

Solvent Cleaning: Degreasing Operations NACT 233



What This Class Is About

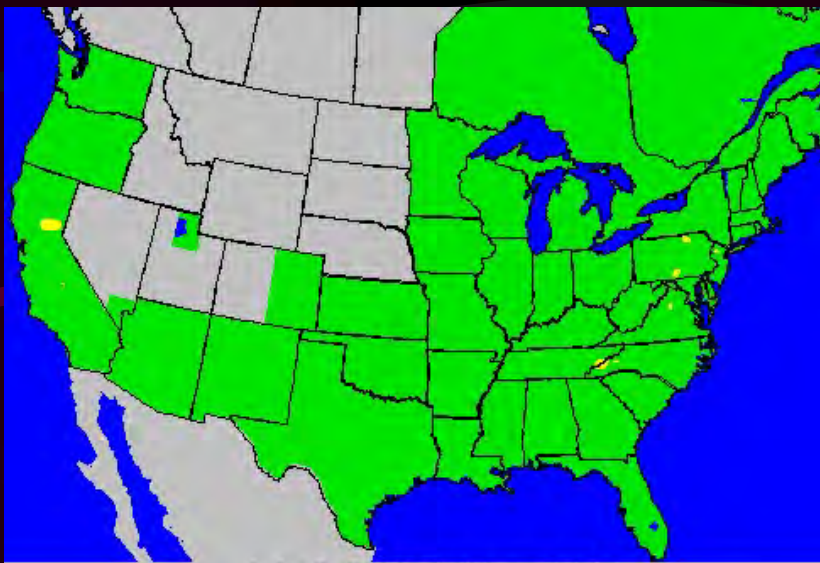
- **Descriptions Of The Solvents**
- **Descriptions Of The Solvent Process**
- **Regulation Requirements**
- **Inspection Procedures**

Why Are We Interested?



- Solvents Emissions In California
- California Clean Air Act
- Air Pollution Health Concerns
- Ozone Problems

OZONE Formation





What Is Solvent Cleaning ?

- **A Process Using Non-Aqueous Solvents To Clean And Remove Soils From Various Surfaces**

Soil Categories

- Organics
 - rosins, glycols, oils, greases, waxes
- Water Soluble Inorganic Salts
 - chlorides, sulfates, etc.
- Insoluble Particles
 - dirt, dust, metal fines, etc.



Traditional Solvents

- Alcohols (Isopropyl alcohol)
- Aliphatic Hydrocarbons (Stoddard, PD-680)
- Halogenated (CFC's, HCFC's, etc.)
- Aromatic Hydrocarbons (Toulene/Xylene)
- Ketones (MEK)

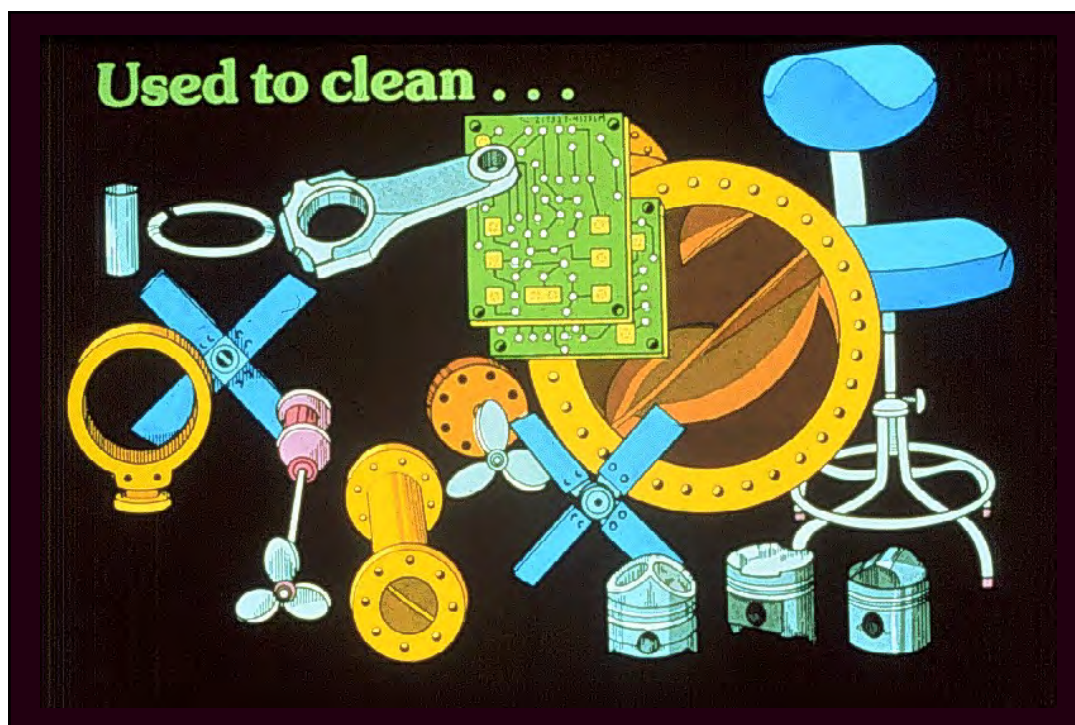
Switching To Aqueous or Semi-Aqueous Cleaners

- Water-Based (Aqueous)
 - Alcohols
 - Alkaline Detergents
 - Surfactants
 - Saponifiers
- Citrus Based (Semi-Aqueous)
 - Terpenes
- Lower VOC Products
 - Hydrocarbons with Surfactants and Rust Inhibitors
 - Glycol Ethers
 - Acetone



Solvent Applications

- Metal Working
 - Automotive
 - Electronics
 - Appliance
 - Furniture
 - Jewelry
 - Plumbing
 - Aircraft
 - Refrigeration
 - Business Machinery
 - Fasteners
 - Etc.
- (pp 200-3)



California Solvent Degreasing Usage

- 2001: Stationary sources emitted 90 Tons Per Day of ROG's
- 46% of the stationary source VOC emissions
- 1994: >20,000 tons/yr. of VOC's

Storing Solvents

- Sealed Containers
- Properly Labeled
- No Leaks
- Protected Areas
- Hazardous Waste

Solvent Cleaning Classifications

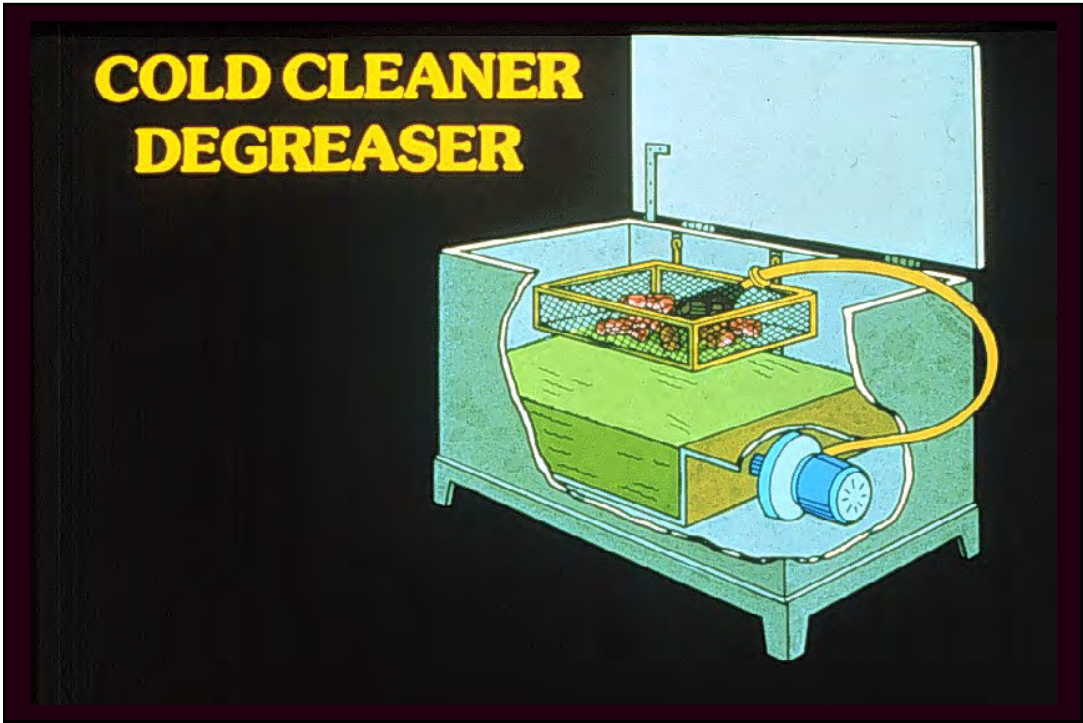
- Cold Cleaning
- Open Top Vapor Cleaning
- Conveyorized Cleaning

Cold Cleaning



- Uses All Types Of Solvents
- ~55%-60% Of Solvent Emissions
- Average Unit Emission: ~.3 TPY
- Includes
 - Spraying
 - Brushing
 - Flushing &
 - Immersion

(pp 300-1 & 2)





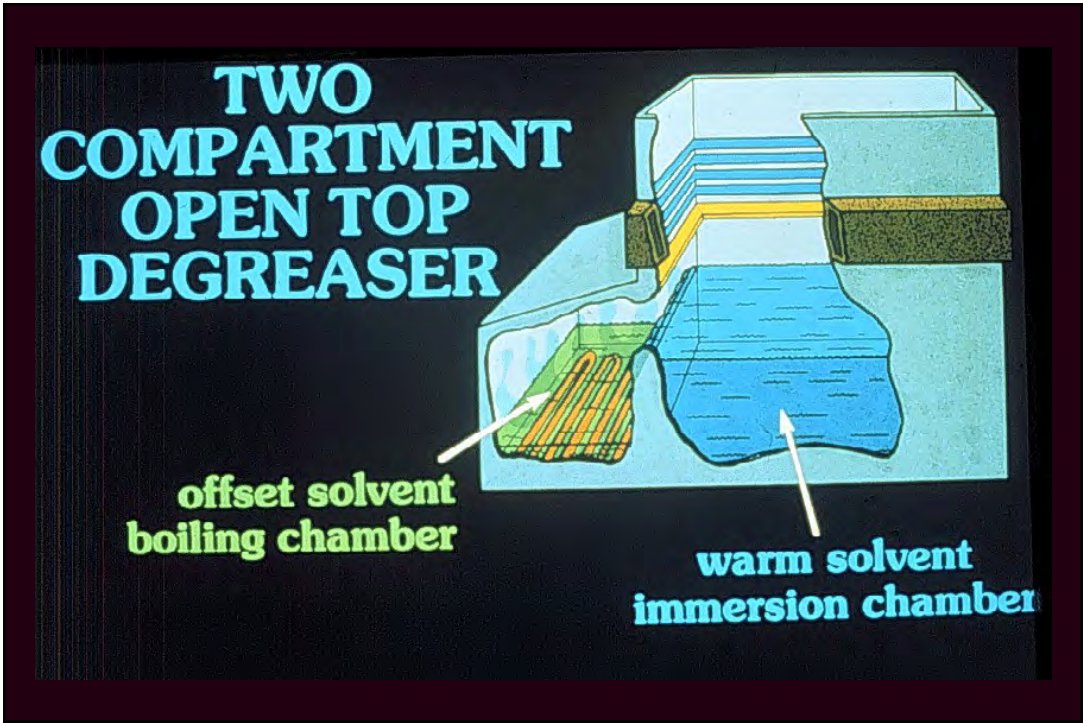
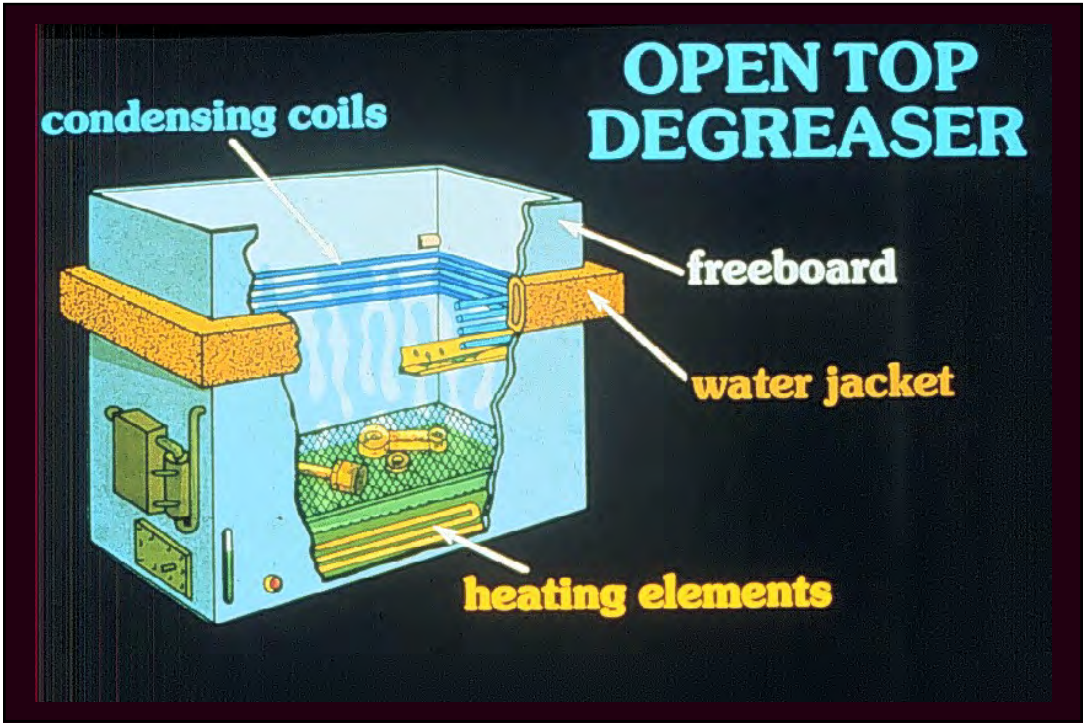




