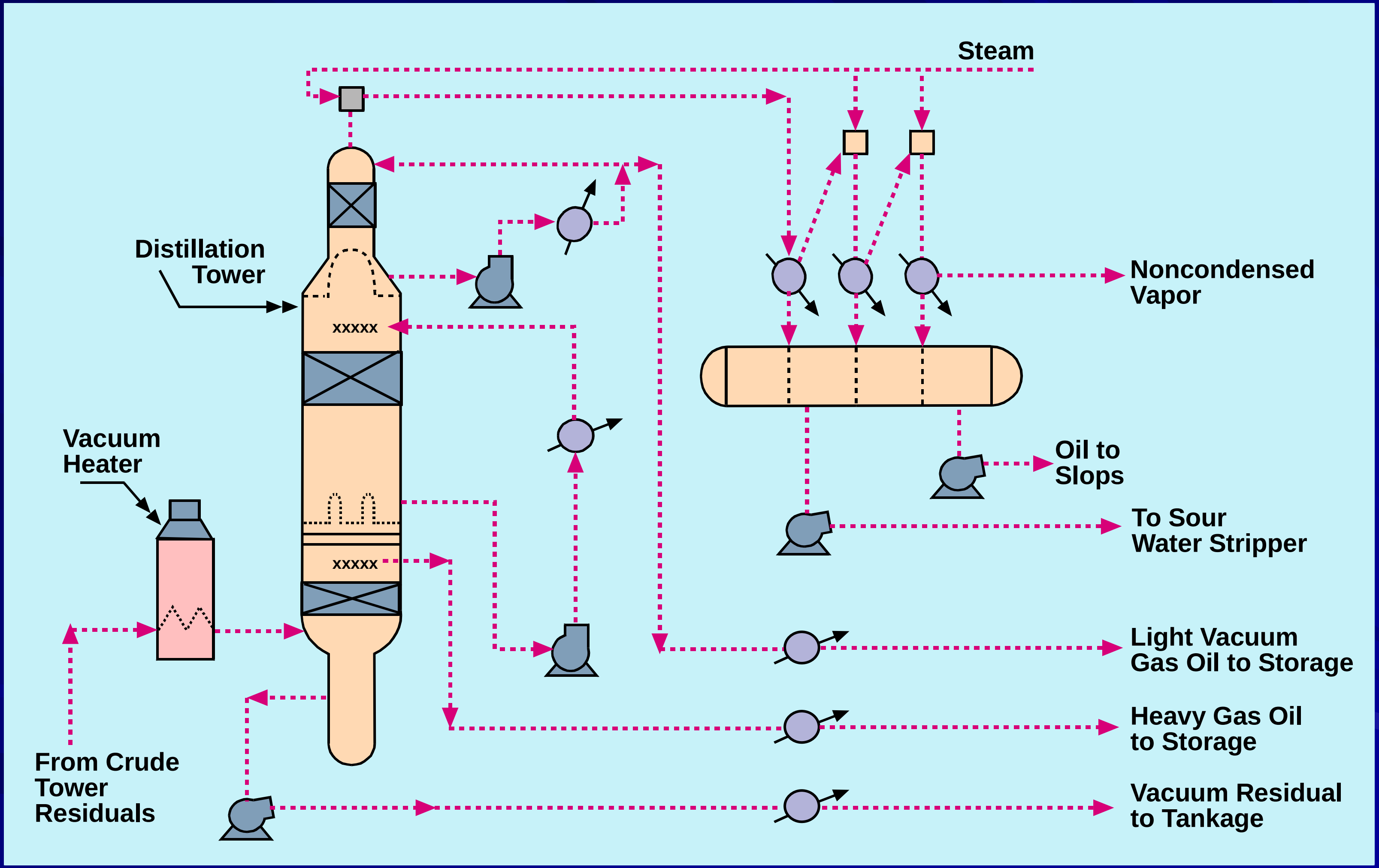
Distillation

- Atmospheric distillation
- Vacuum distillation

Atmospheric Distillation Unit



Vacuum Distillation



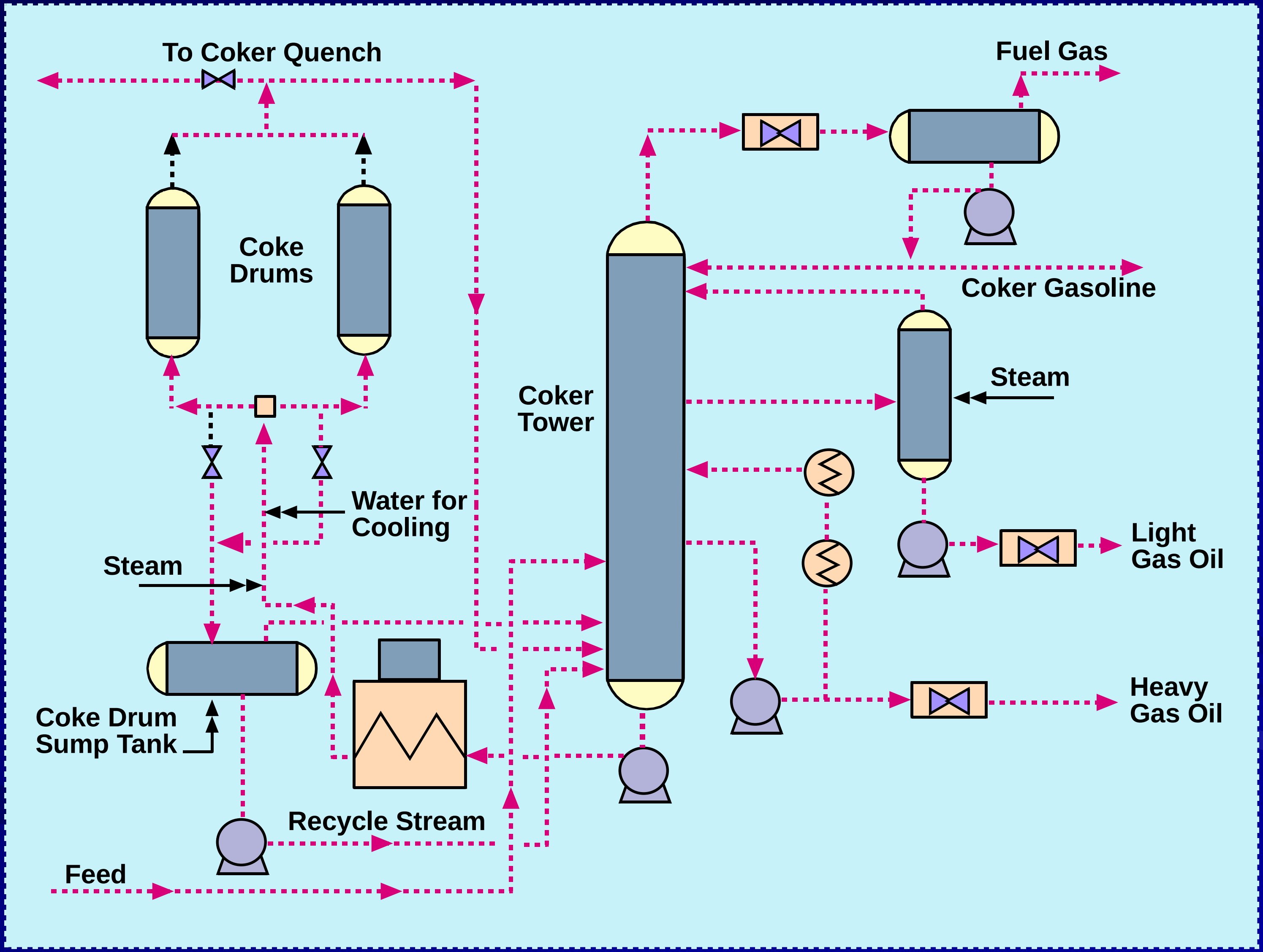
Deasphalting

Separates asphaltic compounds using liquid-liquid extraction with liquid propane

Conversion Processes

- Coking
- Visbreaking
- Catalytic cracking
- Polymerization
- Alkylation
- Isomerization
- Reforming

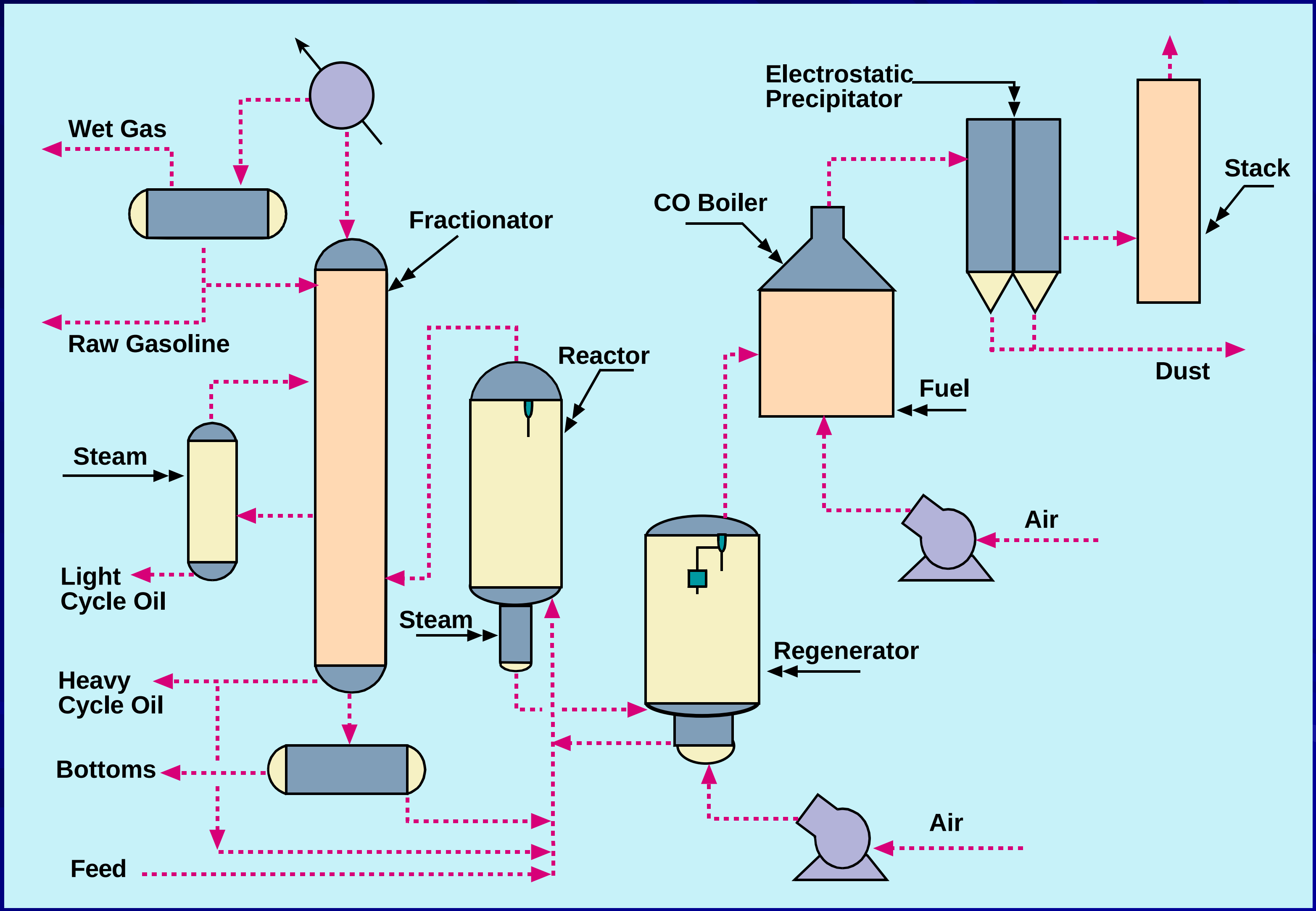
Delayed Coking Unit



Visbreaking

- Milder form of cracking than coking
- Residues from atmospheric and vacuum distillation fed to process heater
- Thermal cracking produces residual tars, gas oils, gasoline and light gases
- Used to reduce viscosity of residual fractions for blending into fuel oils

Catalytic Cracking Unit



Polymerization

- Catalytic conversion of olefin gases to liquid condensation products
- Provided a gasoline blending stock when octane level were low
- Rarely used today
- Polymers are valuable as additives for motor oil

Polymerization Processes

- Liquid catalyst polymerization

  Olefin feed is polymerized with liquid phosphoric acid catalyst

- Solid catalyst polymerization

  Olefin feed is mixed with propane and water and polymerized in a fixed-bed reactor containing pellets impregnated with phosphoric acid catalyst

Alkylation

- Branched hydrocarbons are synthesized by the catalytic addition of a paraffinic or aromatic hydrocarbon to an olefin
- The product, alkylate, is used as an antiknock additive

Alkylation Processes

- Sulfuric acid alkylation

  Olefin and isobutane are mixed and contacted with sulfuric acid in a refrigerated reactor. Emulsion is formed, recovered and separated to obtain alkylate

- Hydrofluoric acid alkylation

  Olefin, isobutane and hydrofluoric acid are mixed and react to form an emulsion that is recovered and separated to obtain alkylate

Isomerization

- Rearranges feedstock molecular structure to produce branched-chain compounds from straight-chain compounds
- Process is usually applied to butane or mixtures of pentane and hexane

Isomerization Process

- Feedstock is mixed with hydrogen and passed over a fixed-bed noble metal catalyst
- Reactor effluent is separated to recover the hydrogen and the branched-chain isomers

Reforming

- Converts straight-chain naphtha compounds to ring or branched structures
- Predominate use is the dehydrogenation of naphthenes to form aromatics

Reforming Process

- Platforming
- Ultraforming
- Powerforming
- Magna-forming
- Houdriforming

Platforming Process

- Naphtha feed is mixed with hydrogen and passed over a fixed-bed noble metal catalyst
- Reactor effluent is separated to recover the hydrogen and the reformate product
- Catalyst regeneration cycle varies from once a day to less than once a year, depending on pressure and hydrogen-naphtha ratio

Treatment Processes

- Hydrotreating
- Amine treating
- Chemical sweetening
- Asphalt blowing

Hydrotreating

- Removes sulfur, nitrogen and metal compounds from intermediate fractions
- In hydrodesulfurization, the petroleum stream is mixed with hydrogen and passed over a fixed-bed catalyst
- Reactor effluent is separated to recover the hydrogen and the hydrogen sulfide and ammonia

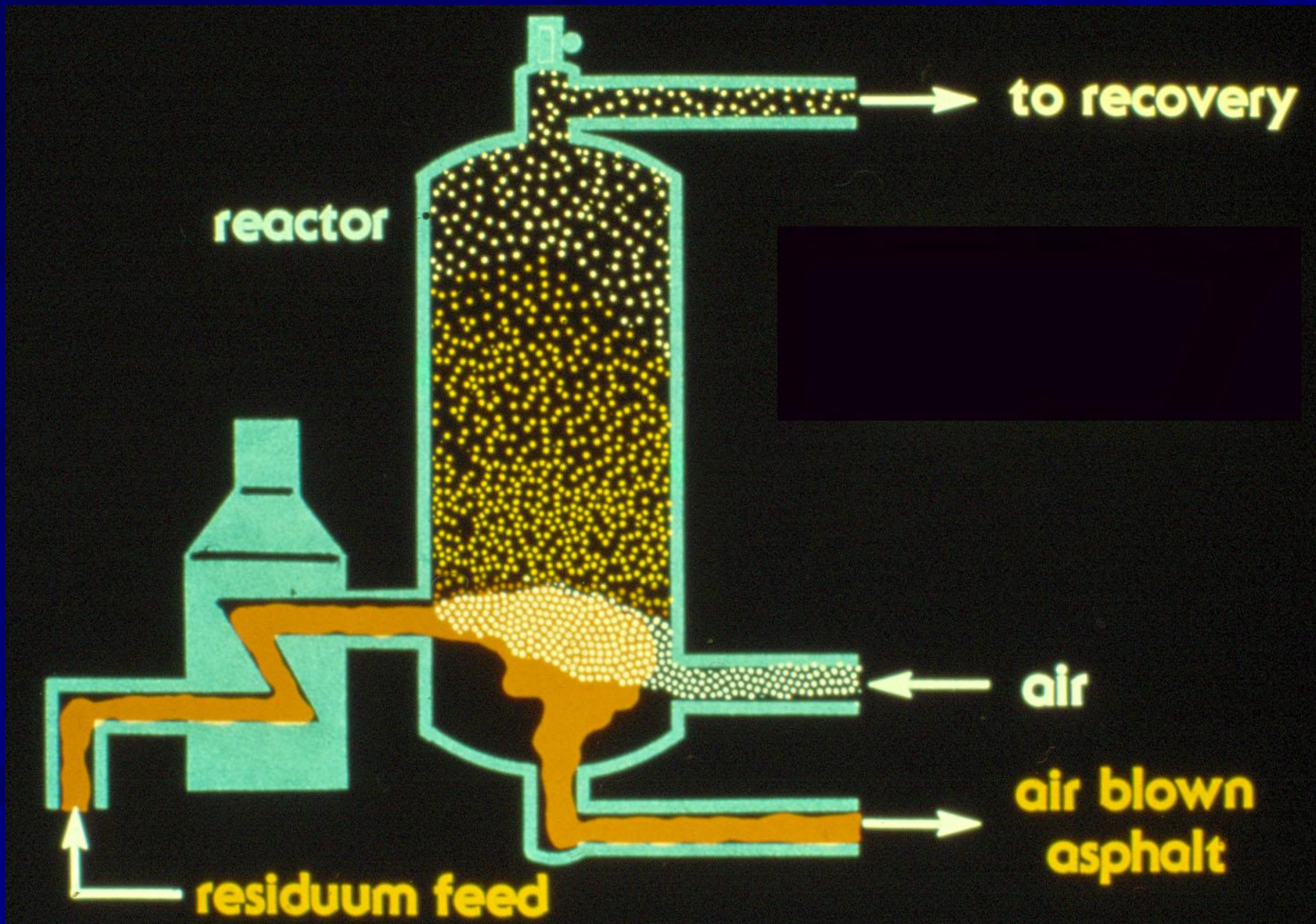
Amine Treating

- Removes acid impurities, mainly hydrogen sulfide and carbon dioxide, from intermediate fractions
- Petroleum stream is contacted with an aqueous amine solution in a tray or packed tower
- Spent amine solution is processed to regenerate the scrubbing solution and producing a concentrated acid-gas stream

Chemical Sweetening

- Sweetens distillates by extraction or conversion of mercaptans
- In conversion process, sour feed is sparged with air and passed over a fixed-bed catalyst wetted by caustic solution
- In extraction process, sour feed is contacted with caustic solution in a packed tower. Spent caustic is regenerated and mecaptans recovered as alkyl disulfides

Asphalt Blowing



Auxiliary Processes

- Sulfur recovery
- Wastewater treatment
- Fuel gas recovery
- Blowdown systems

Sulfur Recovery

- Sulfur compounds in petroleum fractions are converted into hydrogen sulfide by treatment processes
- Hydrogen sulfide is collected and converted to elemental sulfur, usually with a Claus process

Wastewater Treatment

- Specific design of system varies
- Systems generally include:
  - Drain systems
  - Oil-water separators
  - Air flotation units
- Additional treatment may involve secondary and tertiary processes

Fuel Gas Recovery

- Recovers hydrocarbon vapors from various refinery processes
- Collected gases are compressed, condensed and separated into constant vapor pressure mixtures
- Recovered mixtures used as refinery fuel or feedstock or sold

Blowdown Systems

- Provides for safe disposal of liquid and gaseous hydrocarbons from pressure-relief devices
- Blowdown is separated into liquid and vapor fractions and recycled or flared

Emission Control Techniques

- Flares
- Incinerators
- Process heaters
- Covers
- Fugitive emission control

Emission Regulation

Control of Refinery Vacuum Producing Systems, Wastewater Separators and Process Unit Turnarounds, Control Technique Guideline Document, EPA-450/2-77-025

Recommended standard:

- Incinerate, or compress and add to the refinery fuel gas system, non-condensable vapors from the vacuum producing system.
- Cover the forebay and separator sections of wastewater separators.
- Vent all vapors to a flare or vapor recovery system when a process unit is shut down for a turnaround.