Open Top Vapor Cleaning

- Emit ~200,000 Metric Tons Or 30% Of The National Solvent Cleaning Emissions
- Are Batch Loaded
- Clean Through The Condensation Of Hot Solvent Vapor On Colder Parts
- >100,000 Tons/yr. Of Halogenated Solvents Are Used In This Type Of Cleaner In U.S.

(pp 200-8)







Solvent



Sprays



Open Top Vapor Cleaners



Important Elements:

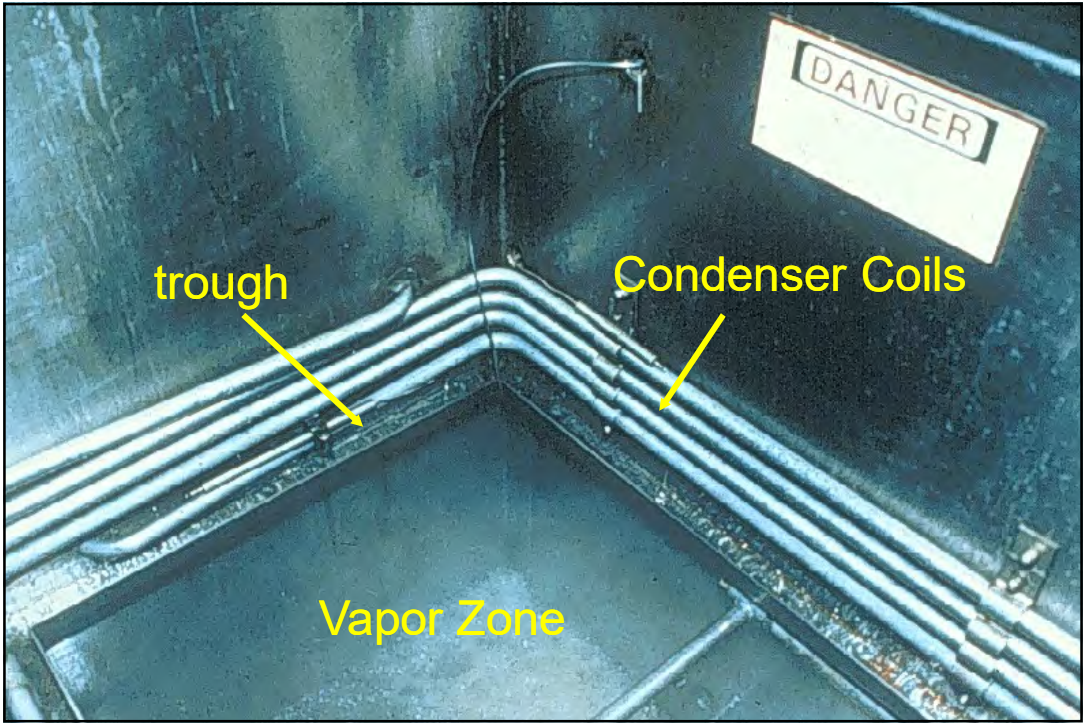
- Condenser Coils
- Freeboard
- Water Separators
- Covers

(pp 300-7-13)

Cooling Coils

- Located On Inside Walls Of Cleaner
- Contains Vapor Zone With Cool Air Blanket Cover
- Usually Has Water As The Coolant

(pp 300-7)



Freeboard

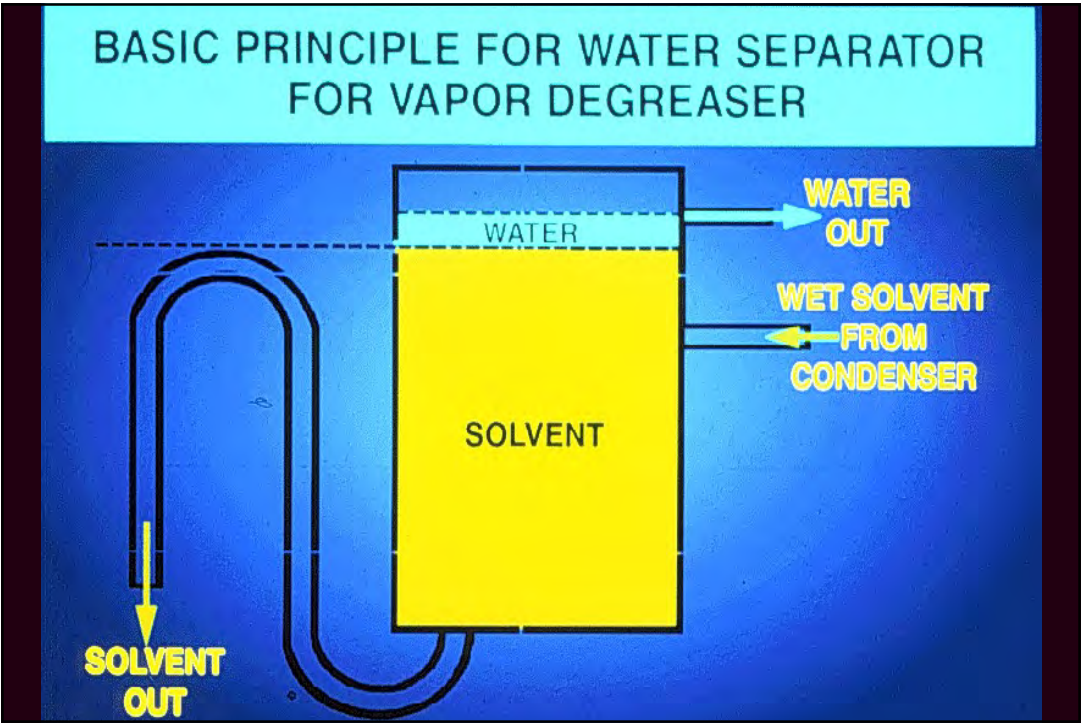
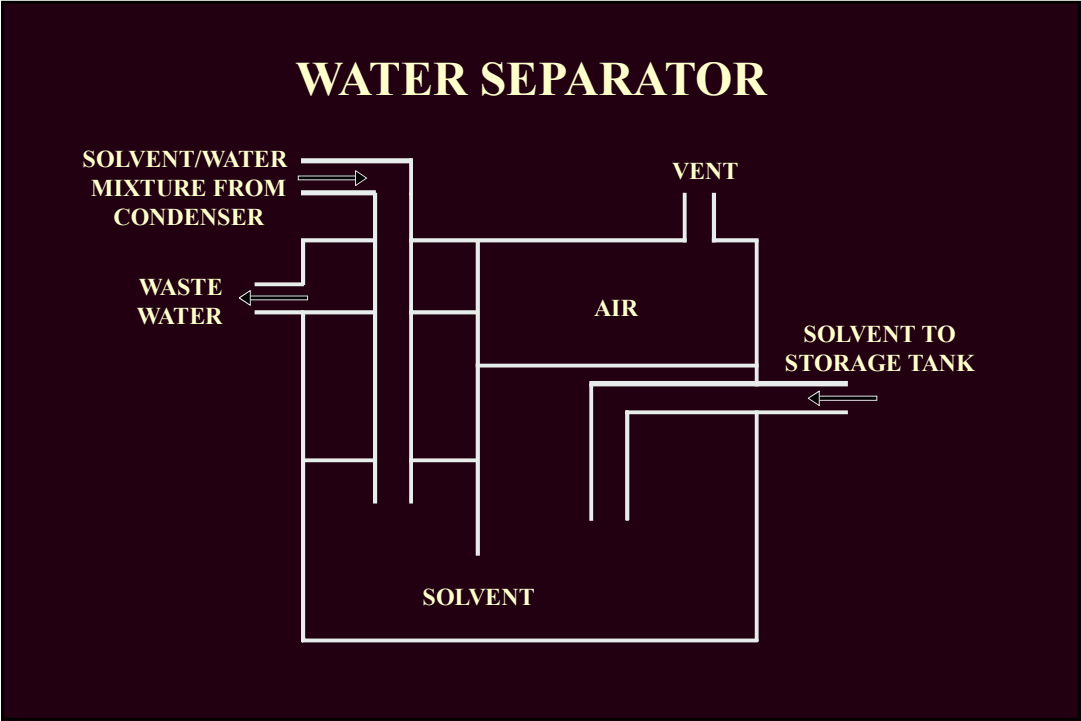
- Protects The Solvent Vapor Zone From Disturbance Caused By Air Movement Around The Equipment
- Generally Established By The Location Of The Condenser Coils

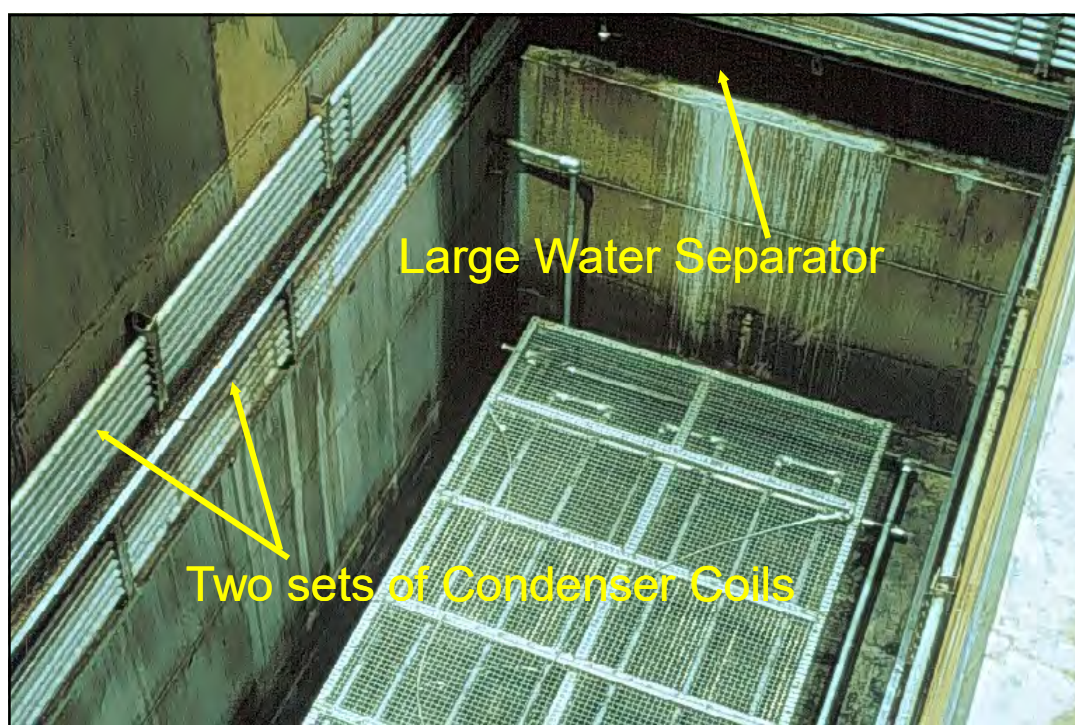
(pp 300-7)

Water Separators

- Nearly All Vapor Cleaners Have Water Separators
- These Allow The Water That Condenses On The Coils To Separate From The Solvent Before The Solvent Is Reintroduced In The System

(pp 300-13)

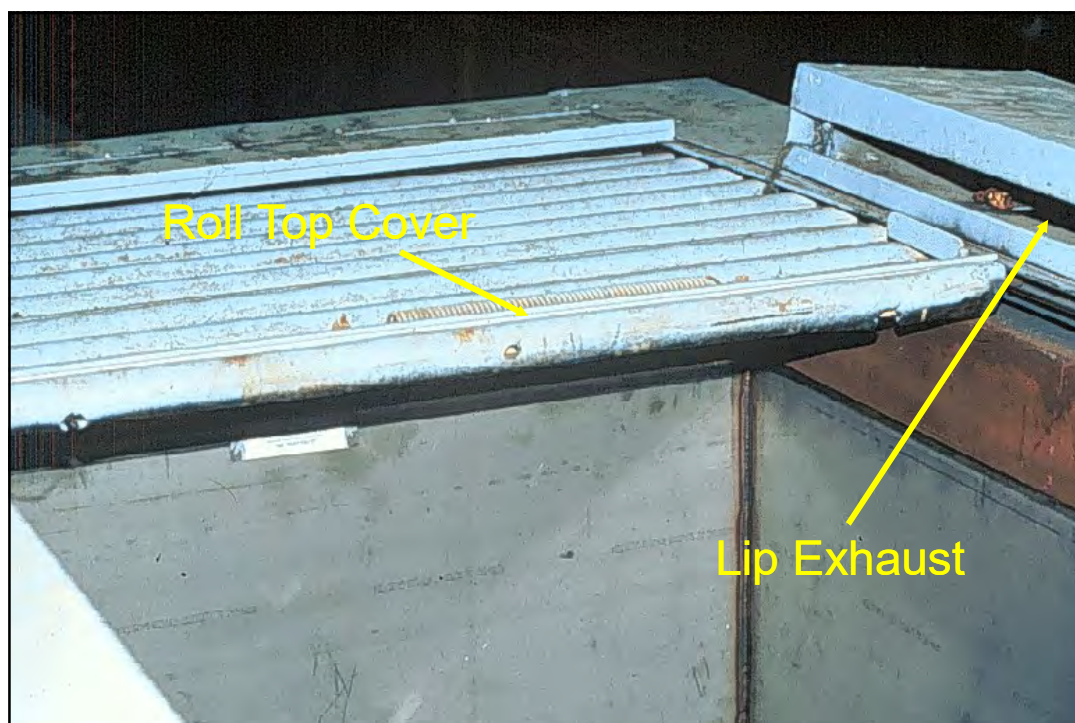




Covers

- Historically Single Piece, Unhinged Metal Cover
- Newer Designs Might Have:
 - Roll-top Plastic Covers
 - Canvas Curtains
 - Hinged Counter Balanced Metal Covers

(pp 300-13)



Conveyorized Degreasers

- Average Unit Emits About 25 Metric tpy.
- About 15% Of Nationwide total.
- There Are Seven Different Types:
 - Cross-Rod
 - Monorail
 - Vibra
 - Ferris Wheel
 - Belt
 - Strip
 - Circuit Board

(pp 300-14)

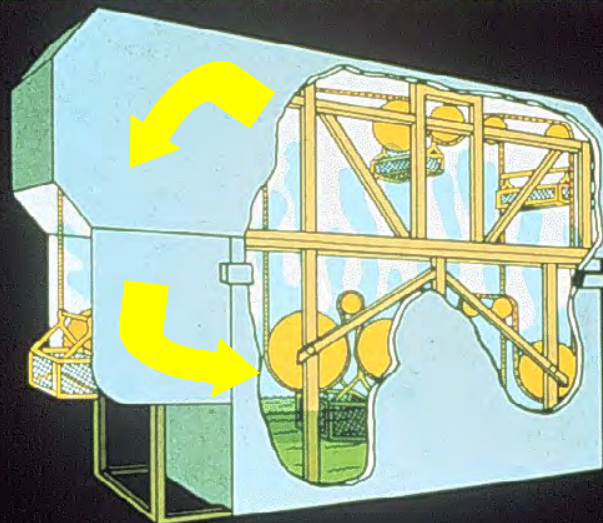
Cross-Rod Degreaser



- Parts are supported by Rods Between The two Power Driven Chains.
- Designed To immerse Small Parts.

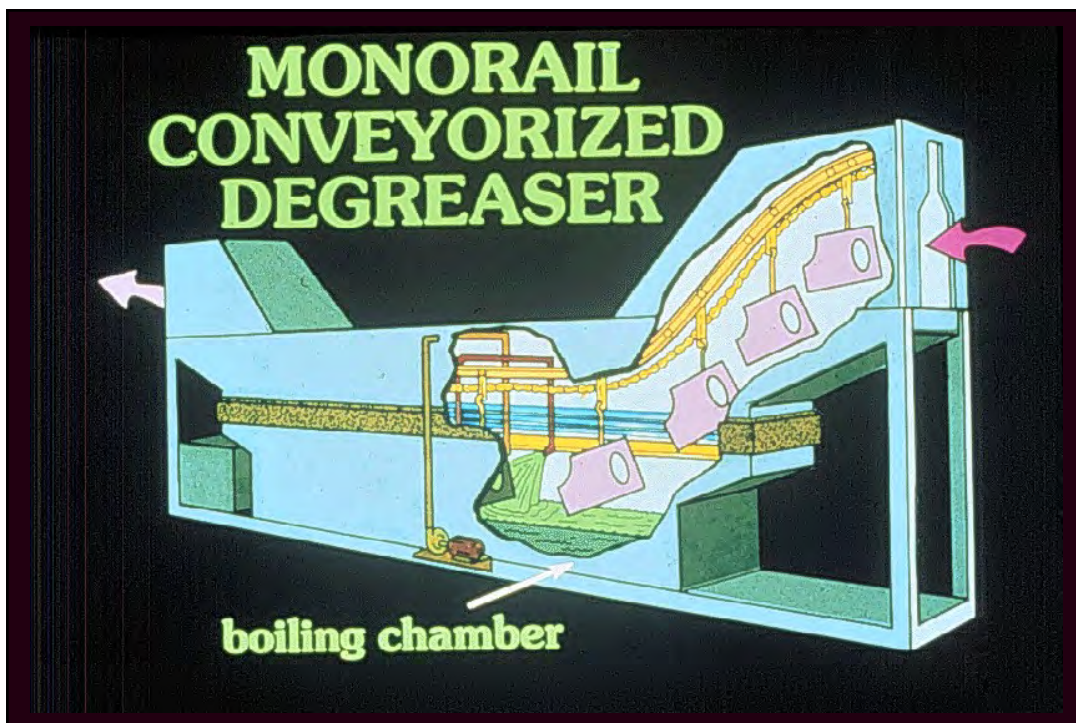
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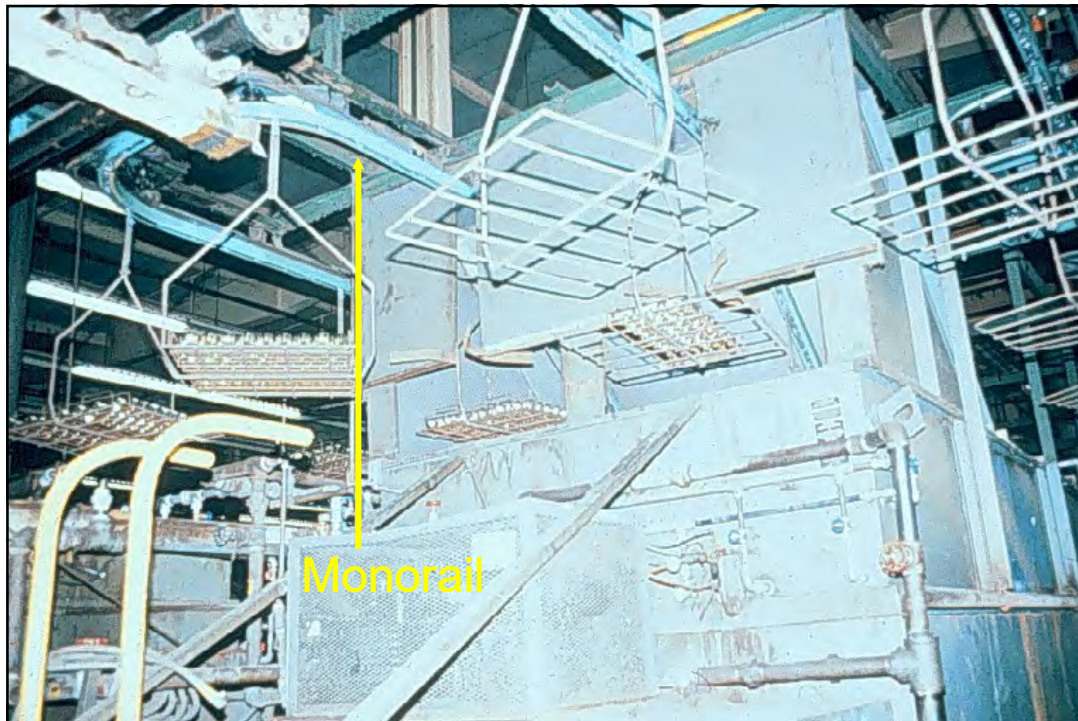
CROSS-ROD CONVEYORIZED DEGREASER



Monorail Degreasers

- Used when The Parts To Be Cleaned Are Being Transported Between Manufacturing Operations.
- Automatic Cleaning With Solvent Spray And Vapor.