Standards of Performance for VOC Emissions from Petroleum Refinery Wastewater Systems, 40CFR60, Subpart QQQ

Applicability Date: May 4, 1987

Standard: Individual Drain Systems

- Each drain shall be equipped with water seal controls.
- Junction boxes shall be equipped with a tightly sealed cover and may have an open vent pipe.
- Sewer lines shall be covered or enclosed.
- Wastewater routed through new process drains and a new first common downstream junction box shall not be routed through a downstream catch basin.
- Modified or reconstructed drain systems that had a catch basin in the existing configuration are exempt from the provisions of this section.
- An alternative standard allows for a completely closed drain system.

Standard: Oil-Water Separators

- Each separator shall be equipped with a fixed roof that completely covers the separator with no separation between the roof and wall. An alternative standard allows for the use of a floating roof.
- Separators treating greater than 250 gallons per minute shall be equipped with a closed vent system and control device with at least 95 percent efficiency. Modified or reconstructed separators handling less than 600 gallons per minute that were equipped with a fixed roof are exempt from this requirement.
- Slop oil and oily wastewater shall be collected, stored, transported, recycled, reused or disposed of in an enclosed system.
- Separator tanks, slop oil tanks, storage vessels and other required auxiliary equipment may be equipped with a pressure control valve set at the maximum pressure for proper system operation, but may not vent continuously.
- Storage vessels subject to 40CFR60, subparts K, Ka or Kb are not subject to this section.

Standard: Closed Vent Systems and Control Devices

- Combustion devices shall be at least 95 percent efficient or have a minimum residence time of 0.75 seconds at 1,500°F.
- Vapor recovery system shall be at least 95 percent efficient.
- Closed vent systems shall operate with no detectable emissions, be equipped with a flow indicator, and direct the vapors to a control device.

National Emission Standards for Hazardous Air Pollutants from Petroleum Refineries, 40CFR63, Subpart CC

Applicability: All process vents, storage vessels, wastewater streams and treatment operations, equipment leaks, gasoline loading racks and marine vessel loading racks that are located at major sources and that handle one or more HAPs listed in the subpart.

Standard: Process Vents (Group 1)

- Reduce emissions using a flare that operates with no visible emissions and meets 40CFR63.11(b); or
- Reduce emissions using a control device by 98 percent by weight or to an outlet concentration of 20 ppmv, whichever is less stringent.

Standard: Storage Vessels (Group 1)

The provisions for Group 1 storage vessels are essentially the same as 40CFR60, Subpart Kb, and are summarized in Chapter 9.

Standard: Wastewater (Group 1)

Comply with the provisions of 40CFR61, Subpart FF, for tanks, surface impoundments, containers, individual drain systems, oil-water separators, treatment processes, and closed vent systems and control devices.

Standard: Equipment Leaks

- Existing sources shall comply with 40 CFR 60, Subpart VV.
- New sources shall comply with 40 CFR 63, Subpart H.

Standard: Gasoline Loading Racks

Comply with 40 CFR 63, Subpart R. The provisions of this standard are summarized in Chapter 9.

Standard: Marine Tank Vessel Loading

Comply with 40CFR63, Subpart Y.

Process Inspection

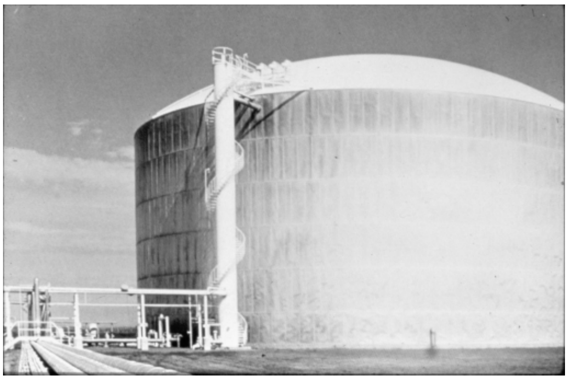
Chapter 9

Petroleum Product Storage and Distribution

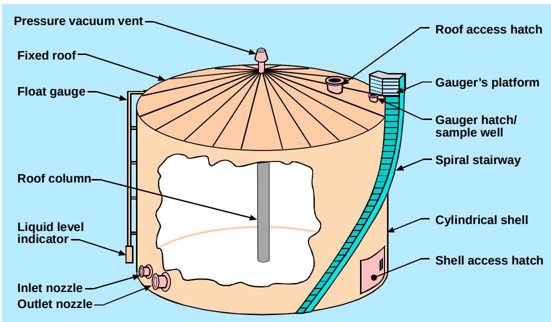
Petroleum Product Storage

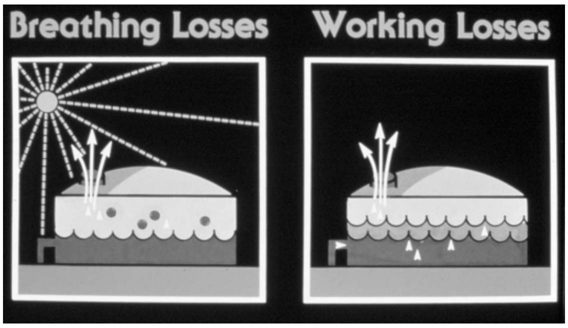
- Fixed roof tanks
- Internal floating roof tanks
- External floating roof tanks

Product	Volatility	VP Range	Tank Type
Crude, lube oils	Low	<1.5 psia	Fixed
Kerosene, gasoline, fuel oils	Moderate	1.5-11.1 psia	Float
Butane, propane	High	>11.1 psia	Pressure

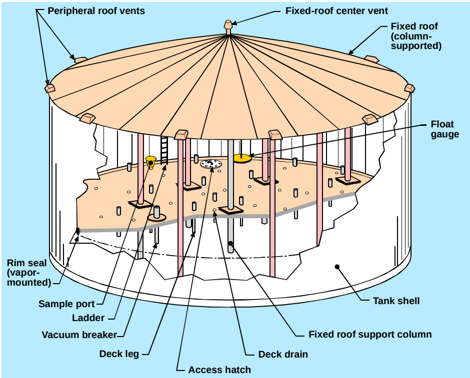


Fixed Roof Tank





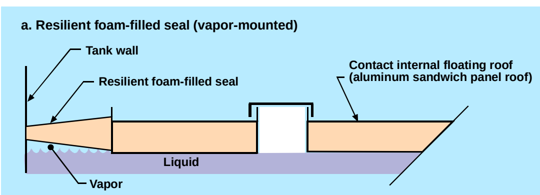
Internal Floating Roof Tank



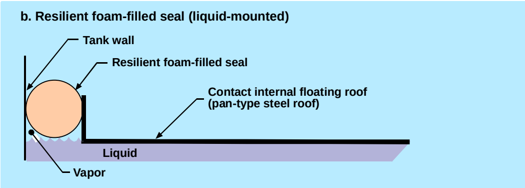
Floating Roof Construction

- Aluminum panel with honeycombed core
- Aluminum deck on aluminum framework
- FRP panel
- Steel pan

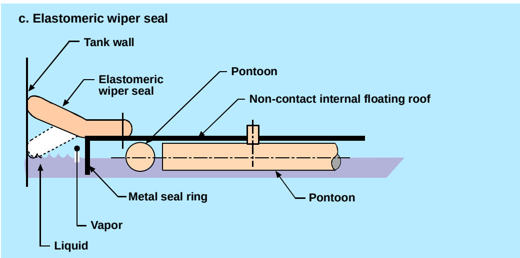
Vapor Mounted Foam Seal



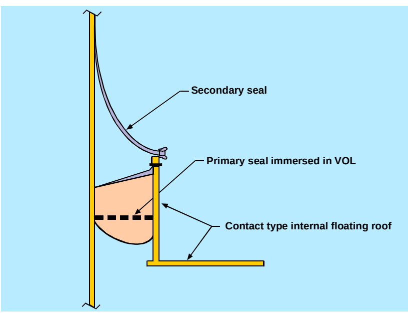
Liquid Mounted Foam Seal



Elastomeric Wiper Seal



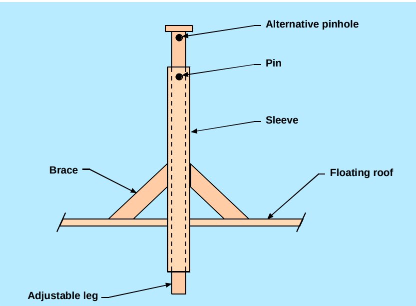
Rim Mounted Secondary Seal



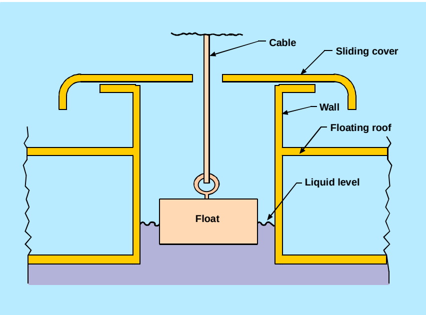
Roof Penetrations

- Column wells
- Roof legs
- Vacuum breakers
- Gauge-float wells
- Sample wells
- Access hatches
- Ladder wells

Roof Leg



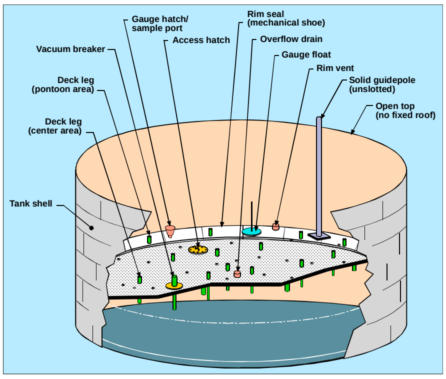
Gauge-Float Well



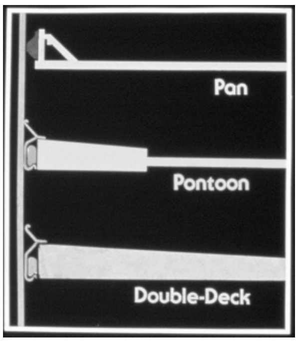
Sources of VOC Losses

- Rim seal
- Roof fittings
- Non-welded deck seams
- Wet tank wall

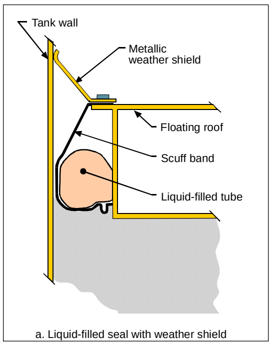
External Floating Roof Tank



Types of External Floating Roofs

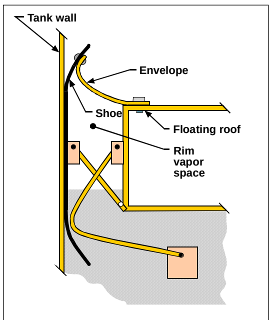


Liquid Filled Seal



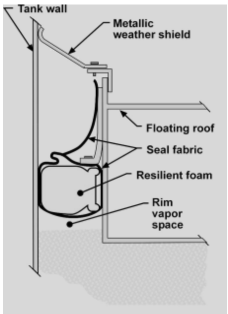
a. Liquid-filled seal with weather shield

Mechanical Shoe Seal



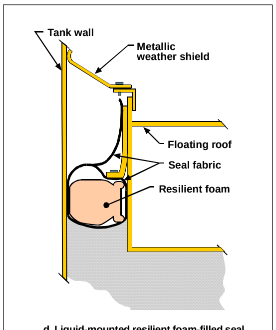
b. Metallic shoe seal

Vapor Mounted Foam Seal



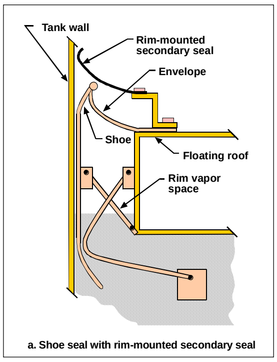
c. Vapor-mounted resilient foam-filled seal with weather shield

Liquid Mounted Foam Seal



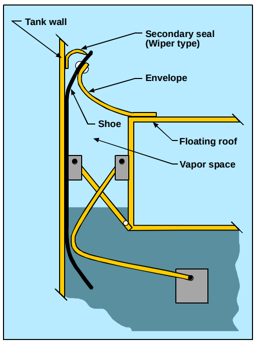
d. Liquid-mounted resilient foam-filled seal
with weather shield

Mechanical Shoe Seal
with Secondary Seal

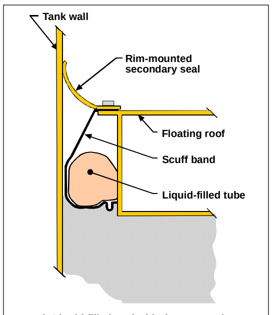


a. Shoe seal with rim-mounted secondary seal

Shoe Mounted Secondary Seal

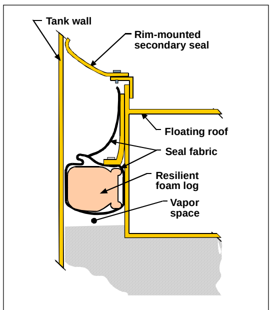


Liquid Filled Seal with Secondary Seal



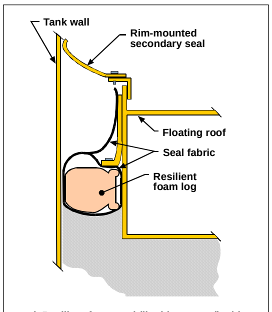
b. Liquid-filled seal with rim-mounted secondary seal

Vapor Mounted Foam Seal with Secondary Seal



c. Resilient foam-filled seal (vapor-mounted) with rim-rounted secondary seal

Liquid Mounted Foam Seal with Secondary Seal

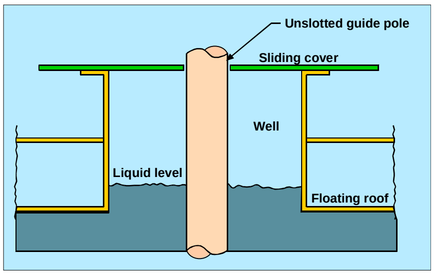


d. Resilient foam seal (liquid-mounted) with rim-rounted secondary seal

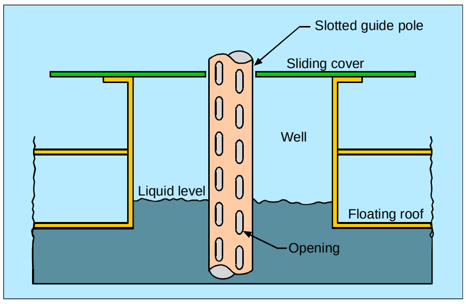
Roof Penetrations

- Guide-pole wells
- Sample wells
- Roof drains
- Rim vents

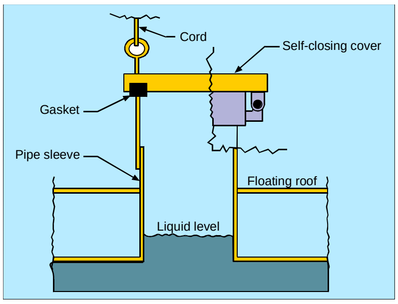
Unslotted Guide Pole Well



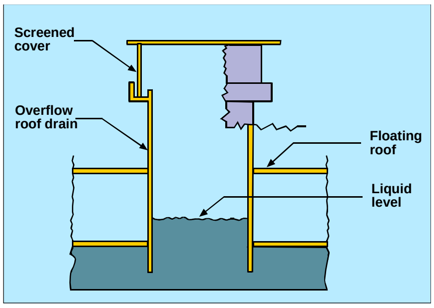
Slotted Guide Pole Well



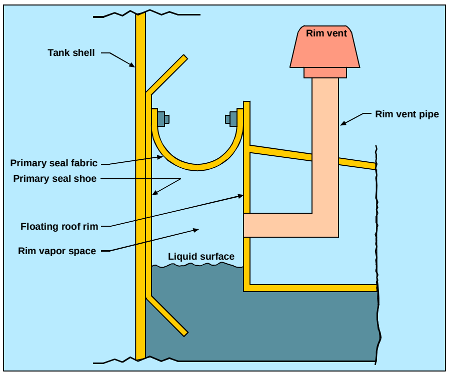
Sample Well



Overflow Drain

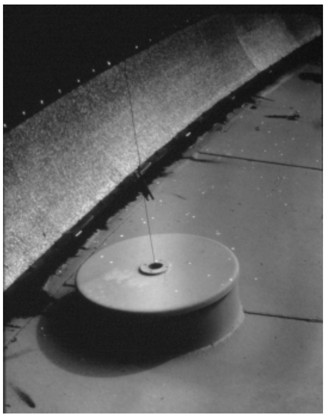


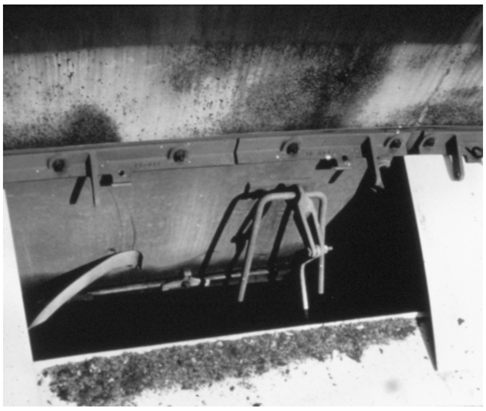
Rim Vent

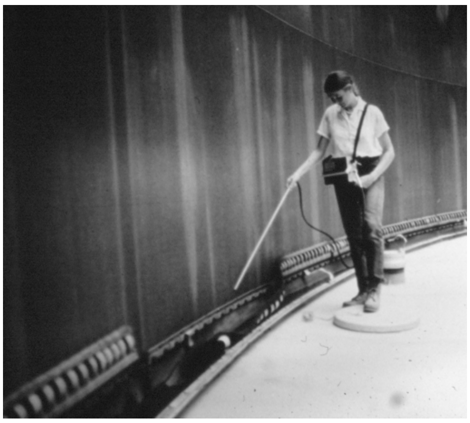


Sources of VOC Losses

- Rim seal
- Roof fittings
- Wet tank wall







Emission Control Techniques

Fixed Roof Tanks

- Internal floating roof
- Vapor recovery system

Basic Internal Floating Roof Design

- Non-contact bolted roof
- Primary vapor mounted wiper seal
- Uncontrolled fittings