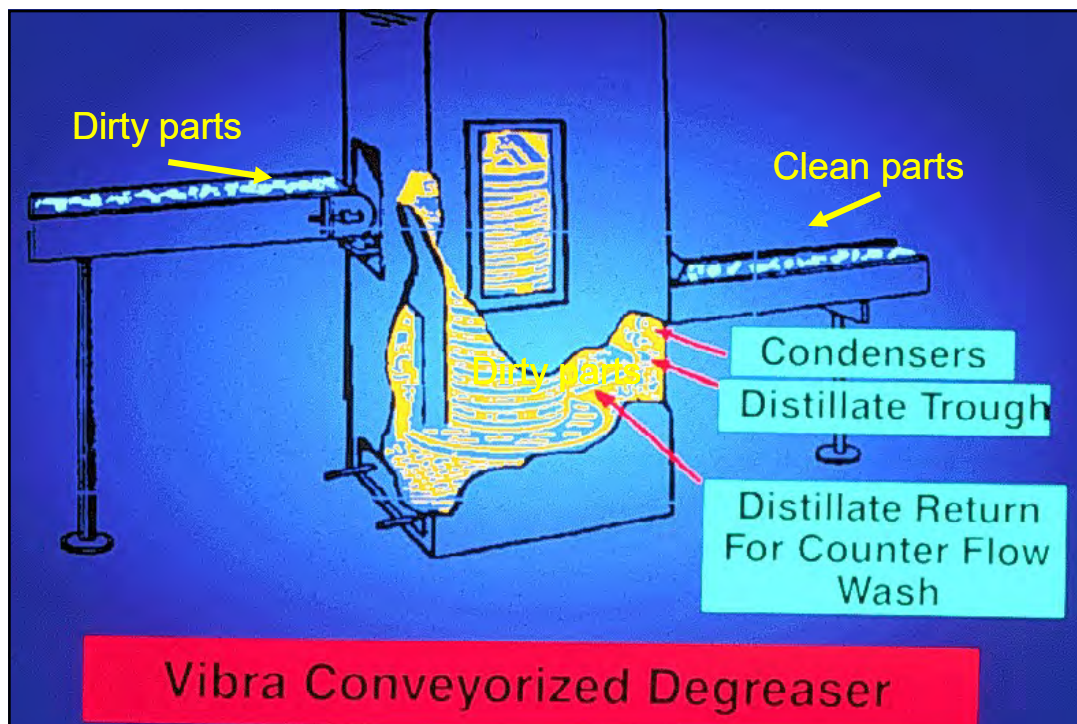


Vibra Degreaser



- Metal Parts Are Vibrated From A Solvent Flooded Pan Up A Spiral Elevator To Dry Before Exiting.
- Capable Of Processing Small Parts.
- Vibratory Action Creates Considerable Noise.

(pp 200-14)

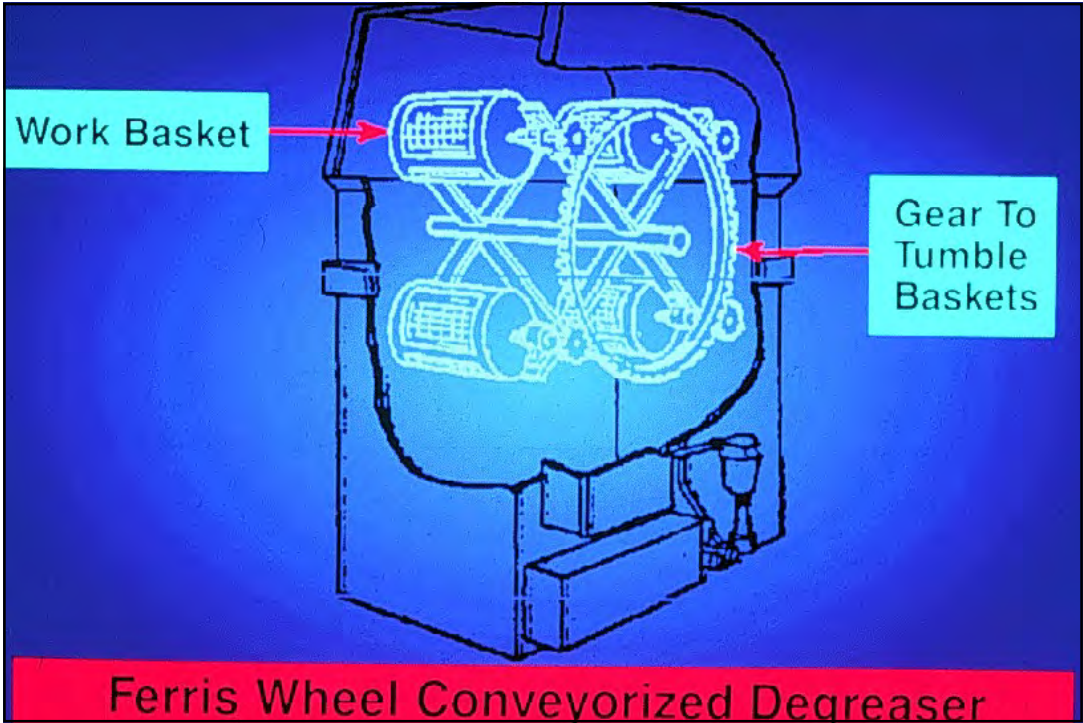


Ferris Wheel Degreaser



- Least Expensive Conveyorized Degreaser
- Smallest.
- Uses Perforated Baskets

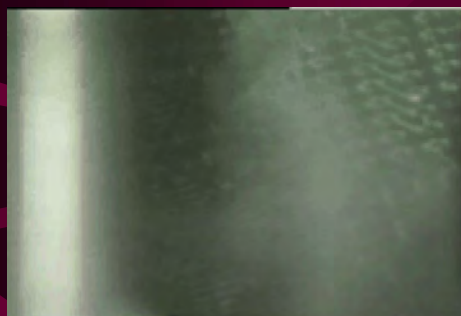
(pp 300-18)



Belt & Strip Degreasers

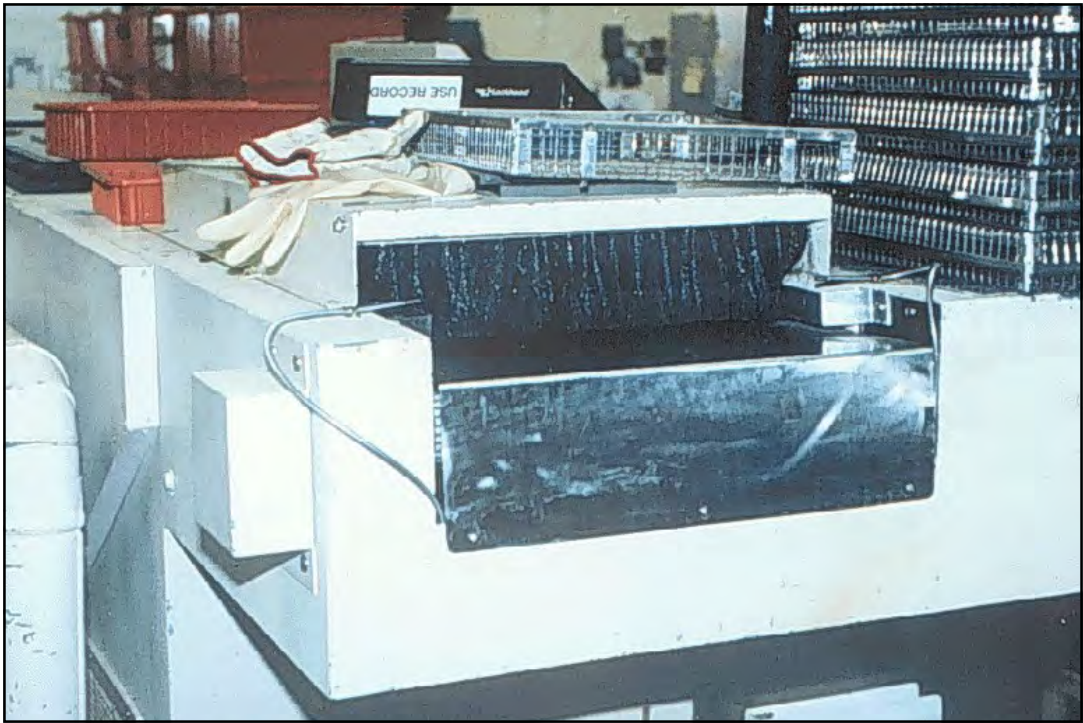
- Enables Simple Loading And Unloading Of Parts.
- Strip Degreaser Also Cleans The Strip While A Belt Degreaser Does Not.

Circuit Board Cleaner

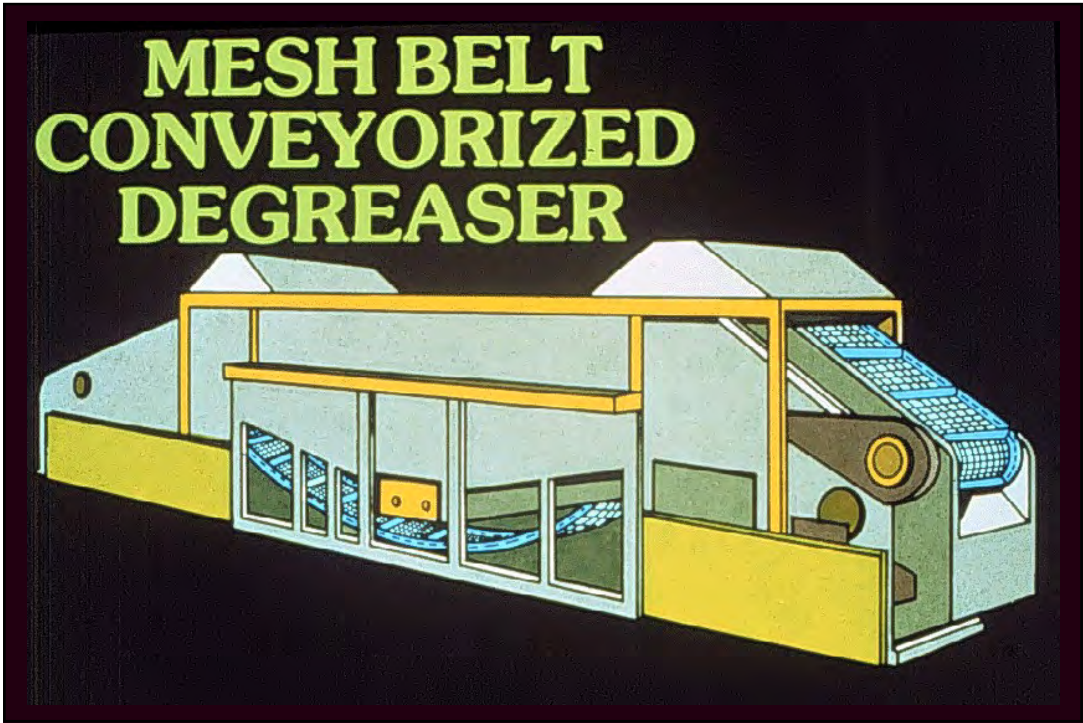


- Used Specifically In The Production Of Printed Circuit Boards.
- There Are Two Types:
 - Developers
 - Strippers

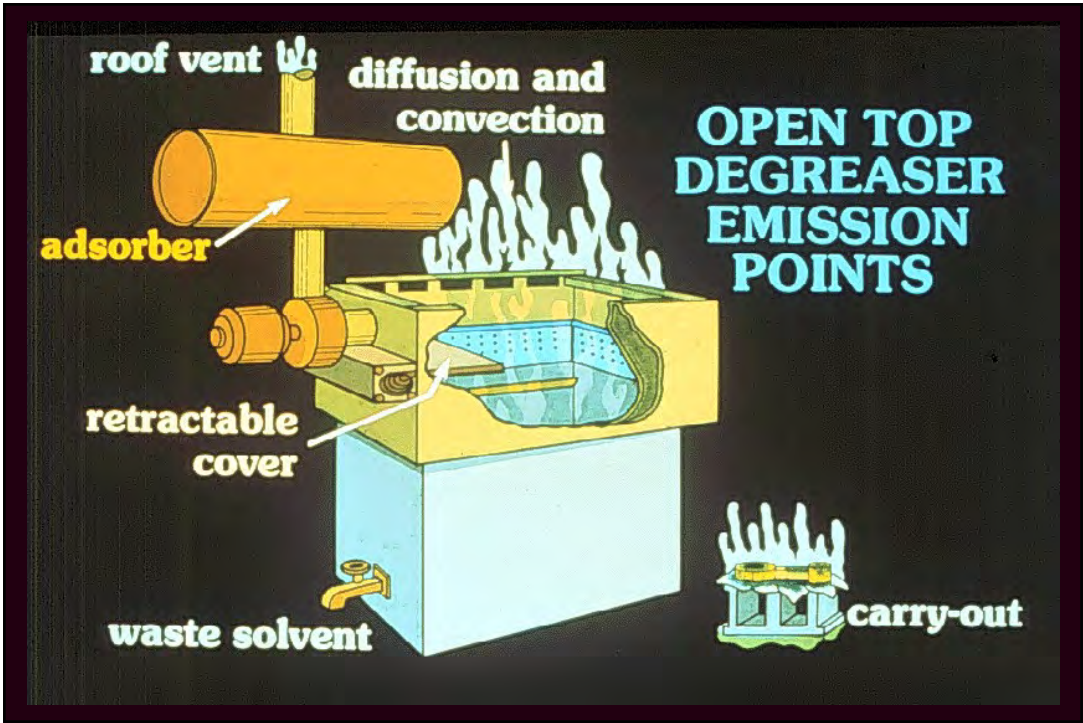
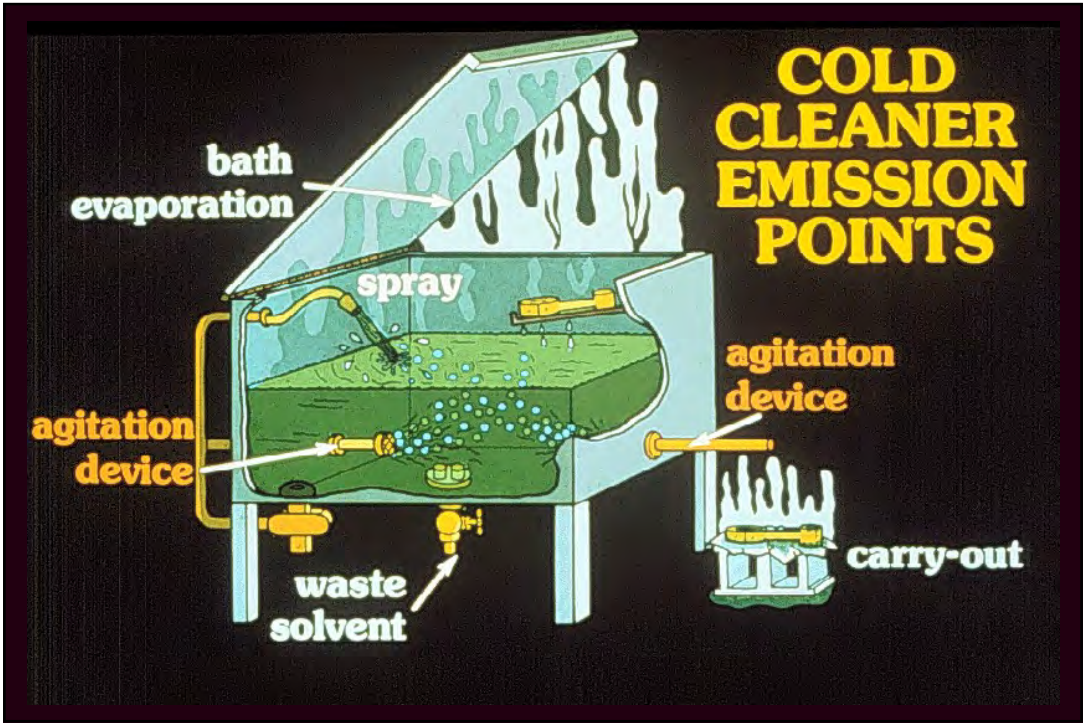
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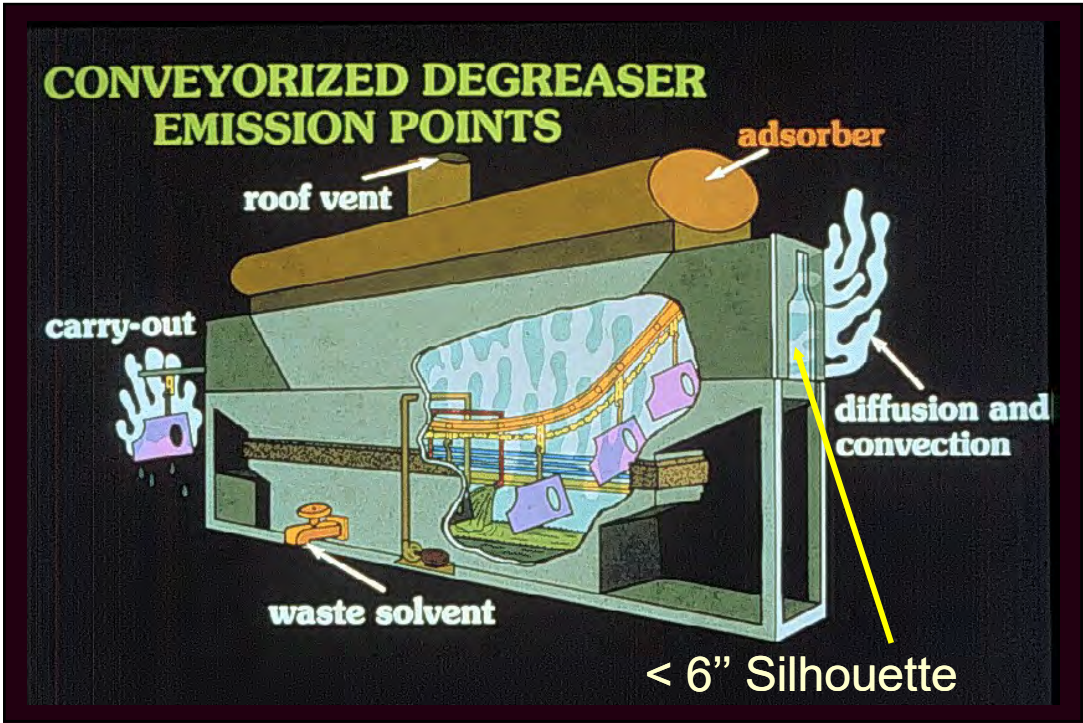












Emissions Of Concern

VOC ---> O₃

- VOC Emissions
- Toxic Emissions
- CFC Emissions

CFC ---> 

DANGER
TOXIC VAPORS

(pp 300-18-19)



Control Technology

- Improved Cover
- High Freeboard
- Refrigerated Chillers
- Carbon Adsorption
- Safety Switches
- Thermal Reduction

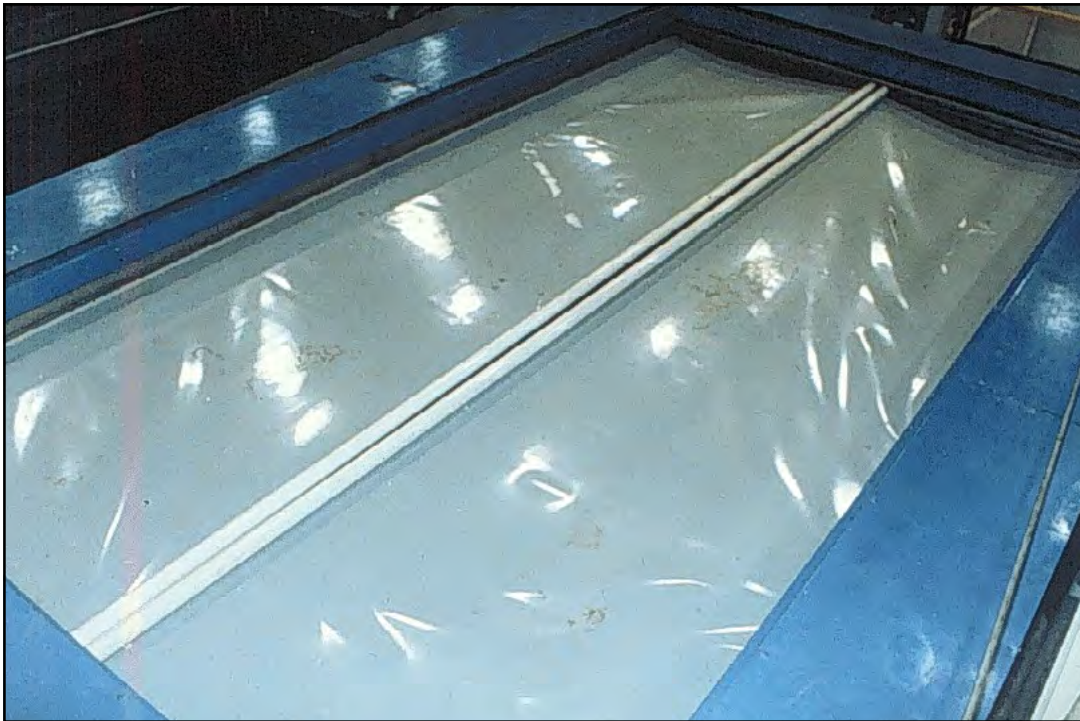


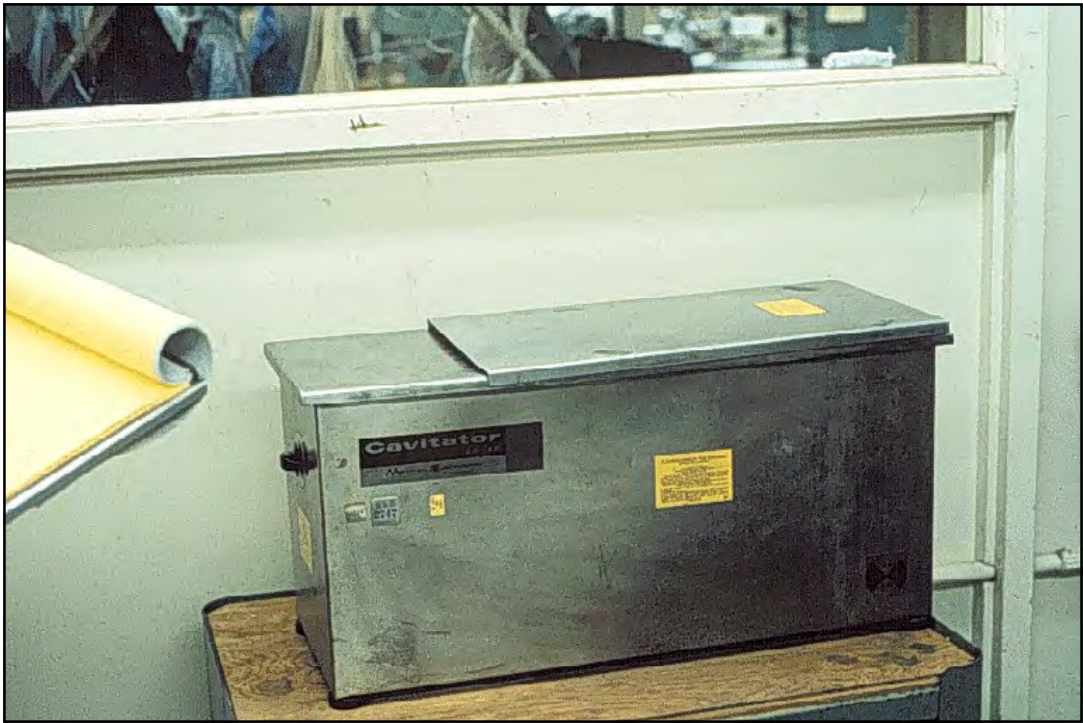
(pp 300-20)

Improved Covers

- Single Most Important Control Device For Open Top Vapor Degreasers
- Open & Close In A Horizontal Direction
- Includes Plastic Covers, Canvas Curtains, And Guillotine Covers
- Also Includes Water Cover