Distribution of VOC Losses for Internal Floating Roof Tanks

Rim seal losses	35%
Fitting losses	35%
Deck seam losses	18%
Withdrawal losses	12%

Controlled and Uncontrolled Internal Floating Roof Deck Fittings

Deck Fitting Type	Equipment Description	
	Uncontrolled	Controlled
Access hatch	Unbolted, ungasketed cover; or unbolted gasketed cover	Bolted, gasketed cover
Gauge-float well	Unbolted, ungasketed cover; or unbolted, gasketed cover	Bolted, gasketed cover
Column well	Built-up column with sliding cover, ungasketed	Built-up column with sliding cover, gasketed; or pipe column with flexible fabric sleeve seal

Controlled and Uncontrolled Internal Floating Roof Deck Fittings
(continued)

Deck Fitting Type	Equipment Description	
	Uncontrolled	Controlled
Ladder well	Ungasketed sliding cover	Gasketed sliding cover
Sample well	Slotted pipe with sliding cover, ungasketed; or slotted pipe with sliding cover, gasketed	Sample thief well with slit fabric seal and 10% open area
Vacuum breaker	Weighted mechanical actuation, ungasketed	Weighted mechanical actuation, gasketed

Internal Floating Roof Rim Seal System Control Efficiency

Seal System Description	Efficiency Relative to Baseline
Vapor mounted primary seal only	Baseline
Mechanical shoe or liquid mounted primary seal only	55%
Vapor mounted primary seal with secondary seal	63%
Mechanical shoe or liquid mounted primary seal with secondary seal	76%

Basic External Floating Roof Design

- Welded steel roof
- Mechanical shoe primary seal
- Uncontrolled fittings

Distribution of VOC Losses for External Floating Roof Tanks

Rim seal losses	68%
Fitting losses	28%
Withdrawal losses	4%

Controlled and Uncontrolled External Floating Roof Deck Fittings

Deck Fitting Type	Equipment Description	
	Uncontrolled	Controlled
Access hatch	Unbolted, ungasketed cover; or unbolted gasketed cover	Bolted, gasketed cover
Gauge-float well	Unbolted, ungasketed cover; or unbolted, gasketed cover	Bolted, gasketed cover
Guide-pole well	Unslotted pipe with sliding cover, ungasketed	Unslotted pipe with sliding cover, gasketed

Controlled and Uncontrolled External Floating Roof Deck Fittings

(continued)

Deck Fitting Type	Equipment Description	
	Uncontrolled	Controlled
Sample well	Weighted mechanical actuation, ungasketed	Weighted mechanical actuation, gasketed
Vacuum breaker	Weighted mechanical actuation, ungasketed	Weighted mechanical actuation, gasketed
Roof drain	Open	90% closed
Rim vent	Weighted mechanical actuation, ungasketed	Weighted mechanical actuation, gasketed

External Floating Roof Rim Seal System Control Efficiency

Seal System Description	Efficiency Relative to Baseline
Vapor mounted primary seal only	Baseline
Vapor mounted primary seal with secondary seal	66%
Mechanical shoe primary seal only	84%
Mechanical shoe primary seal with shoe mounted secondary seal	95%
Liquid mounted primary seal only	95%
Mechanical shoe primary seal with rim mounted secondary seal	99%
Liquid mounted primary seal with rim mounted secondary seal	99%

Emission Regulation

Process Inspection

- Review records maintained by source
- Observe condition of tank
- Observe floating roof
- Measure rim seal gap areas

Review Records Maintained by Source

- Design information
  - Type of floating roof
  - Type of rim space seals
  - Type of penetration seals
- Operational information
  - Liquid stored
  - Period of storage
  - Maximum true VP
- Maintenance information

Observe Condition of Tank

- Evidence of corrosion
- Liquid or vapor leaks
- Condition of relief valves

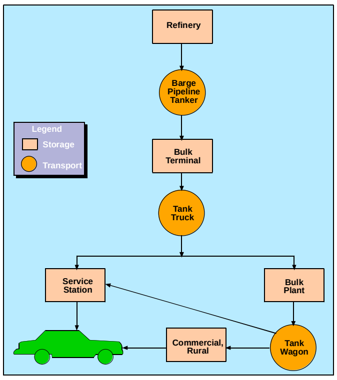
Observe Floating Roof

- SAFETY
- General condition
- Roof floating on liquid
- Liquid accumulation on roof
- Condition of rim space seals
- Roof penetrations

Process Inspection

- Review records maintained by source
- Observe condition of tank
- Observe floating roof
- Measure rim seal gap areas

Gasoline Marketing System



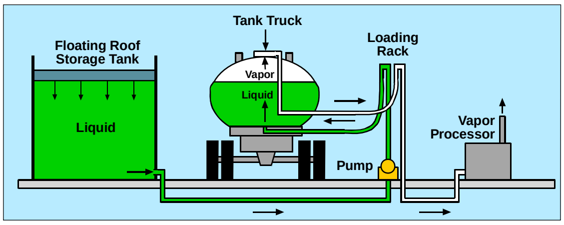
Emission Control Techniques

Collect vapors emitted at end of chain and transport to beginning of chain for recovery or destruction

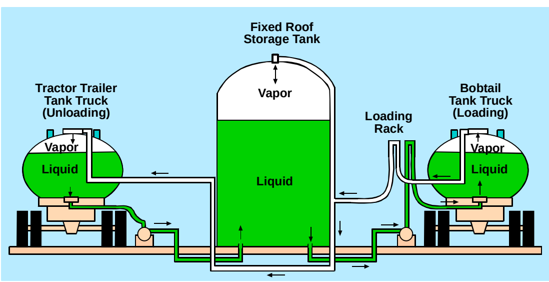
Tank Trucks

- Must be equipped with vapor return piping
- System must be free of significant leaks

Bulk Terminals



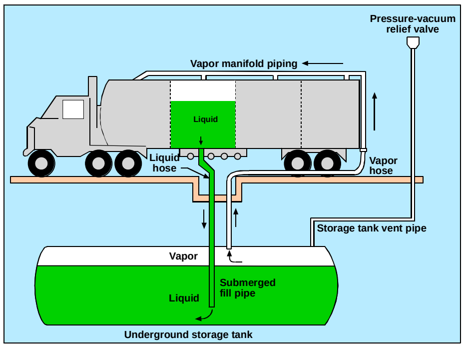
Bulk Plants



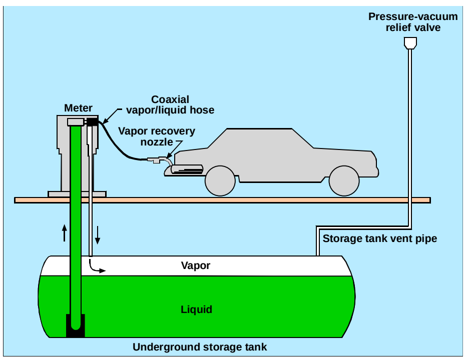
Service Stations

- Stage I controls
- Stage II controls

Stage I Control

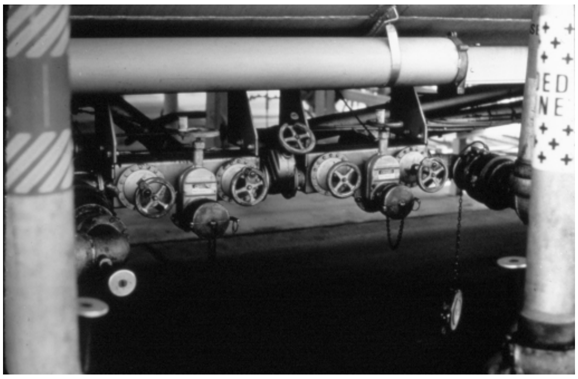


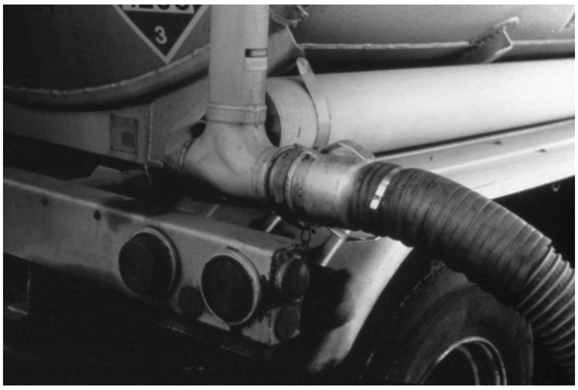
Stage II Control

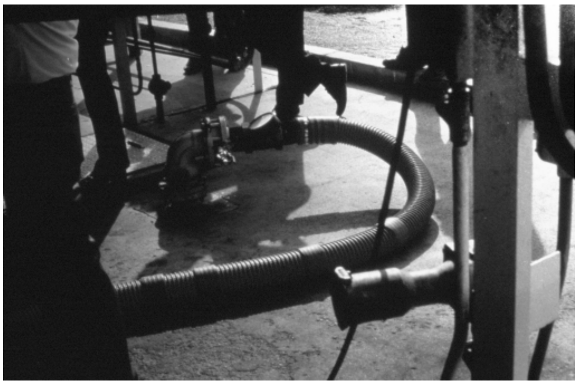


Onboard Stage II Control System

- Displaced vapors sent to onboard carbon adsorber
- Carbon regenerated while vehicle is in operation
- Recovered vapors sent to engine air intake and burned







Emission Regulation

Process Inspection

- Obtain source information
- Check tank truck and storage tank equipment
- Observe operating procedures
- Check for vapor and liquid leaks
- Check vapor recovery system operation

Obtain Source Information

- Determine method of refueling
- Determine daily maximum and annual throughput
- Determine number and location of loading stations and what materials are loaded
- Determine emission control method
- Review maintenance records

Check Tank Truck and Storage Tank Equipment

- Determine if properly equipped for vapor recovery
- Determine if tank truck has valid leak-tightness certification
- Verify submerged fill

Observe Operating Procedures

- Verify that vapor return line is connected
- Verify that other return lines are closed
- Verify that overfill sensor is connected
- Verify that relief valves do not open
- Check for switch loading

Check for Vapor and Liquid Leaks

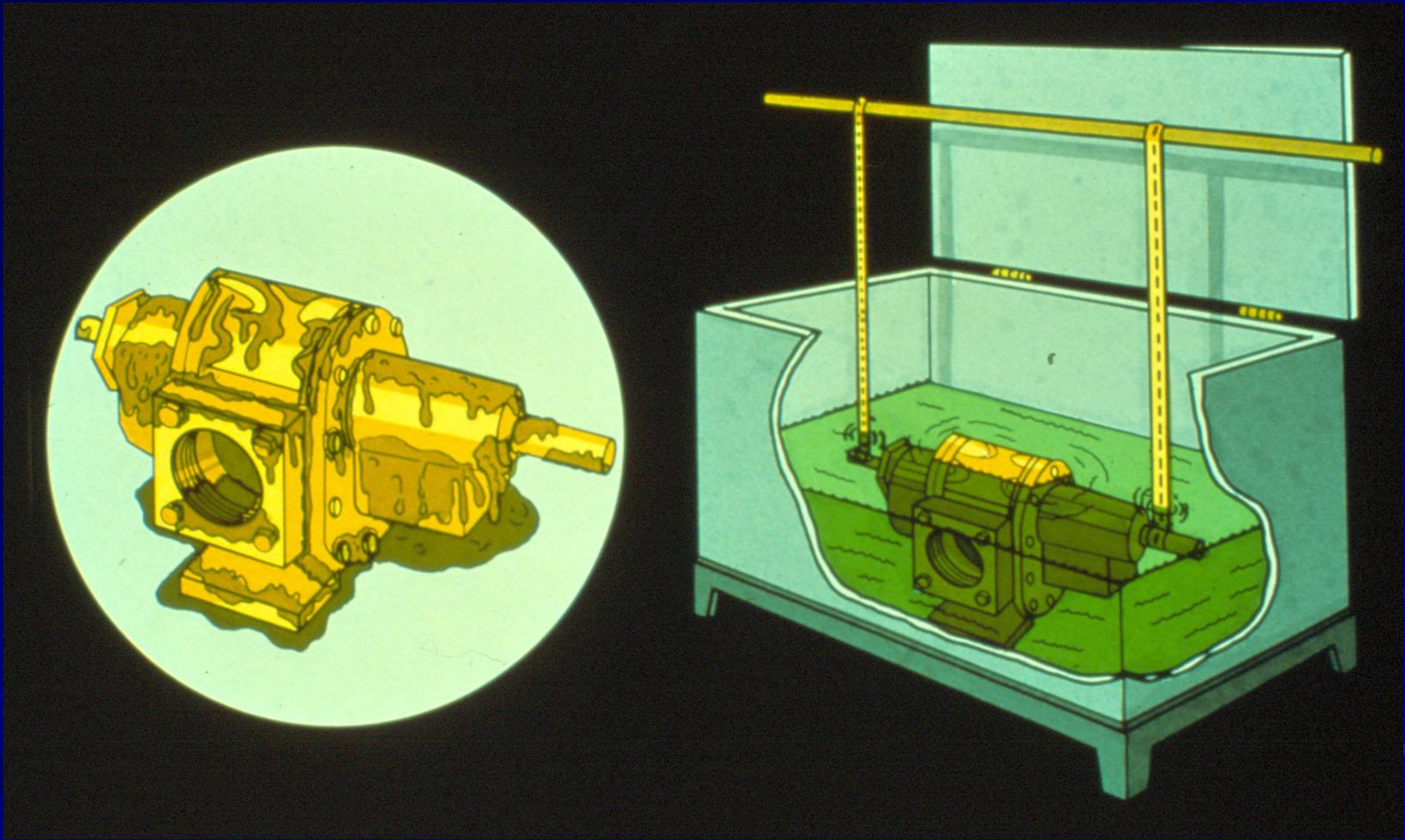
- Check piping, hoses, connectors, covers and relief valves for vapor leaks
- Check piping, hoses, connectors, covers and tank shell for liquid leaks
- Verify no spills or excessive drips when lines are disconnected

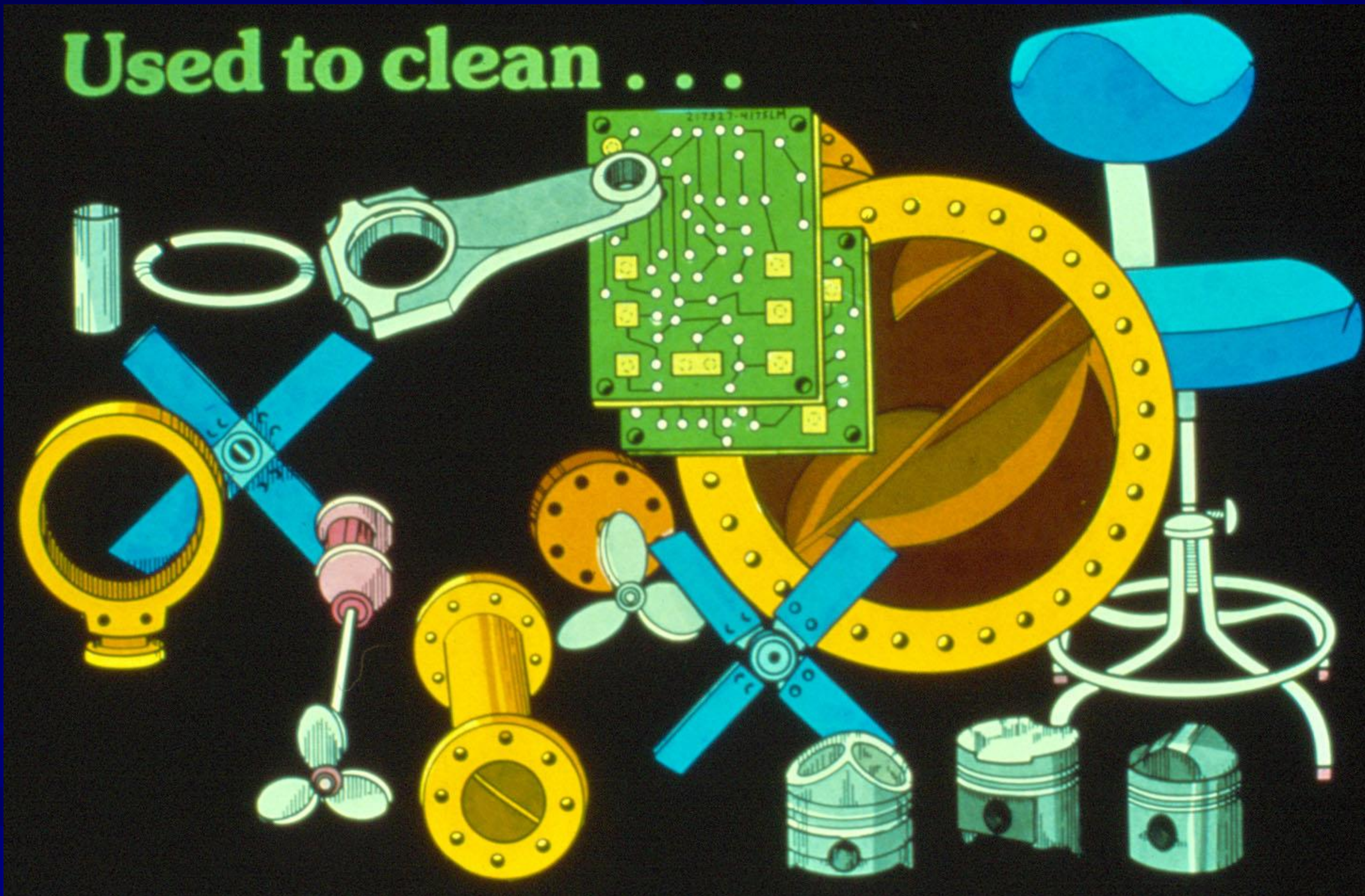
Check Vapor Recovery System Operation

- Verify system is operating during loading or when accumulator is full
- If not operating, verify accumulator is filling
- Verify that pressure relief valves are closed

Chapter 10

Degreasing




Used to clean . . .

Types of Degreasing Equipment

- Cold cleaners
- Open top vapor cleaners
- In-line cleaners

Degreasing Solvents

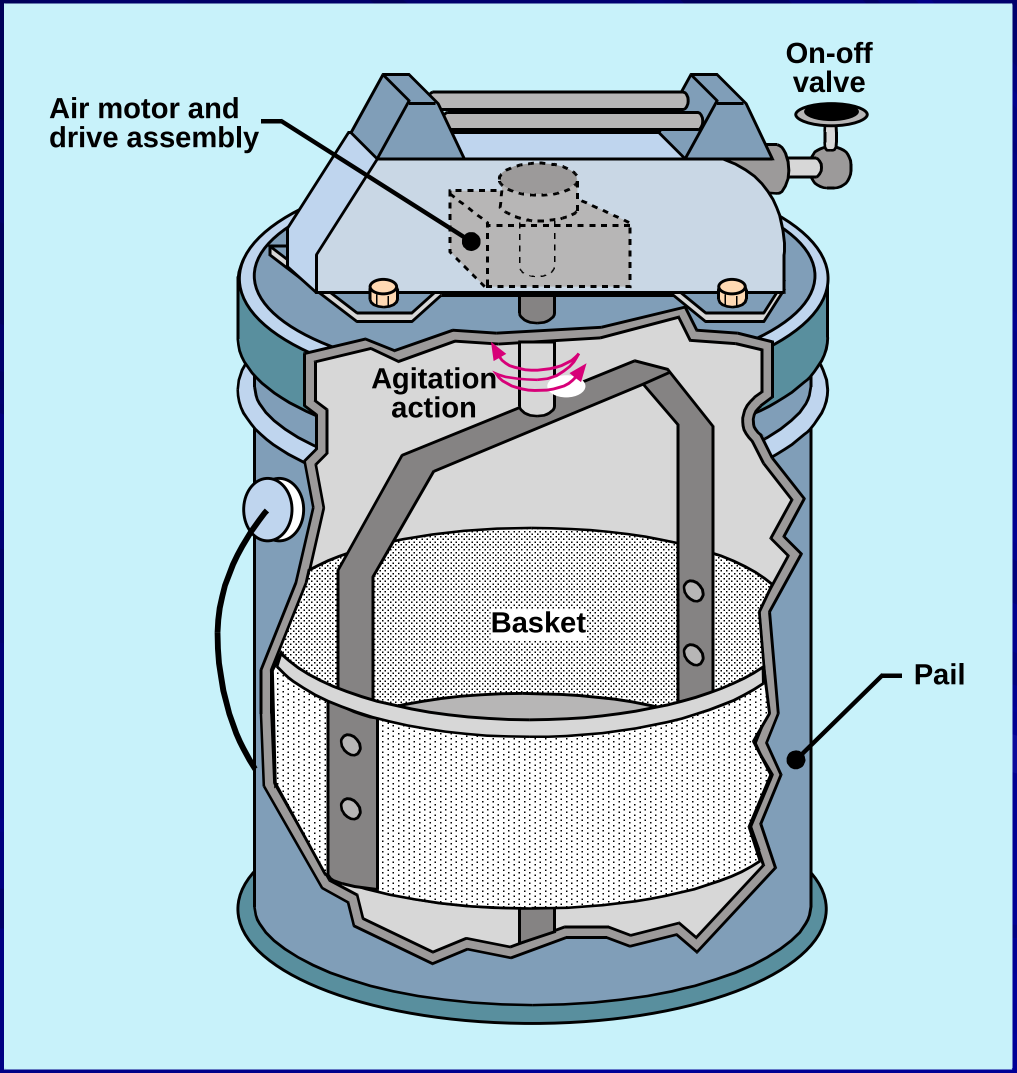
- Mineral spirits
- Stoddard solvents
- Alcohols
- Halogenated solvents

Halogenated Solvents

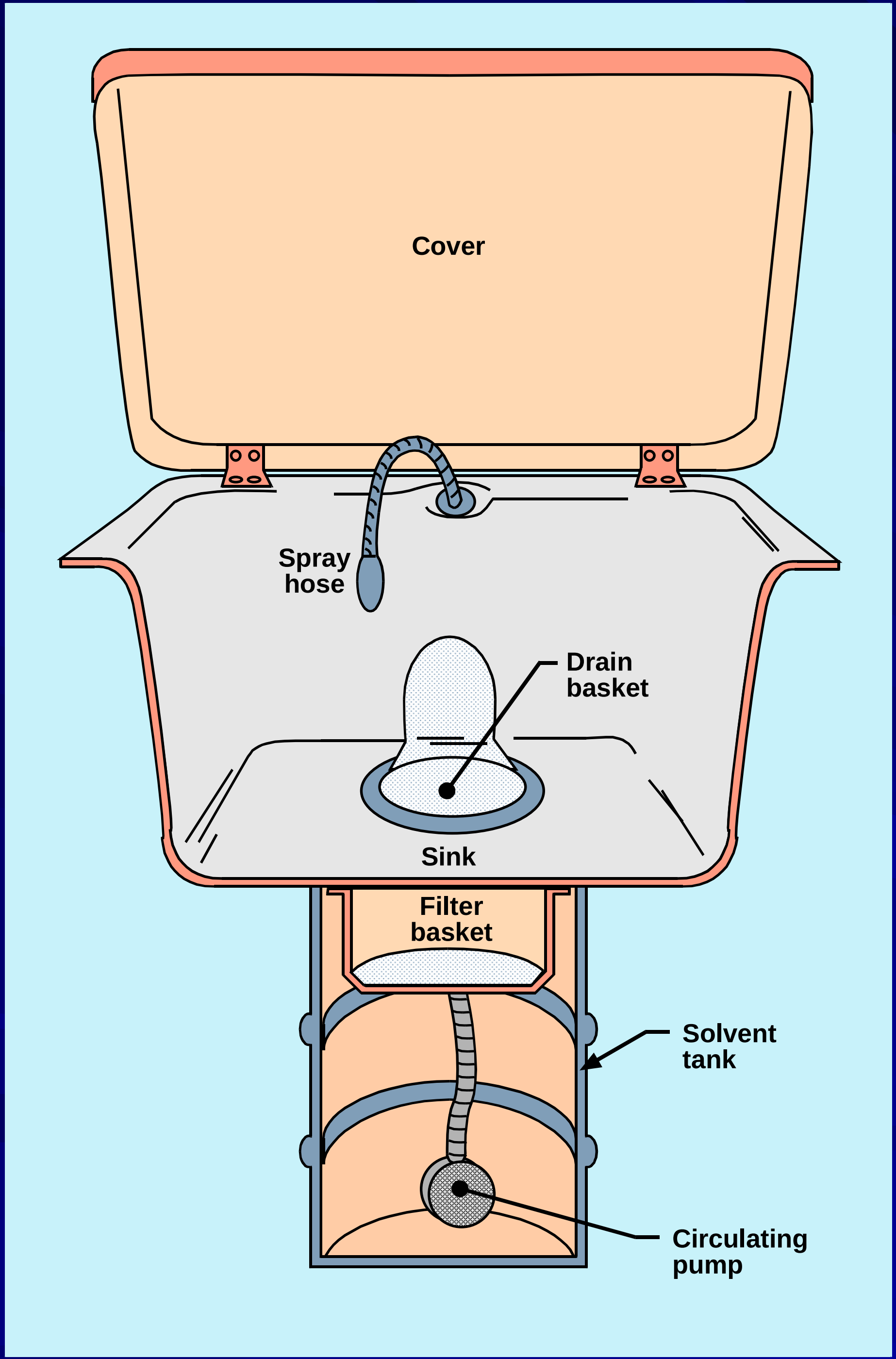
- Methylene chloride
- Perchloroethylene
- Trichloroethylene
- Hydrochlorofluorocarbons