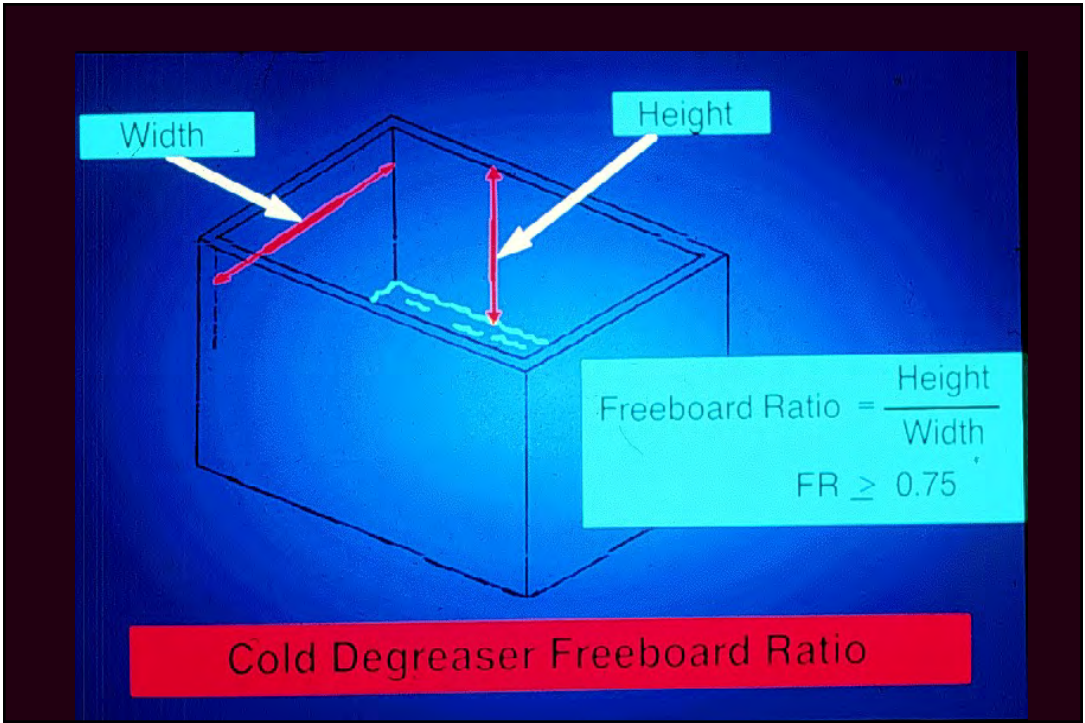
(pp 300-20-22)

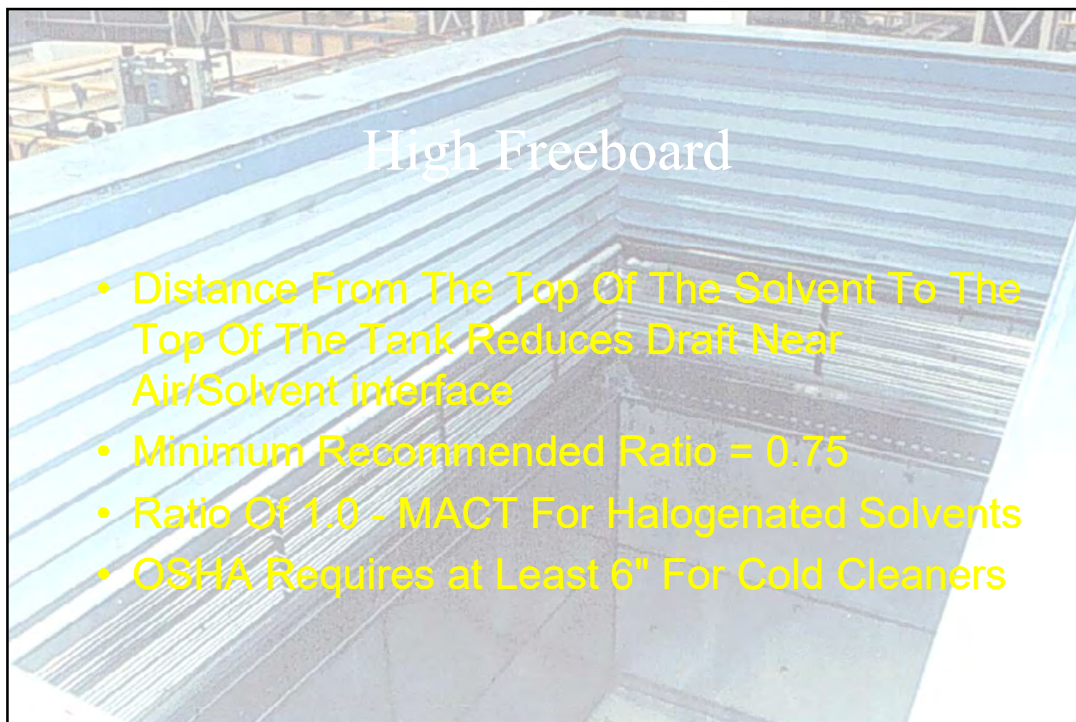


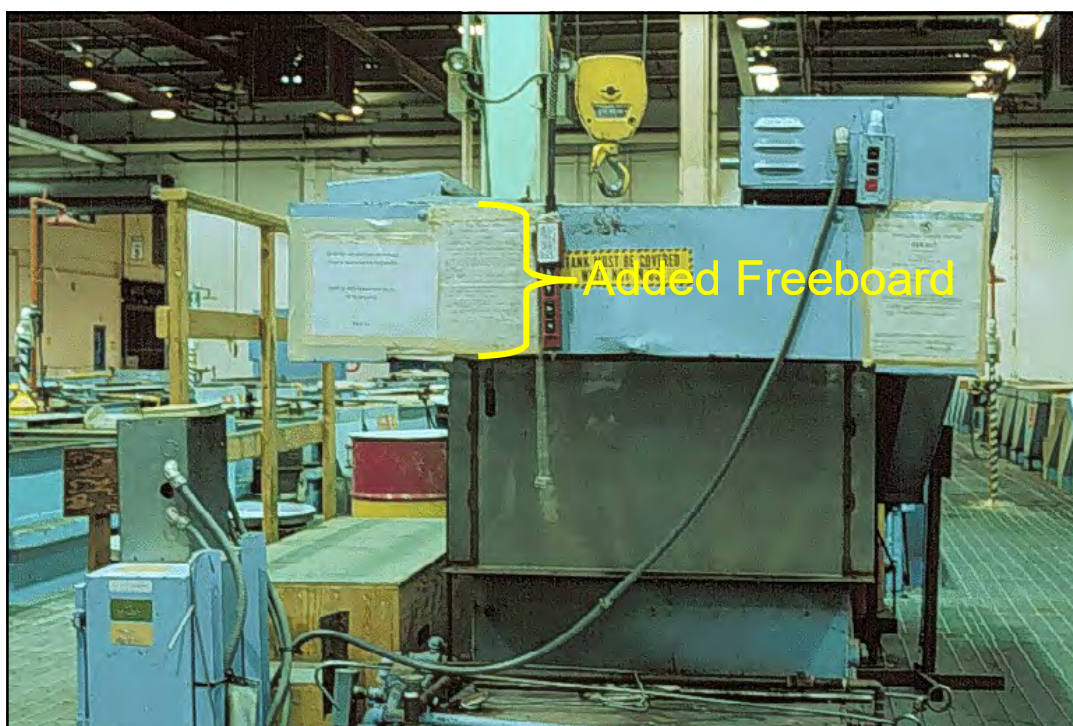




Measuring
Freeboard

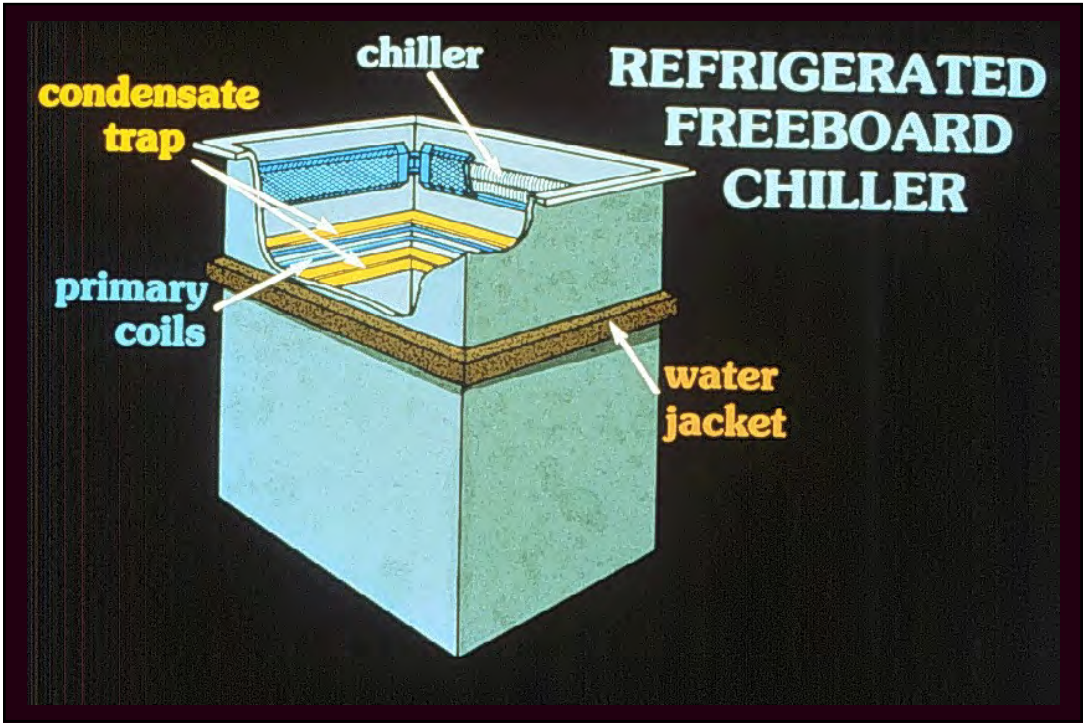






Refrigerated Chillers

- Condenser Coils
 - Create Cold Air Blanket
 - Results In A Temperature Gradient
 - Provides A Stable Inversion Layer
 - Chillers
 - Offers More Cooling
 - Refrigerated Condenser Coils
 - Offers Portability when not plumbed
- (pp 200-23-25)



Adsorption

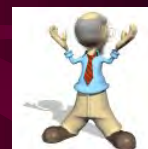
- Types Of Adsorbents:
 - Activated Carbon
 - Molecular Sieves
 - Silica Gels
- 90%+ Efficiency Possible
- Handles High VOC Concentrations
- High Humidity Decreases Efficiency
- VOC Mixtures Can Cause Problems



(pp 300-25 & 26)

Safety Switches

- Prevent Emissions During Malfunctions And Abnormal Operation
- Five Main Types:
 - Vapor Level Control Thermostat
 - Condenser Water Flow And Thermostat
 - Sump Thermostat
 - Solvent Level Control
 - Spray Safety Switch