Cold Cleaners

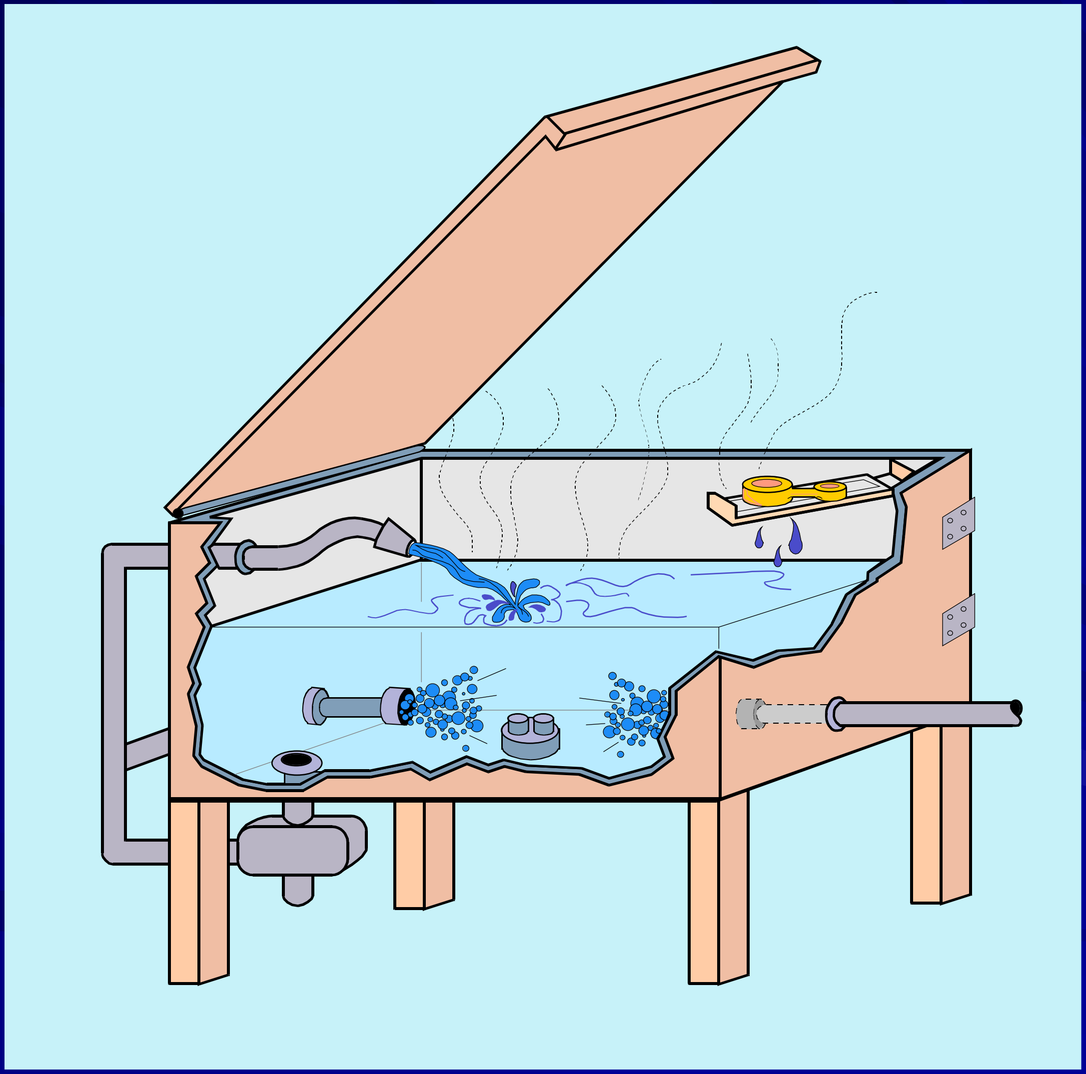
Carburetor Cleaner



Spray Sink


Cover
Spray hose
Drain basket
Sink
Filter basket
Solvent tank
Circulating pump

Dip Tank Cold Cleaner

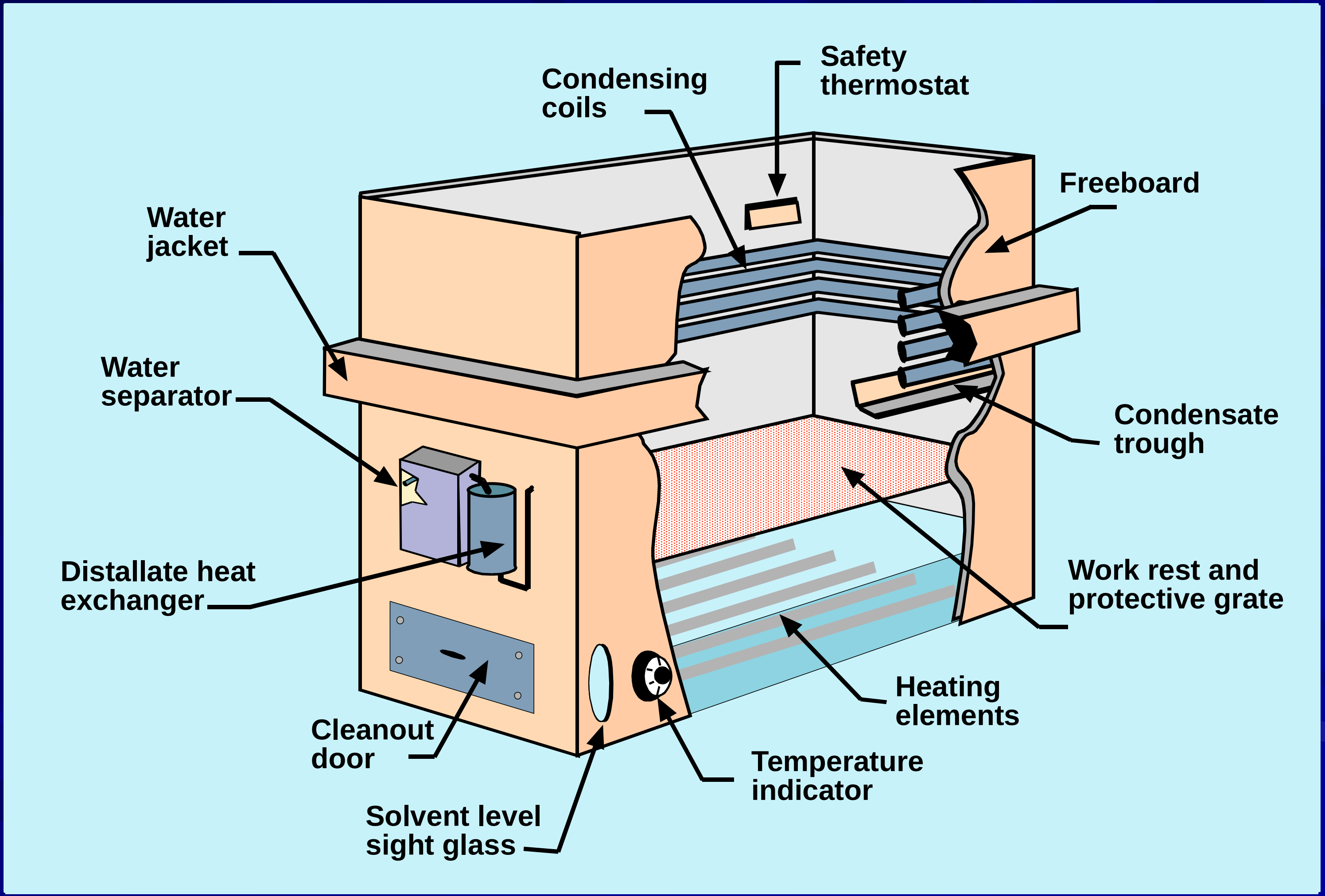


Potential Sources of Emissions

- Waste solvent disposal
- Solvent carryout
- Bath evaporation

Open Top Vapor Cleaners

Open Top Vapor Cleaner

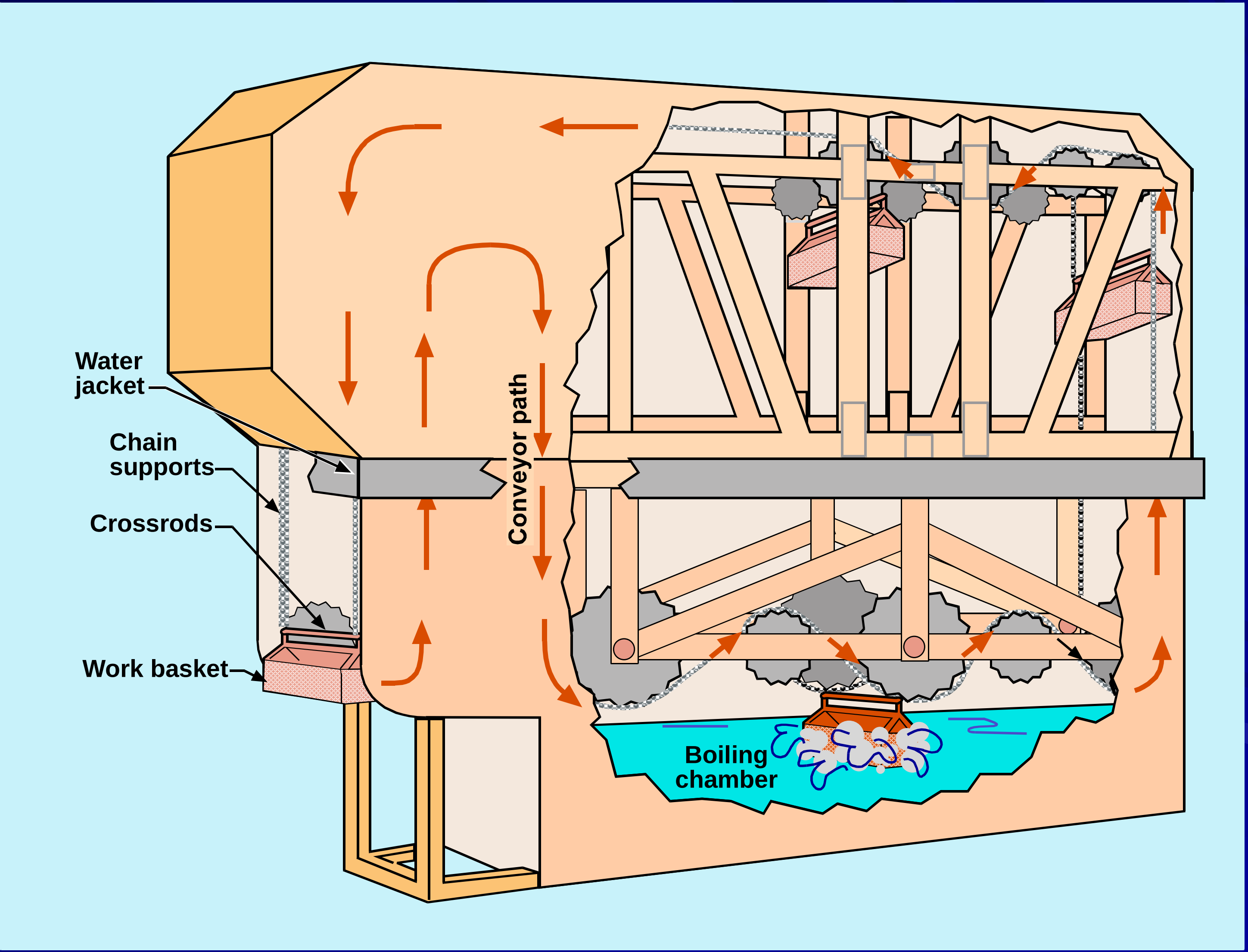


Potential Sources of Emissions

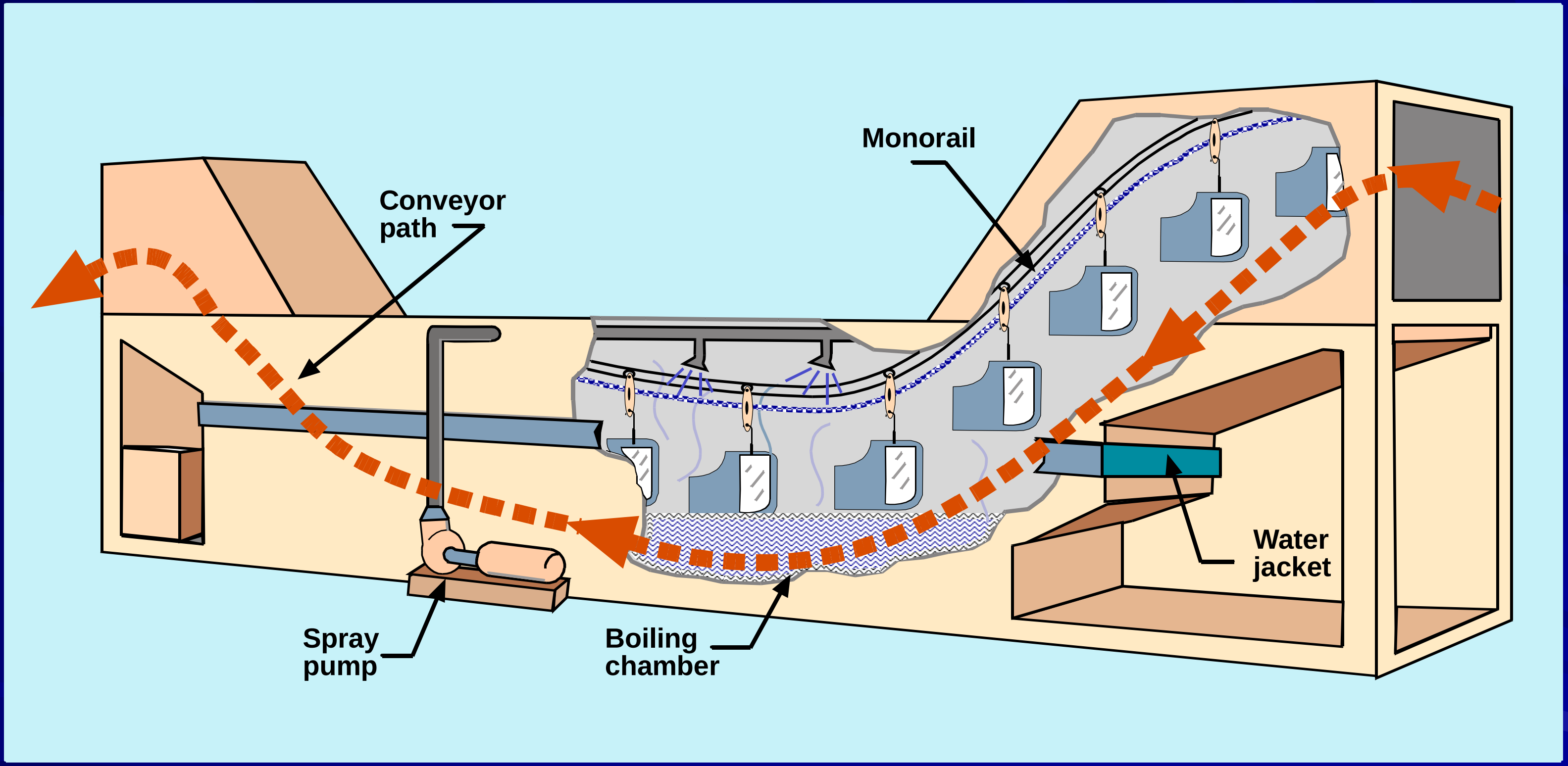
- Waste solvent disposal
- Solvent carryout
- Bath evaporation

In-Line Cleaners

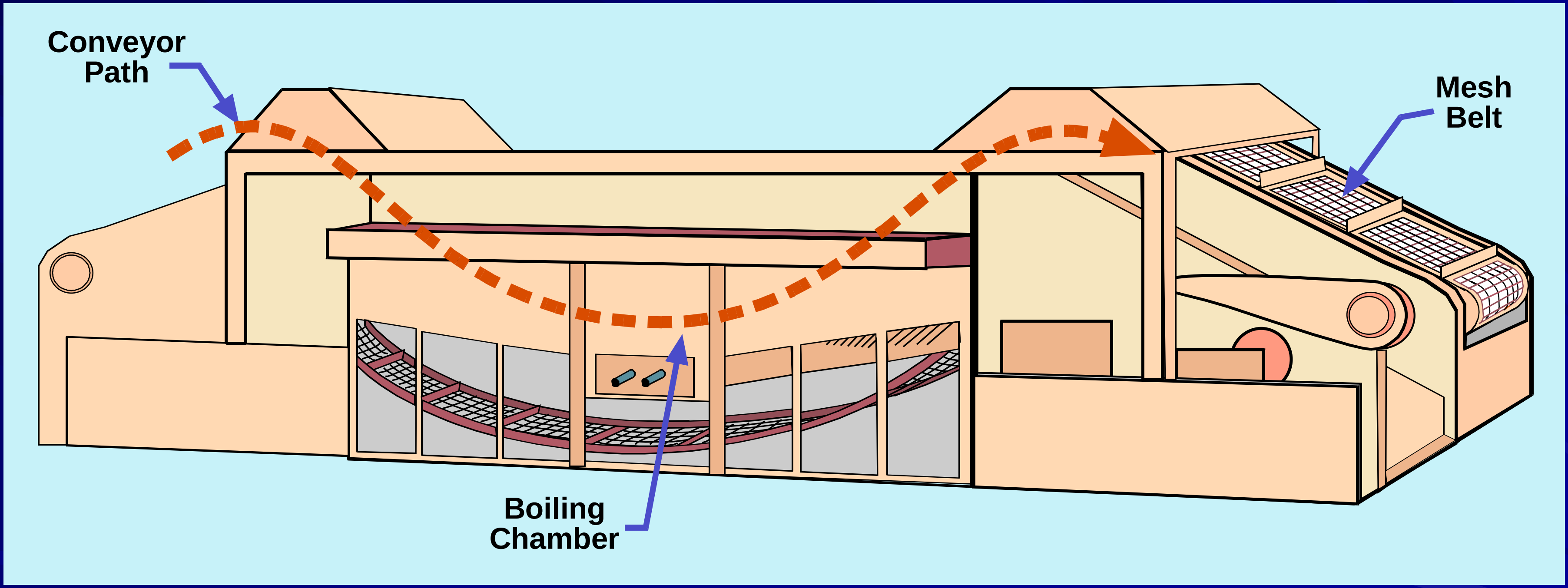
Cross-Rod Cleaner



Monorail Cleaner



Mesh Belt Cleaner



Emission Control Techniques

(Cold Cleaners and Open Top Vapor Cleaners)

- Water cover (cold cleaner only)
- Manual or powered cover
- Refrigerated primary condenser
- Refrigerated freeboard device
- Increased freeboard ratio
- Reduced room draft
- Enclosed designs
- Mechanically assisted parts handling
- Carbon adsorption
- Operation and maintenance

Operation and Maintenance

- Spray within vapor zone.
- Start condenser coolant flow before starting sump heater
- Operate sump cooler during downtime
- Drain parts before removing
- Repair leaks and equipment promptly
- Perform solvent transfer in a closed system
- Utilize control safety switches

Emission Control Techniques
(In-Line Cleaners)

- Minimized entrance and exit openings
- Refrigerated freeboard device
- Drying tunnels
- Rotating baskets
- Carbon adsorbers
- Hot vapor recycle or superheated vapor
- Operation and maintenance

Emission Regulation

Solvent Metal Cleaning, Control Technique Guideline Document, EPA-450/2-77-022

RACT guidelines for degreasers are divided into two levels of control:

- Control System A consists of operating practices and simple, inexpensive control equipment.
- Control System B consists of System A plus additional requirements to improve control effectiveness.

Facilities emitting less than 100 tons per year are expected to apply System A.

Facilities emitting more than 100 tons per year or that are located in urban non-attainment areas greater than 200,000 population are expected to apply System B.

Recommended standard: Cold cleaners

System A:

- Cover
- Facility for draining cleaned parts
- Label summarizing operating requirements
  - Proper disposal of waste solvent
  - Close degreaser when not handling parts
  - Drain cleaned parts for 15 seconds or until dripping stops

System B:

- Cover (operate with one hand if VP >0.3 psi at 100°F or agitated)
- Facility for draining cleaned parts (must be internal if VP >0.6 psi at 100°F
- Solid spray at pressure minimizing splashing
- Major control device (if VP >0.6 psi at 100°F or solvent is >120°F
  - Freeboard ratio greater than 0.7
  - Water cover
  - Other equivalent control

Recommended standard: **Open top vapor cleaners**

System A:

- Cover, closed except when processing
- Minimize solvent carryout
    - Rack parts for drainage
    - Move parts in and out at less than 11 ft/min
    - Degrease for 30 seconds or until condensation stops
    - Tip out pools of solvent
    - Dry parts within degreaser for 15 seconds or until visually dry
- No porous or absorbent materials
- Work load not over half of open top area
- Vapor level drop should be less than 4 inches when parts enter
- Never spray above vapor level
- Repair leaks immediately
- Dispose of waste solvent properly
- Exhaust ventilation less than 65 cfm/ft^2
- No water in solvent exiting separator

Recommended standard: **Open top vapor cleaners (continued)**

System B:

- Powered cover if degreaser opening is greater than 10 ft^2
- Safety switches
    - Condenser flow switch and thermostat
    - Spray safety switch
- Major control device
    - Freeboard ratio greater than 0.75
    - Refrigerated chiller
    - Enclosed design
    - Carbon adsorption system or equivalent, with ventilation less than 50 cfm/ft^2 and exhausting less than 25 ppm
- Label summarizing operating procedures

Recommended standard: **In-line cleaners**

System A:

- Exhaust ventilation less than 65 cfm/ft^2
- Minimize solvent carryout
    - Rack parts for drainage
    - Move parts in and out at less than 11 ft/min
- Dispose of waste solvent properly
- Repair leaks immediately
- No water in solvent exiting separator

Recommended standard: **In-line cleaner (continued)**

System B:

- Major control device
  - Refrigerated chiller
  - Carbon adsorption system or equivalent, with ventilation less than 50 cfm/ft^2 and exhausting less than 25 ppm
- Drying tunnel or other means to prevent solvent carryout
- Safety switches
  - Condenser flow switch and thermostat
  - Spray safety switch
  - Vapor level control thermostat
- Minimize entrance and exit openings
- Down-time covers

Open top vapor degreasers with area <10.76 ft^2 and in-line cleaners with area <21.53 ft^2 should be exempted from major control device requirement. Facilities in rural non-attainment areas emitting <100 tons per year should also be exempt.

National Emission Standards for Halogenated Solvent Cleaning, 40 CFR 63, Subpart T

Applicability: Batch vapor, in-line vapor, in-line cold and batch cold cleaning machines that contain methylene chloride, perchloroethylene, trichloroethylene, 1,1,1-trichloroethane, carbon tetrachloride or chloroform or any combination thereof in a total concentration greater than 5 percent by weight.

Standard: **Batch cold cleaning machines**

- Employ tight fitting cover and water layer at least 1 inch thick; or employ tight fitting cover and freeboard ratio of 0.75 or greater.
- Collect and store waste solvent in closed containers.
- Spray only within the freeboard area.
- Drain parts for 15 seconds or until dripping stops.
- Solvent level shall not exceed the fill line.
- Use agitation that produces a rolling action with no observable splashing.
- Do not expose machine to drafts greater than 132 fpm when the cover is open.
- Wipe up spills immediately.

Standard: **Batch vapor and in-line cleaning machines**

- Employ idling and downtime mode cover or reduced room draft (50 fpm).
- Have a freeboard ratio of 0.75 or greater.
- Use automated system to move parts at 11 fpm or less.
- Shut off sump heat if solvent level drops to heater coils.
- Shut off sump heat if vapor level rises above primary condenser.
- Employ a primary condenser.
- Spray within the vapor zone.
- Parts shall not occupy more than half of cross-sectional area unless they are introduced at 3 fpm or less.
- Orient parts so that solvent drains freely.
- Employ one of the following control combinations or demonstrate idling emissions <0.045 pounds per hour per square foot for a batch vapor machine or <0.020 pounds per hour per square foot for an in-line machine.

Control Combinations for Batch Vapor Machines Less Than 13 ft^2 in Area

OPTION	CONTROL COMBINATION
1	Cover, freeboard ratio of 1.0, superheated vapor
2	Freeboard refrigeration device, superheated vapor
3	Cover, freeboard refrigeration device
4	Reduced room draft, freeboard ratio of 1.0, superheated vapor
5	Freeboard refrigeration device, reduced room draft

Control Combinations for Batch Vapor Machines Less Than 13 ft^2 in Area

(continued)

OPTION	CONTROL COMBINATION
6	Freeboard refrigeration device, freeboard ratio of 1.0
7	Freeboard refrigeration device, dwell
8	Reduced room draft, dwell, freeboard ratio of 1.0
9	Freeboard refrigeration device, carbon adsorber
10	Freeboard ratio of 1.0, superheated vapor, carbon adsorber

Control Combinations for Batch Vapor Machines Greater Than 13 ft^2 in Area

OPTION	CONTROL COMBINATION
1	Freeboard refrigeration device, freeboard ratio of 1.0, superheated vapor
2	Freeboard refrigeration device, dwell, reduced room draft
3	Cover, freeboard refrigeration device, superheated vapor
4	Freeboard ratio of 1.0, reduced room draft, superheated vapor

Control Combinations for Batch Vapor Machines Greater Than 13 ft^2 in Area

(continued)

OPTION	CONTROL COMBINATION
5	Freeboard refrigeration device, reduced room draft, superheated vapor
6	Freeboard refrigeration device, freeboard ratio of 1.0, reduced room draft
7	Freeboard refrigeration device,carbon adsorber, superheated vapor

Control Combinations for Existing In-Line Machines

OPTION	CONTROL COMBINATION
1	Superheated vapor, freeboard ratio of 1.0
2	Freeboard refrigeration device, freeboard ratio of 1.0
3	Freeboard refrigeration device, dwell
4	Dwell, carbon adsorber

Control Combinations for New In-Line Machines

OPTION	CONTROL COMBINATION
1	Superheated vapor, freeboard refrigeration device
2	Freeboard refrigeration device, carbon adsorber
3	Superheated vapor, carbon adsorber

Process Inspection

- Review records maintained by source
- Check equipment operation
- Observe operating procedures
- Observe work area
- Check for liquid leaks
- Review waste solvent disposal procedures

Review Records Maintained by Source

- Design information
- Operational information
- Maintenance information

Review Records Maintained by Source

- Design information
  - Degreaser dimensions
  - Solvent type
  - Cover design
  - Type of drainage facility
  - Types of safety switches
  - Hoist or conveyor speed
  - Ventilation rate
  - Add-on control equipment

Review Records Maintained by Source

- Operational information
  - Solvent use
  - Operating frequency
  - Quantity and types of parts cleaned
  - Use of covers

Review Records Maintained by Source

- Design information
- Operational information
- Maintenance information

Check Equipment Operation

- Required equipment
- Condition and integrity of equipment
- Solvent temperature
- Coolant temperature and flow rate
- Hoist or conveyor speed
- Ventilation rates

Observe Operating Procedures

Observe Work Area

Check for Liquid Leaks

Review Waste Solvent Disposal Procedures

Chapter 11

Dry Cleaning

What is Dry Cleaning?