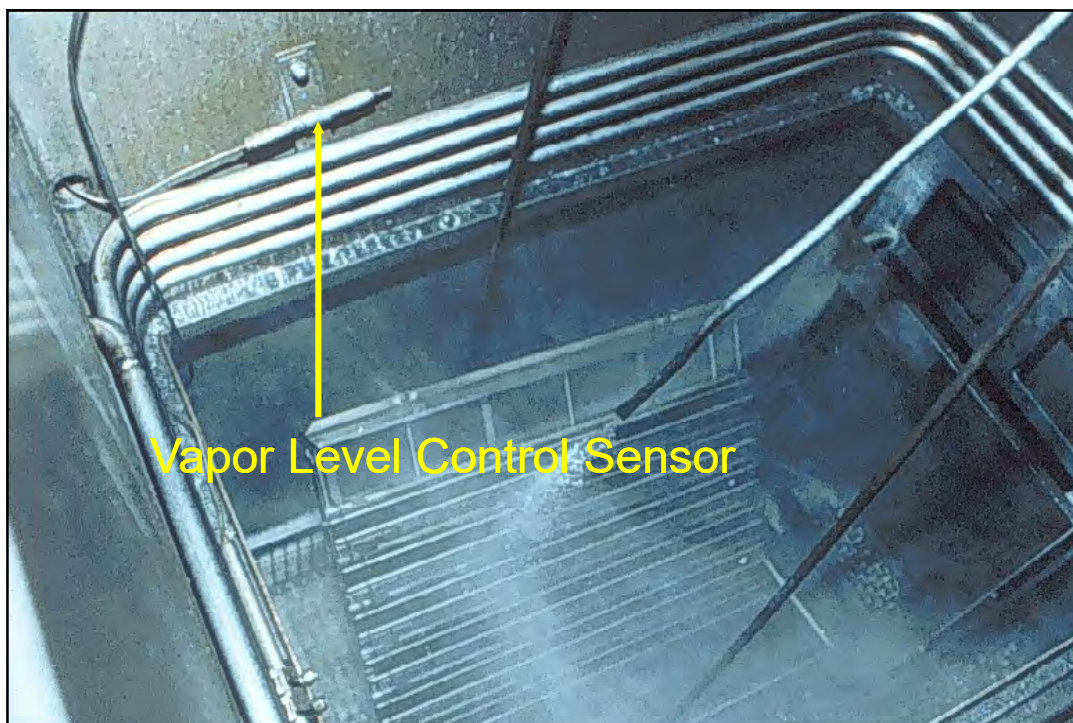


(pp 300-27)

Vapor Level Control

- Most Important Switch
- Activated When Solvent Vapor Zone Rises Above The Designed Operating Level
- Turns Sump Heater Off
- For Conveyorized Degreasers, Should Activate an Alarm

(pp 300-27)



Condenser Water Flow

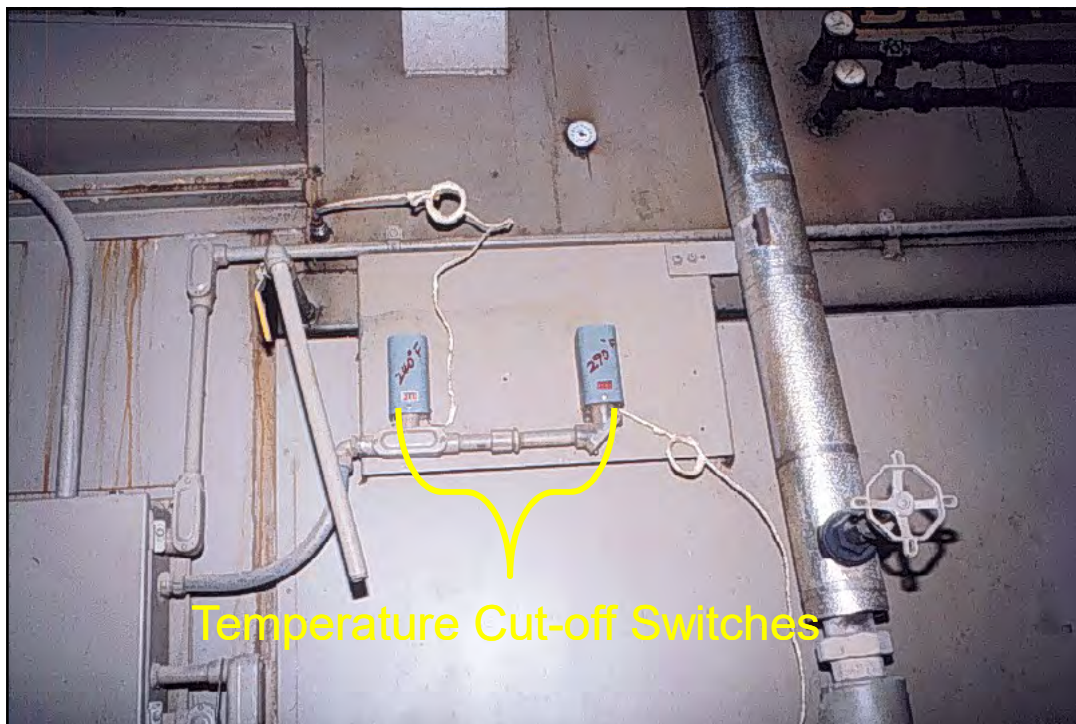
- Turns Off Sump Heat When:
 - The Condenser Water Stops Circulating
 - Or
 - The Condenser Water Becomes Warmer Than Specified
- Serve As Back-up For The Safety Vapor Thermostat

(pp 300-28)

Temperature Cut-off Switch

- Cuts Off Heat When The Sump Temperature Rises Significantly Above The Solvents Boiling Point
- Prevents Decomposition Of Solvents
- Hydrochloric Acid May Be Formed If Solvent Level Becomes So Low It Touches Heating Element.

(pp 300-28)



Carry - Out Emissions

- Results When Clean Parts Still Containing Liquid Or Vapors Are Extracted From The Degreaser
- Main Control Device: Simple Drainage
- Other Controls include:
 - Drying Tunnels
 - Rotating Baskets

(pp 300-28 & 29)

Inspection Procedures

- Pre - Inspection
- Inspection
- Post - Inspection

Pre - Inspection

- Facility History (File Review)
 - How Many Permits?
 - Compliance Status - Pending Actions?
 - Read Permit Conditions
 - Solvent Type
 - Solvent Usage Limits
 - Source Test Requirements?
 - Inspection Forms
 - Fill Out As Much As Possible Prior To Inspection
- (pp 400 - 1-3)



Inspection



- Introduce Yourself To Facility Manager
 - Explain the reason you are there
- Tell Manager Of Any Assistance you May need
- Verify Number & Type Of Degreasers Present
- Review Solvent Usage Records
- Inspect Each Degreaser in use, if possible

(pp 400 - 3-5)

Cold Cleaners

- Equipment Requirements
 - Check For Soundness (Leaks)
 - Check For Cover (when not in use)
 - Check For Changes In Freeboard
- Operational Requirements
 - Check Solvent Usage/Storage
 - Take Sample, If Necessary
 - Check Operation Parameters
 - Check Hoist Speed

(pp 400 - 6-8)

Vapor Degreasers

- Equipment Requirements
 - See Cold Degreaser Req.
 - Check Control Device If Present
 - Check All Safety Switches
- Operating Requirements
 - See Cold Degreaser Req.
 - Parts Degreased In Vapor Zone
 - Water In The Water Separator
 - Check Operation Of Lip Exhaust

(pp 400 - 8-9)

Conveyorized Degreasers

- Equipment Requirements
 - See Cold Degreaser Req.
 - Check To See That Hood Is Present
 - Look For Drying Tunnel, Rotating Basket, Or Tumbler
 - Check Silhouette
- Operational Requirements
 - See Cold Degreaser Req.

(pp 400 - 10)

Air Pollution Control Points Of An Inspection

- Capture
- Transport
- Air Mover
- Instrumentation
- Control
- Subsystem

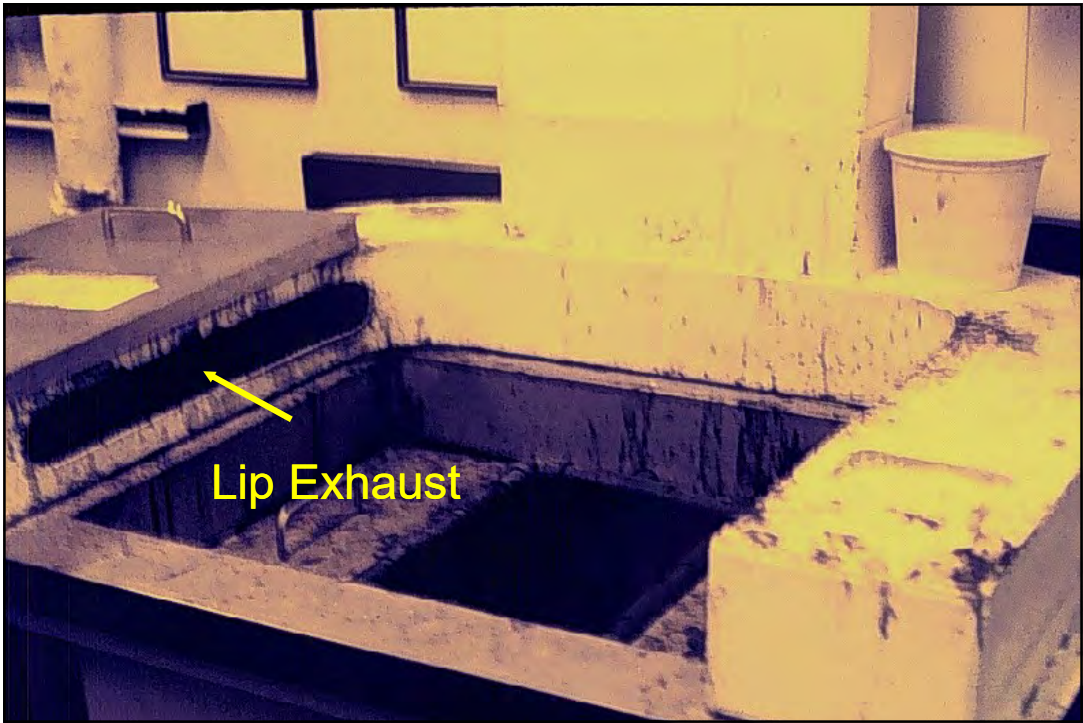
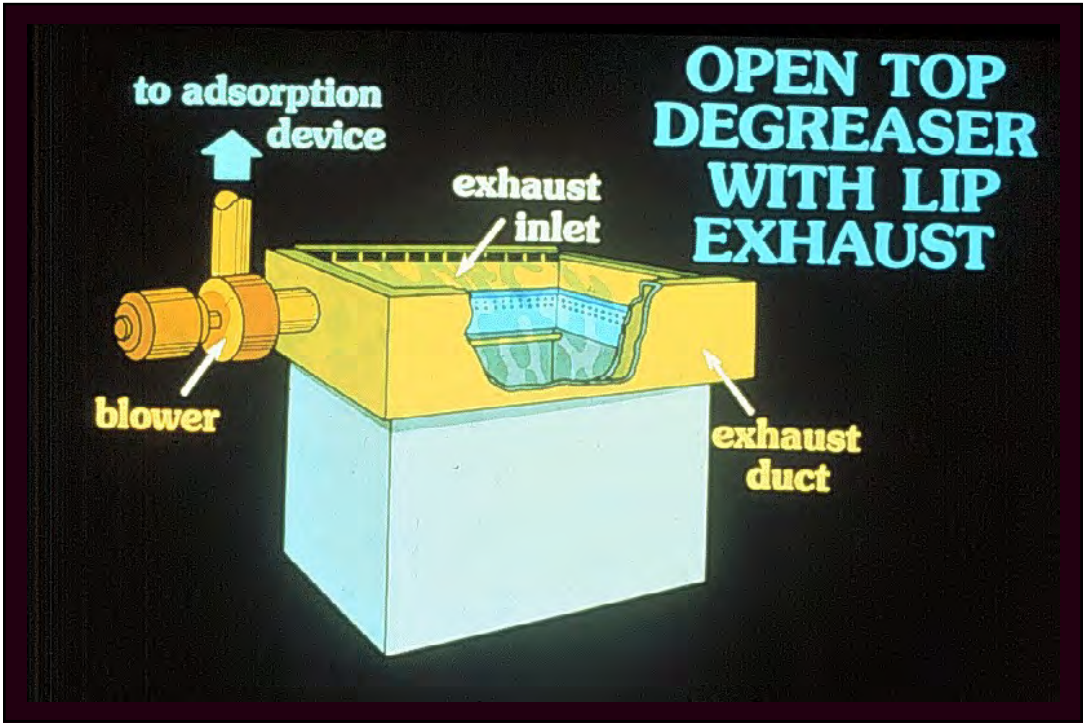


(pp 400-5)

Capture

- Are Process Emissions Drawn into
A Control Device At The Point Of Release
- (Are They Drawn Into A Collection Device)
- If Lip Exhaust Is Installed, Is It On?