A process for cleaning fabrics in which the articles are washed in a non-aqueous solvent and then dried in a heated air stream

Dry Cleaning Steps

- Washing
- Extraction
- Drying

Dry Cleaning Solvents

- Perchloroethylene
- Petroleum solvents

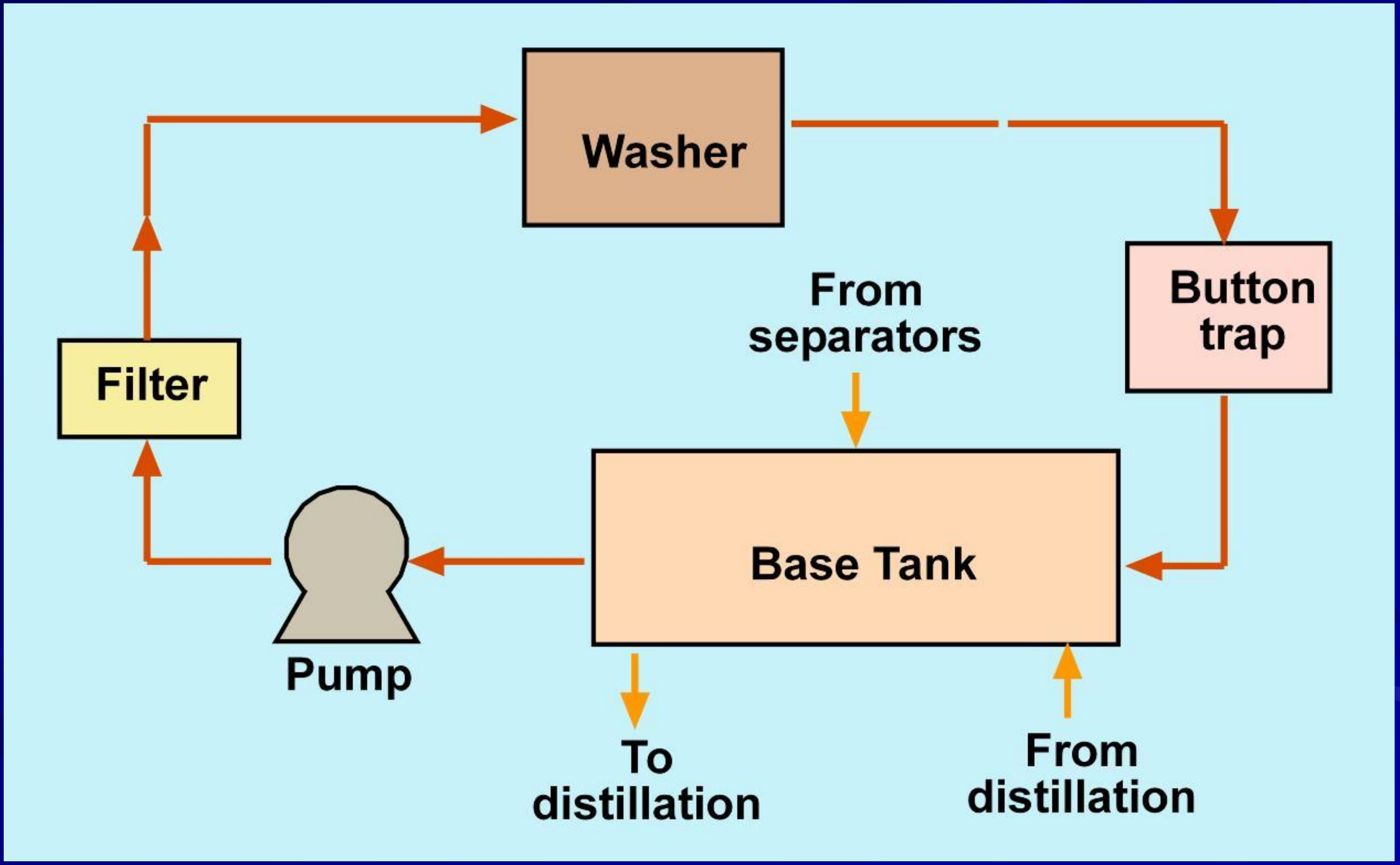
Industry Classes

- Commercial
- Industrial
- Coin operated

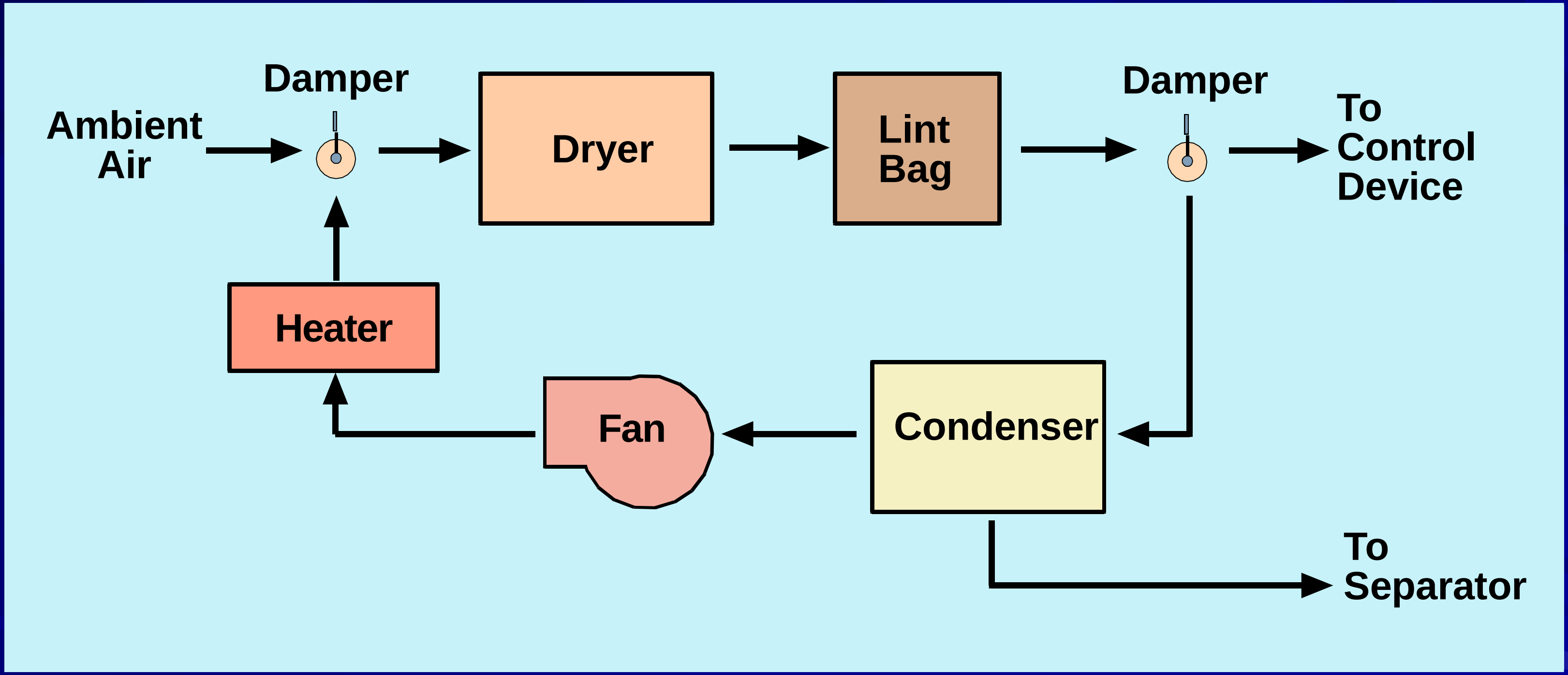
Equipment Types

- Transfer
- Dry-to-Dry

Washing Process



Drying Process



Solvent Filtering

- Powder filters
- Cartridge filters

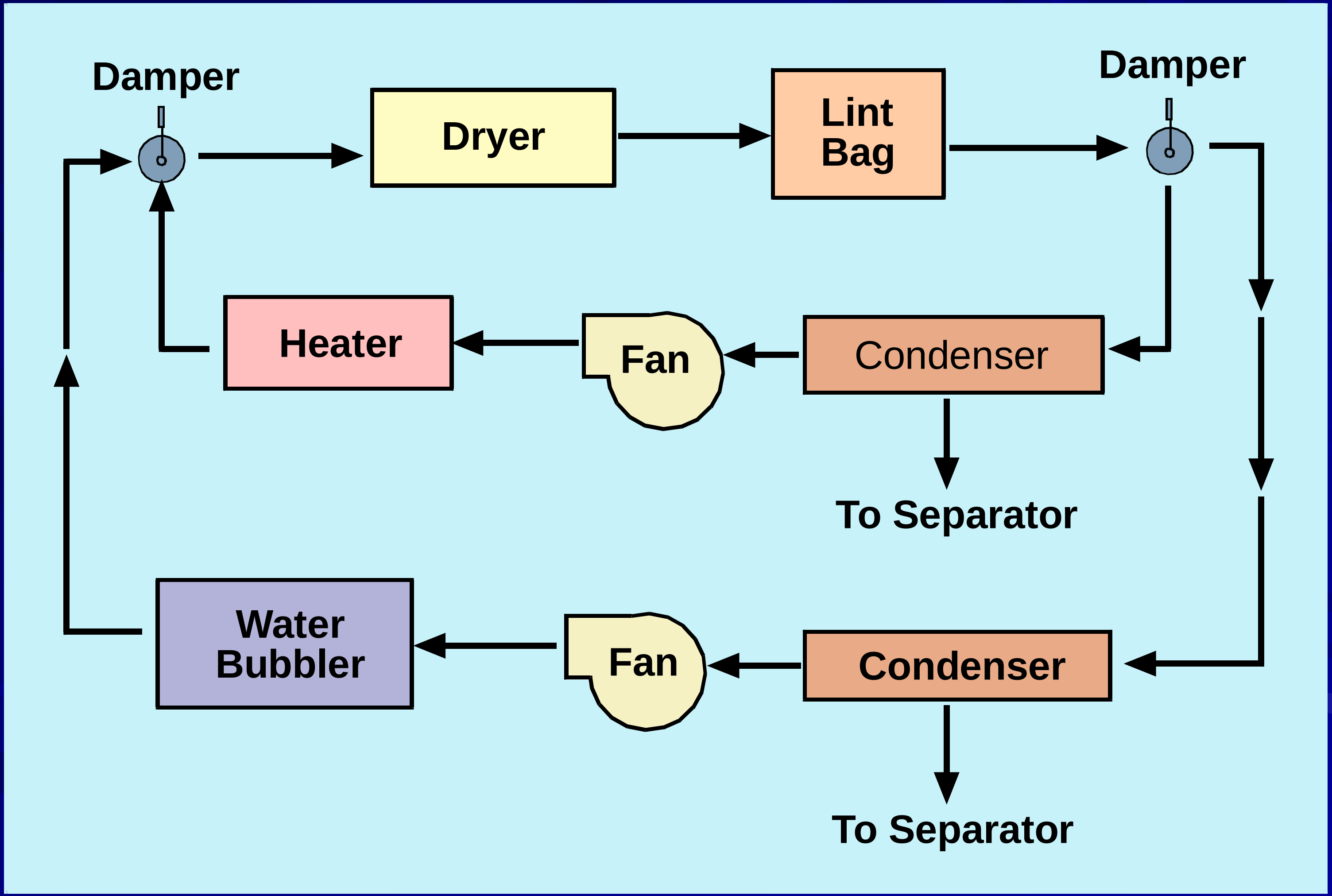
Solvent Distillation

- Perchloroethylene: 250°F at 1 atm
- Petroleum: 225-235°F at -22 to -27 in. Hg
- Still boil down

Emission Control Techniques

- Fugitive emission control
- Carbon adsorption
- Condensation
- Azeotropic vapor recovery

Azeotropic Drying Process



Emission Regulation

Perchloroethylene Dry Cleaning Systems Control Technique Guideline Document, EPA-450/2-78-047

Recommended standard:

- Vent dryer exhaust through a carbon adsorber or equivalent device with an outlet concentration $\leq$100 ppmv (Coin operated dry cleaners are exempt.).
- Reduce filter residue to $\leq$25% perchloroethylene and still residue to $\leq$60% perchloroethylene.
- Drain filter cartridges for $\geq$24 hours or until dry before disposal.
- Immediately repair liquid and vapor leaks.

Large Petroleum Dry Cleaners Control Technique Guideline Document, EPA-450-3-82-009

Recommended standard:

- Use a solvent recovery dryer to reduce emissions by 81%.
- Use a cartridge filter.
- Improve operation of distillation unit.
- Repair liquid and vapor leaks within 3 working days.

Standards of Performance for Petroleum Dry Cleaners, 40CFR60, Subpart JJJ

Applicability Date: December 14, 1982
Applicability Size: $\geq$84 pound capacity

Standard:

- Use a solvent recovery dryer.
- Use a cartridge filter. Drain in sealed housing for at least 8 hours prior to removal.
- Inspect every 15 days and repair all vapor and liquid leaks within the subsequent 15 day period.

National Perchloroethylene Air Emission Standards for Dry Cleaning Facilities, 40 CFR 63, Subpart M

Applicability: Each dry cleaning facility that uses perchloroethylene, except coin-operated machines. An existing transfer plant installed before December 9, 1991, or a new plant installed between December 9, 1991, and September 22, 1993, is exempt from all but recordkeeping and maintenance requirements if it uses less than 200 gallons of perchloroethylene per year. An existing dry-to-dry plant, or a new plant installed between December 9, 1991, and September 22, 1993, is similarly exempted if it uses less than 140 gallons of perchloroethylene per year.

Standard: **Existing systems**

- Route gas stream within dry cleaning machine through a refrigerated condenser or equivalent control device or through a carbon adsorber installed prior to September 22, 1993.
- Contain transfer machines located at a major source in a room enclosure under negative pressure.

Standard: **New systems**

- Route gas stream within dry cleaning machine through a refrigerated condenser or equivalent control device.
- Eliminate emissions during transfer of articles between washer and dryer.
- If at a major source, route gas stream within dry cleaning machine through a carbon adsorber or equivalent device before or as the door is opened.

Standard: **Refrigerated condensers on dry-to-dry, dryer or reclaimer**

- Shall not release gas stream within machine while machine drum is rotating.
- Shall have an outlet temperature less than 45°F.
- Shall have a diverter valve that prevents air drawn in when the door is open from passing through the refrigerated condenser.

Standard: **Refrigerated condensers on a washer**

- Shall not vent gas stream within machine until door opens.
- Shall have a temperature drop of at least 20°F.
- Shall not use the same condenser coil that is used by a dry-to-dry machine, dryer or reclaimer.

Standard: **Carbon adsorber**

- Shall not be bypassed.
- If used on an existing machine or on a new machine immediately upon door opening, outlet concentration at the end of the last cycle before regeneration must be equal to or less than 100 ppmv.
- If used on a new machine prior to door opening, the concentration inside the drum at the end of the cycle must be equal to or less than 300 ppmv.

Standard: **Room enclosure**

- Shall vent all air through a carbon adsorber or equivalent control device.
- Carbon adsorber can not be the same one used for the dry cleaning machine.

Standard: **Additional requirements**

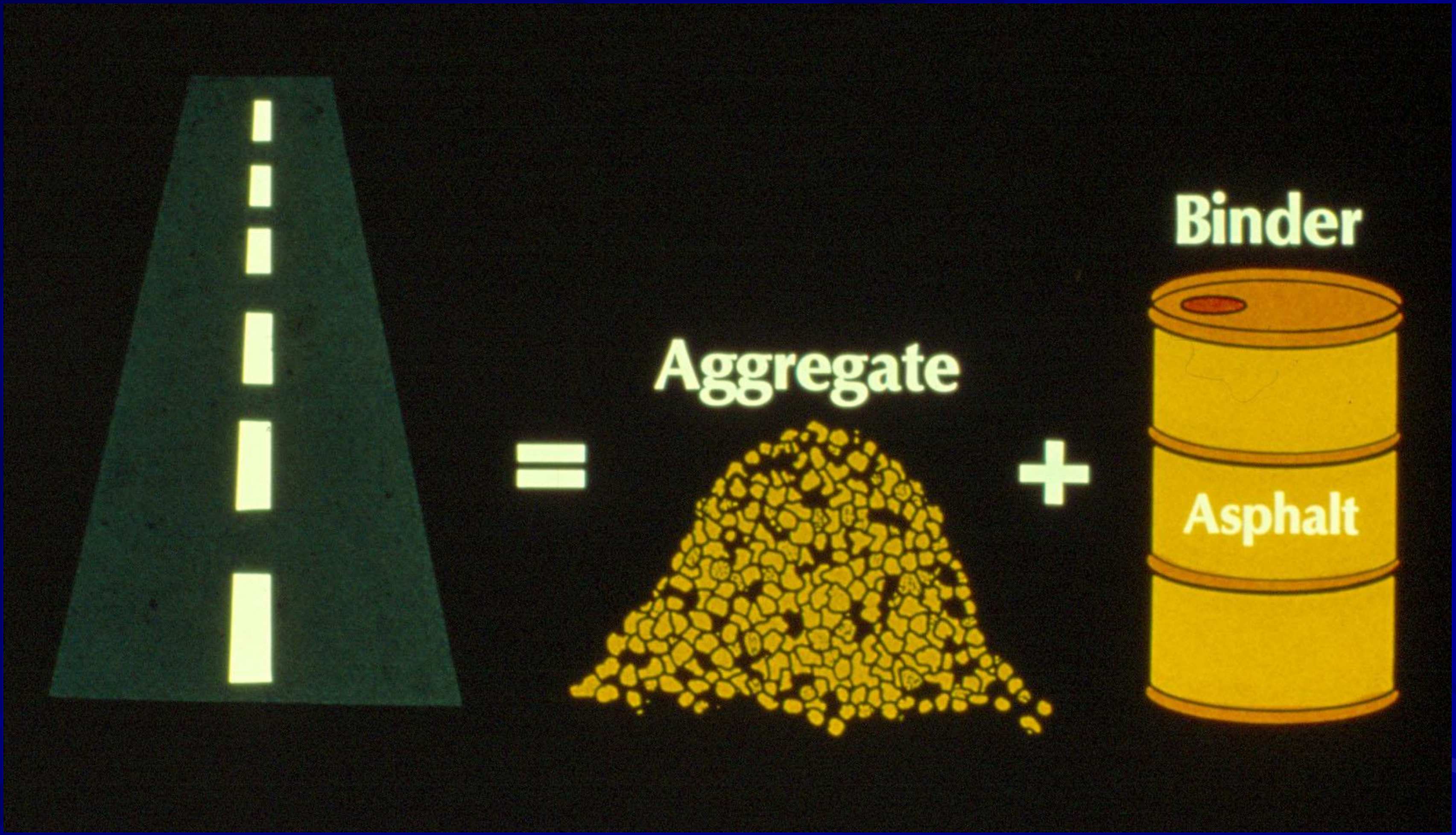
- Use a cartridge filter. Drain in sealed housing for at least 24 hours prior to removal.
- Inspect system weekly and repair leaks within 24 hours.

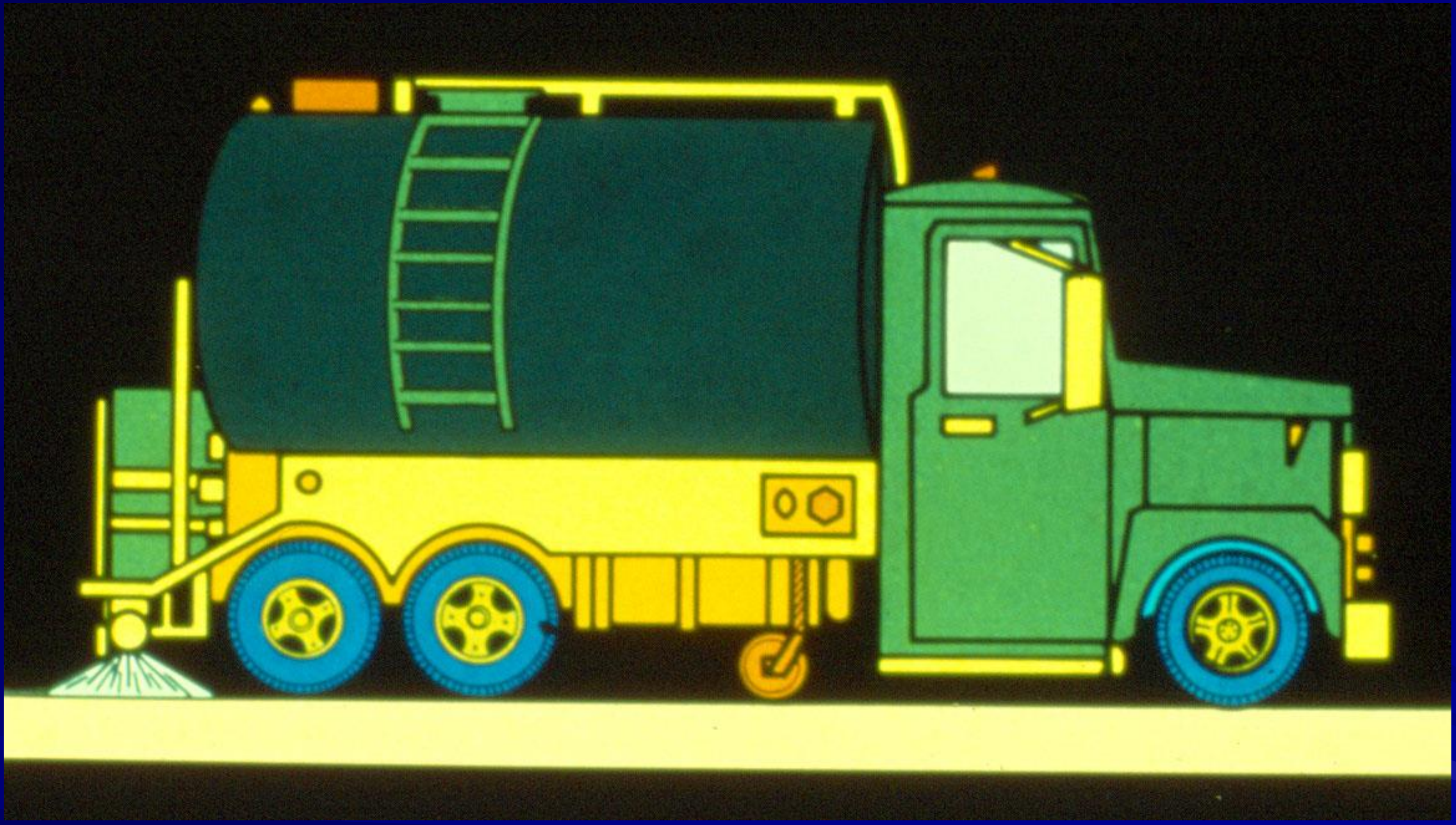
Process Inspection

- Review records maintained by source
  - Solvent purchases
  - Internal inspection audits
  - Monitoring checks
  - Maintenance records
- Check for vapor leaks
- Check for liquid leaks

Chapter 12

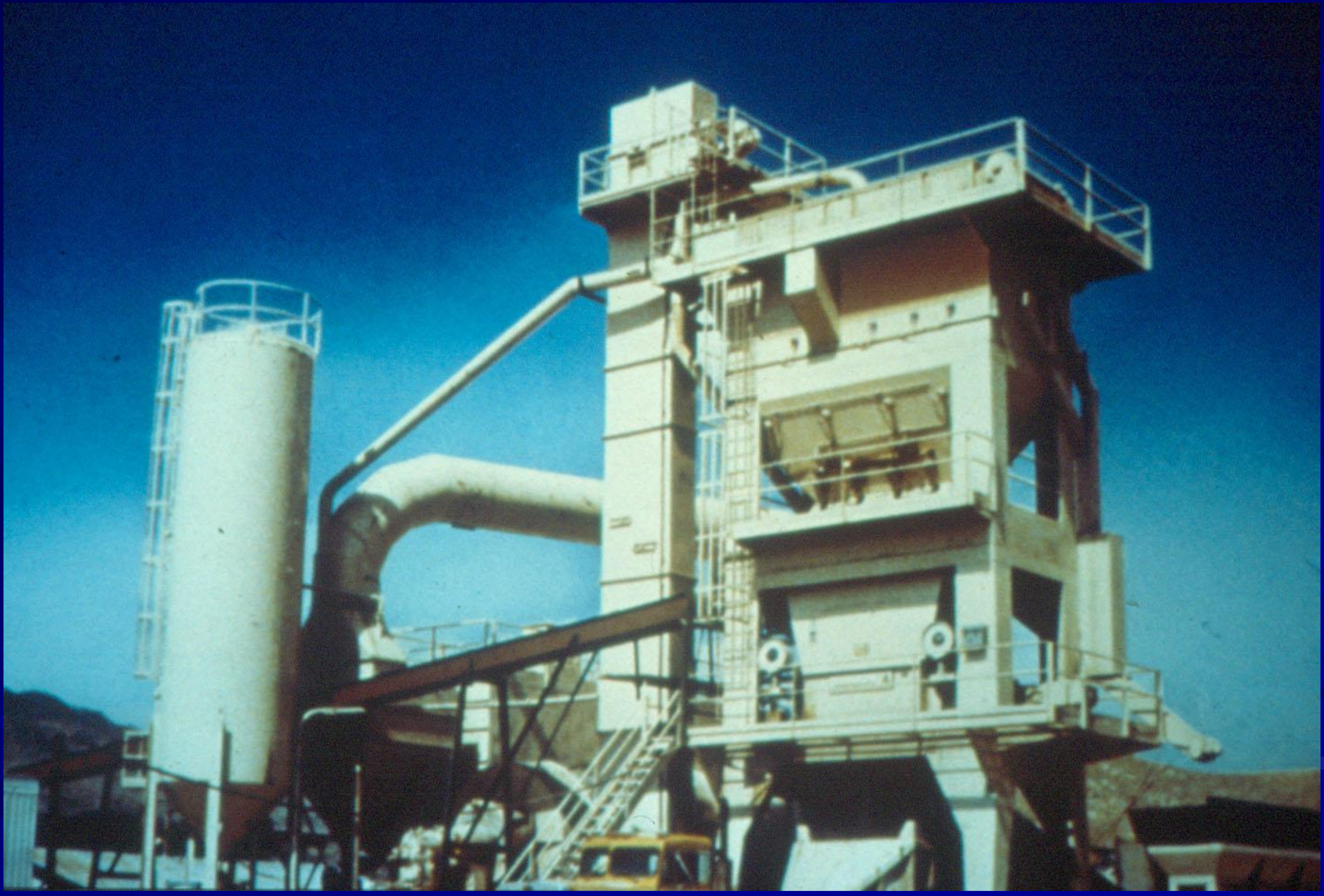
Liquid Asphalt

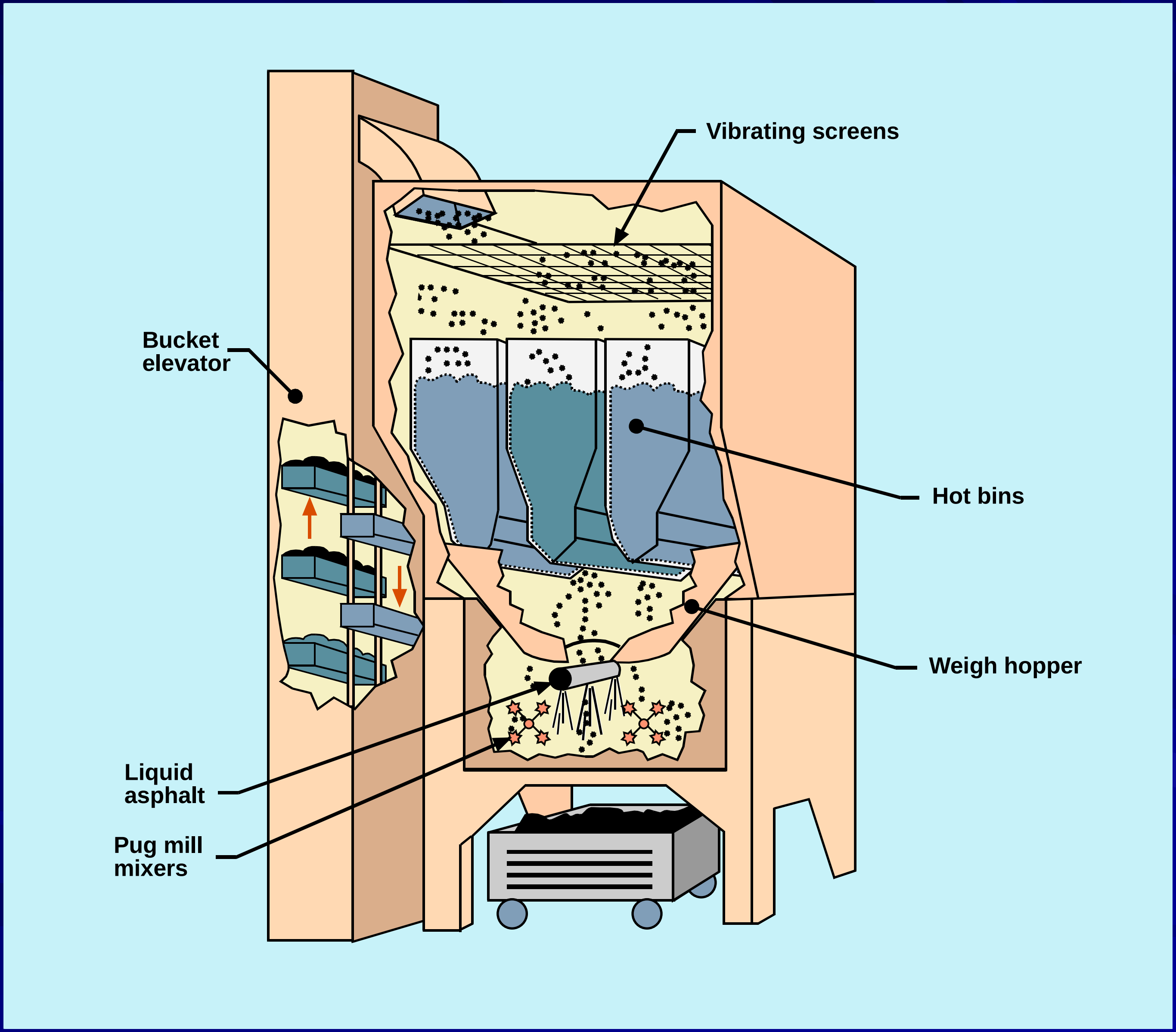

Binder
Aggregate
Asphalt



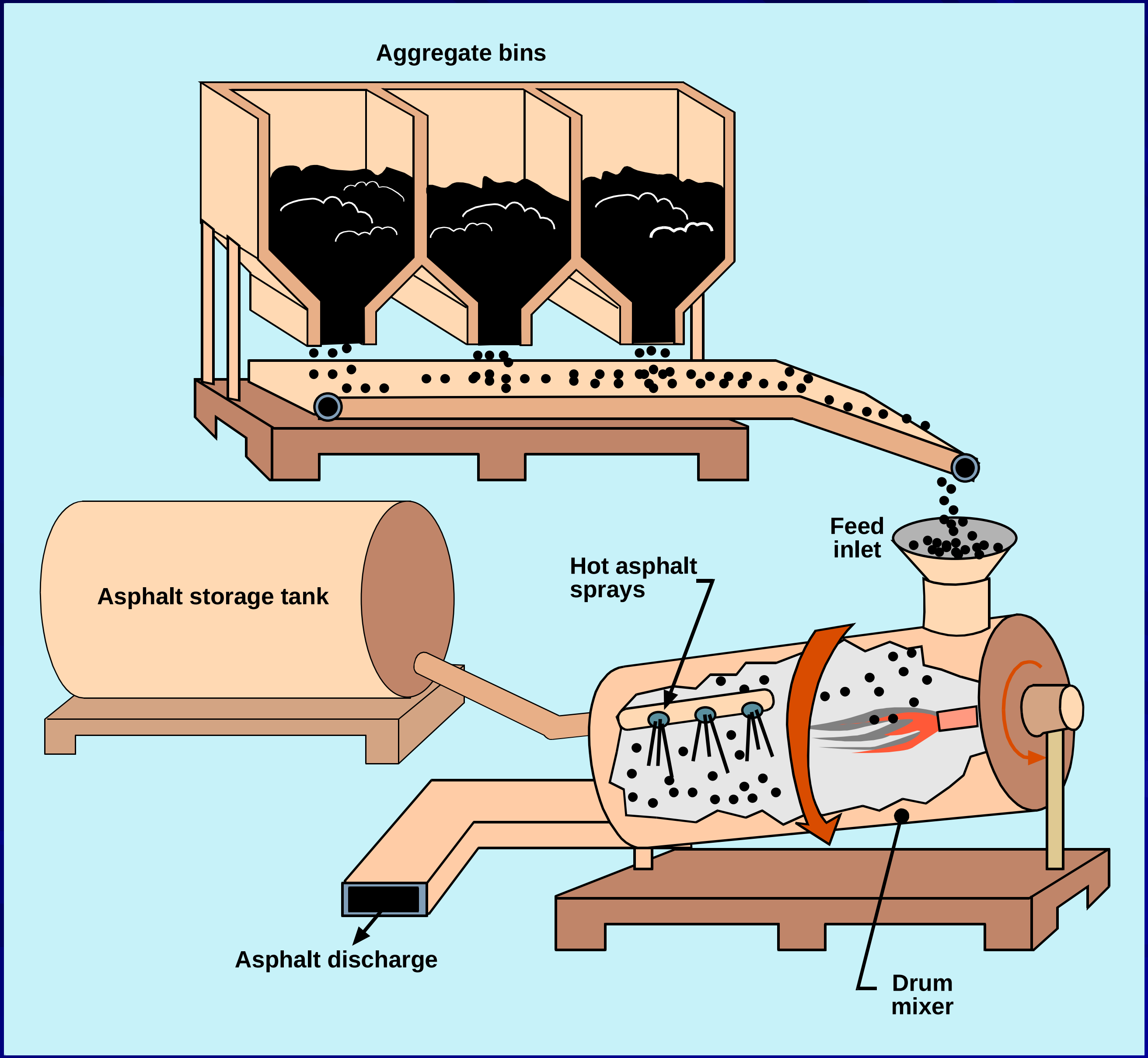
Liquefaction Methods

- Heating
- Blending with petroleum solvents
- Emulsifying with water



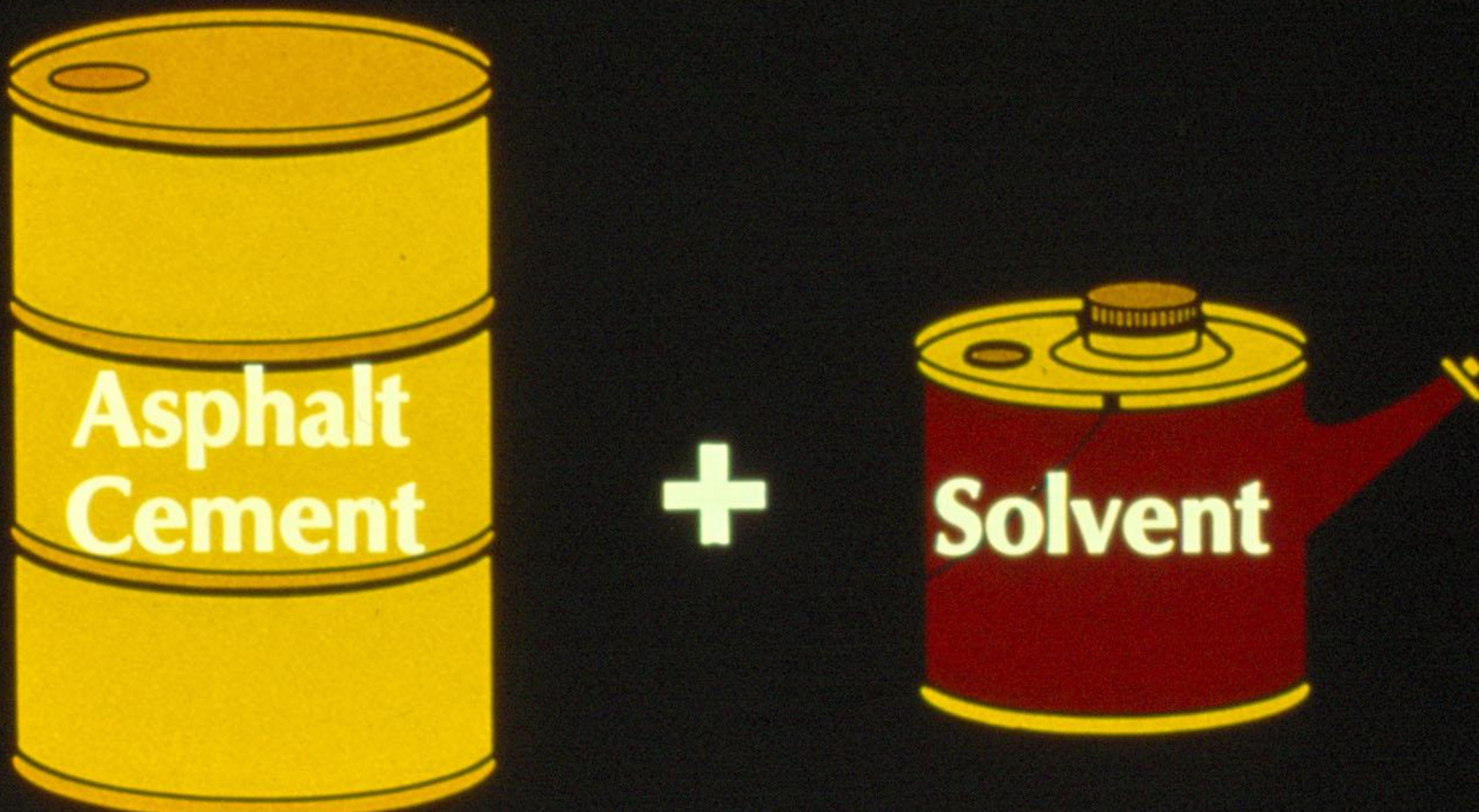


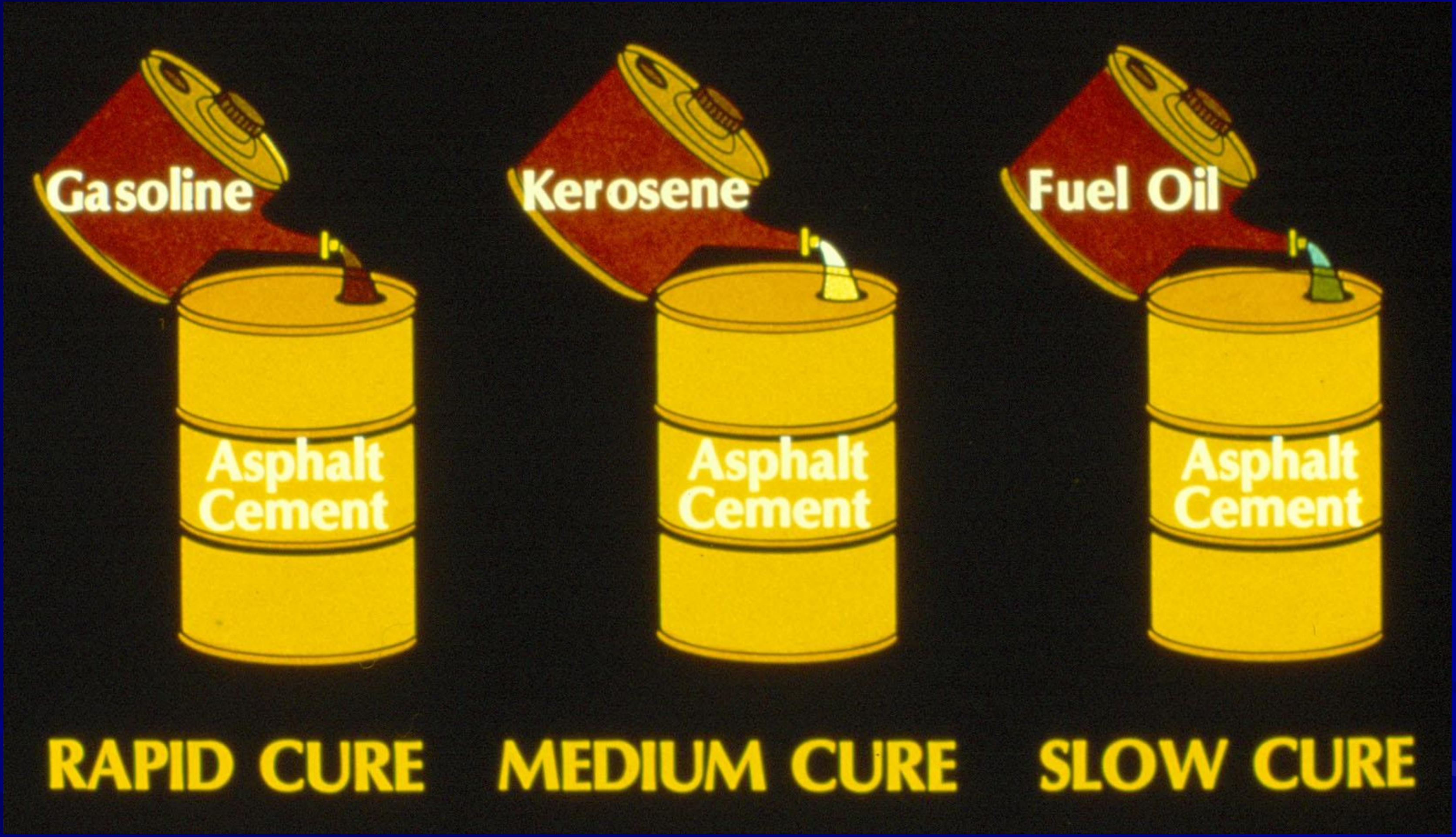
Hot Mix Plant

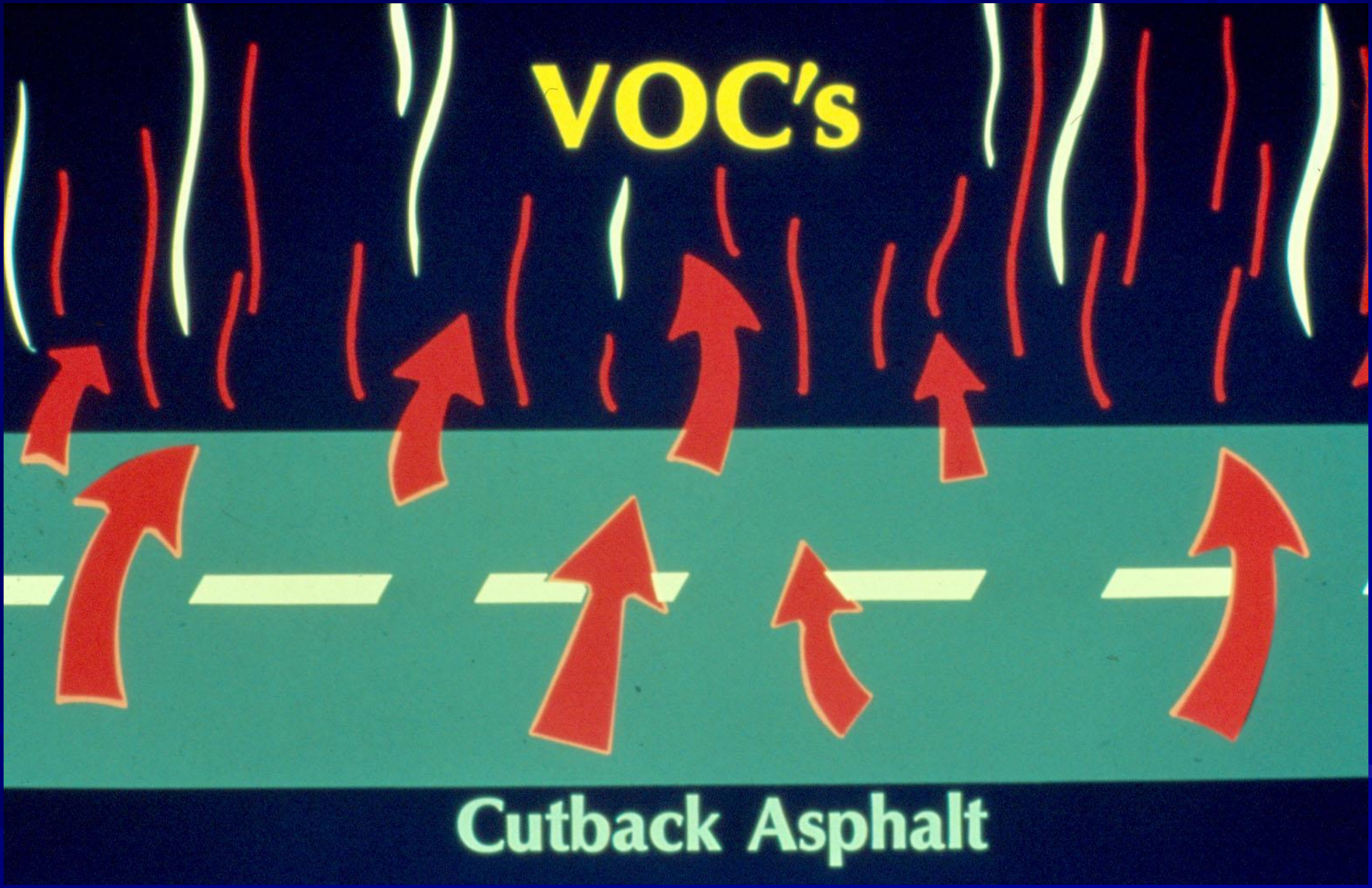


Drum Mix Plant

CUTBACK ASPHALT

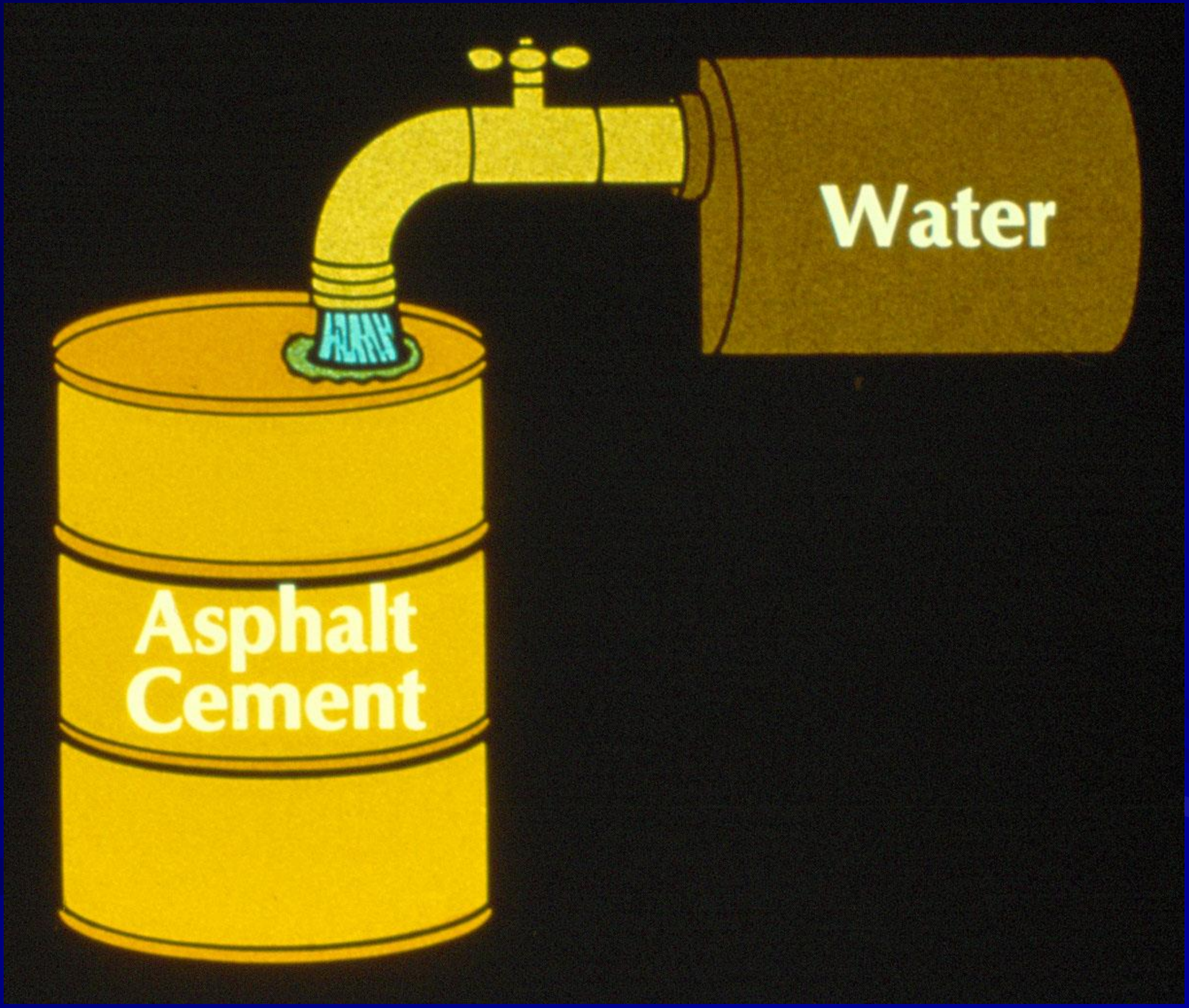



Gasoline
Asphalt Cement
Kerosene
Asphalt Cement
Fuel Oil
Asphalt Cement
RAPID CURE
MEDIUM CURE
SLOW CURE

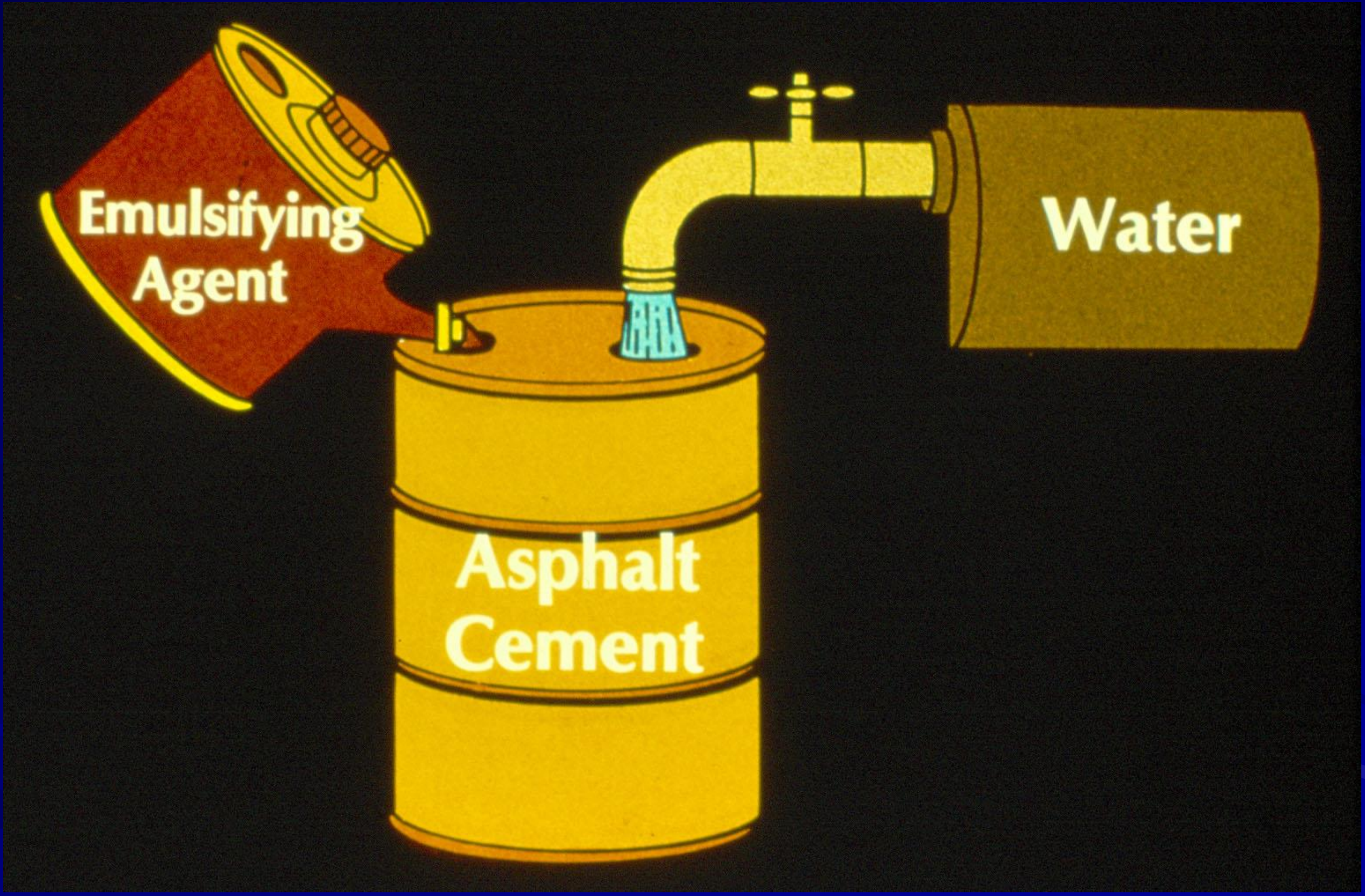

VOC's
Cutback Asphalt

VOC Losses

	Solvent Loss	Curing Period
Rapid cure	80%	2-3 hours
Medium cure	70%	2-3 days
Slow cure	25%	~2-3 weeks


Water
Asphalt
Cement

IMMISCIBLE


Emulsifying
Agent
Water
Asphalt
Cement

H_2O
~~VOC's~~
Not Exactly!
Emulsified Asphalt

Emission Regulation

RACT recommendation: substitute emulsified asphalt for cutback asphalt

Exceptions:

- When cutback asphalt is applied in cold weather (<50°F).
- When emulsified asphalt is stored for longer than a month.
- When cutback asphalt is used as a prime coat.
- When it can be demonstrated that there are no VOC emissions from the cutback asphalt.