(pp 400-5)



Transport

- Are Emissions Moved To The Control Device Without Loss
- Are There Any Leaks

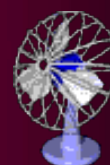
(pp 400-5)





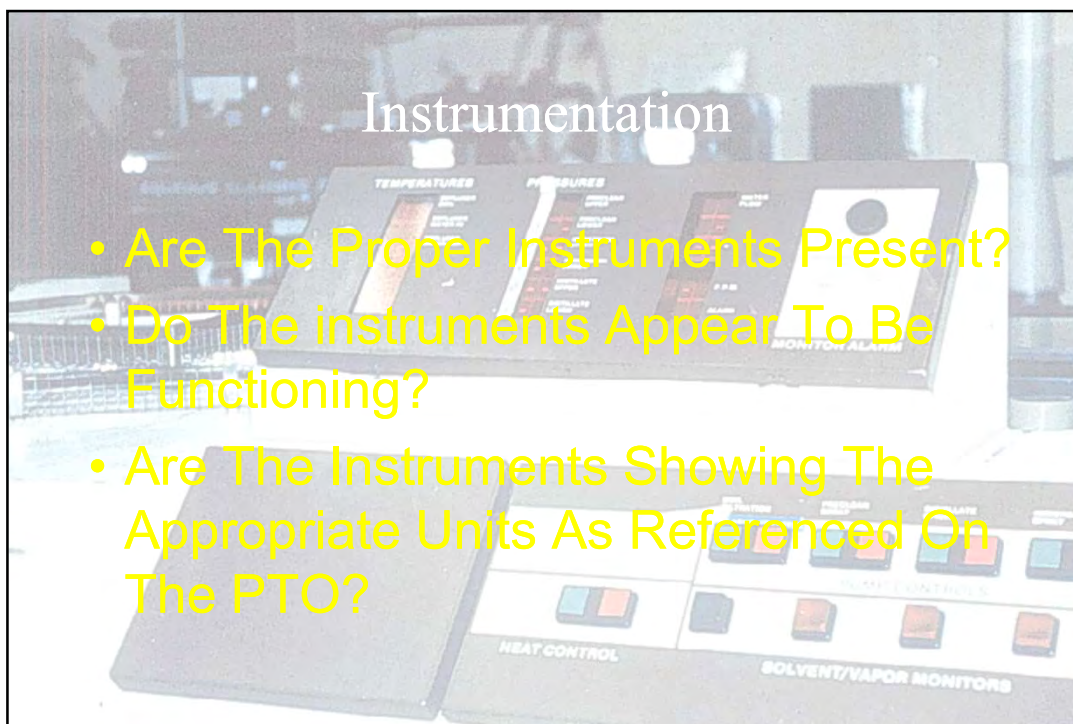
Ducting To Thermal
Oxidizer On Roof

Air Mover



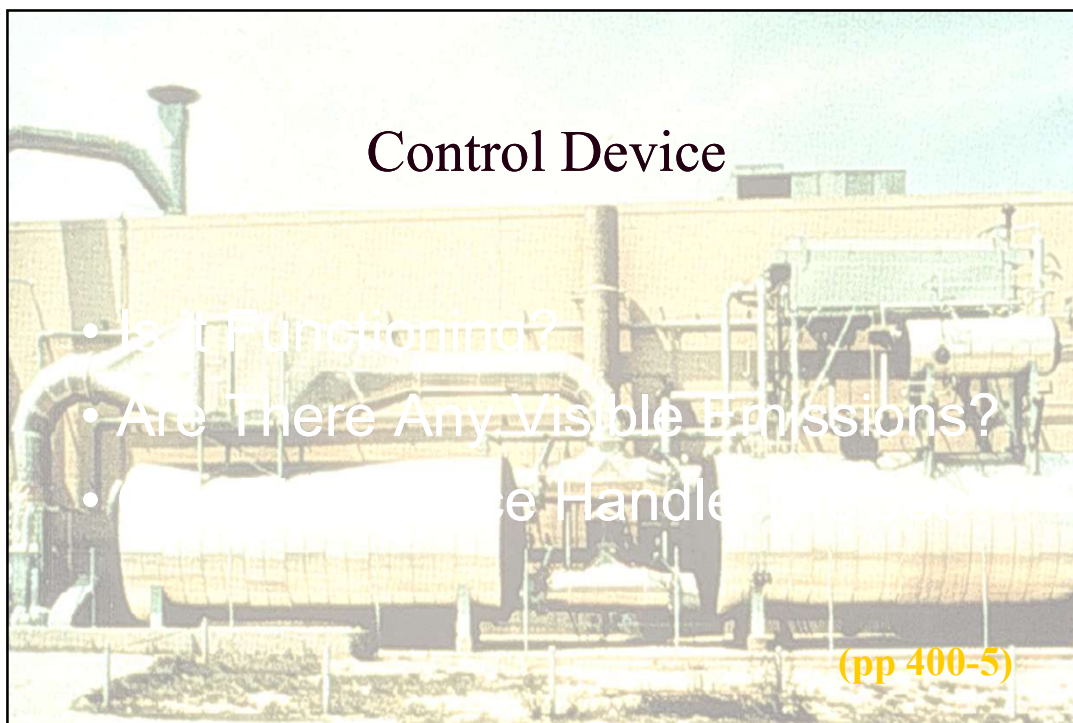
- Is The Fan Big Enough For The Job?
- Is It Operating As Designed And Permitted?

(pp 400-5)



Instrumentation

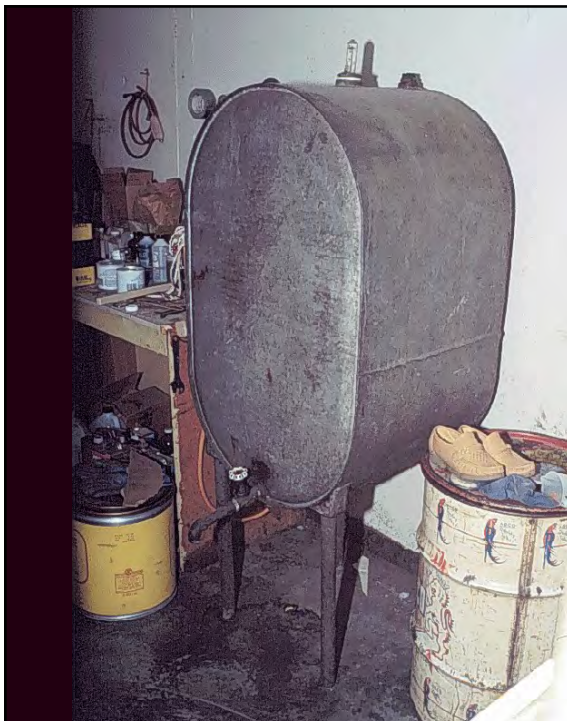
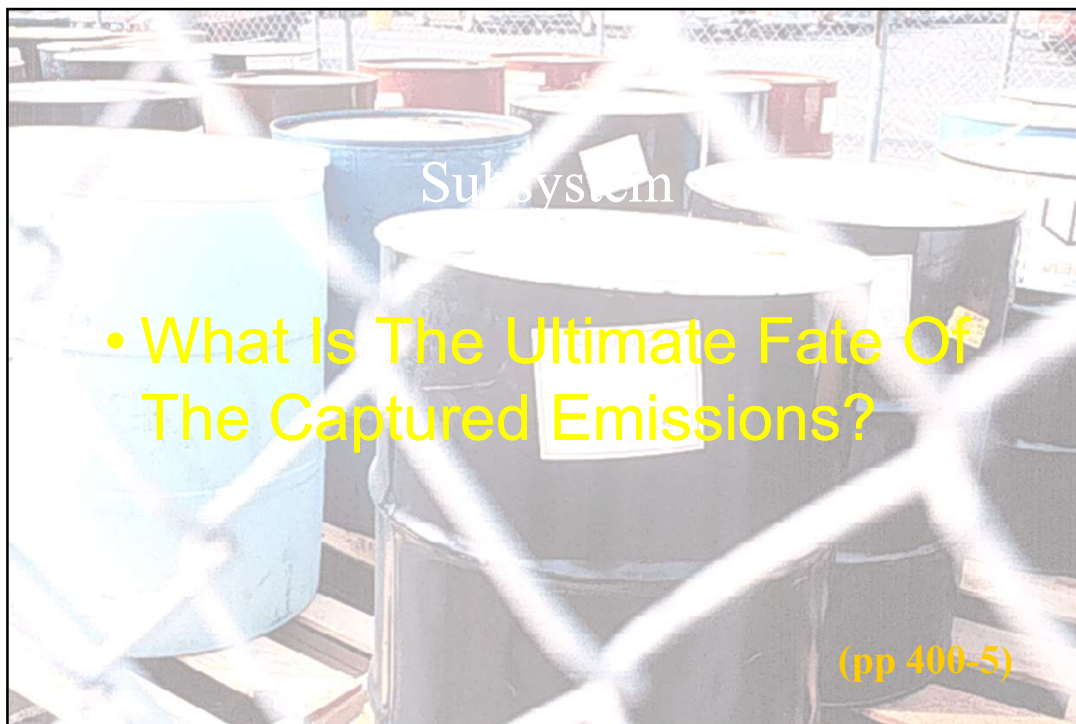
- Are The Proper Instruments Present?
- Do The instruments Appear To Be Functioning?
- Are The Instruments Showing The Appropriate Units As Referenced On The PTO?



Control Device

- Is it Functioning?
- Are There Any Visible Emissions?
- Are There Any Leaks Being Handled?

(pp 400-5)



Solvent Waste
Storage

What About Violations?

- Notice To Comply (NTC)

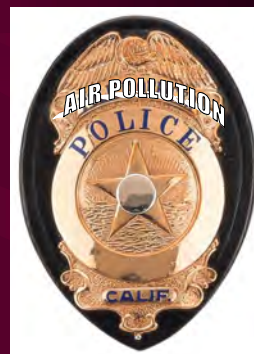
- Minor Deficiency
- Non-Emissions Related
- Non-Recurring



What About Violations?

- Notice Of Violation (NOV)

- Emissions Related
- Same Problem As Last Inspection



Reason To Issue An NTC

- Incomplete Records
- Minor Equipment Change Without Notifying The AQMD
- Some Records Missing
(If Not Emissions Related)

Reason To Issue An NOV

- Exceeded Permitted Solvent Usage Limit
- Missing Or Incomplete Information Necessary To Determine Compliance
- Open Container
- Control Equipment Malfunction
- Failed Source Test
- Same Violation As Their Last Inspection

Four Options After An NOV

- Continue To Operate In Violation
- Cease The Noncompliant Activity
- Correct The Problem
- Apply For A Variance





Post - Inspection

Remember That You Have All The Information To Determine Compliance Before You Leave The Facility

- Explain Results To Facility Manager
- Follow-up On All Violations

WEB SHOTS



Rule Discussion

- Exemptions
- Equipment Requirements
- Operating Requirements
- State BACT/RACT
- Federal NESHAPS/MACT

(Sec 500)

Exemptions

- Grandfather Exemptions
- Source Category Exemption
- Size Exemptions
- Equipment Exemptions
- Process Exemptions

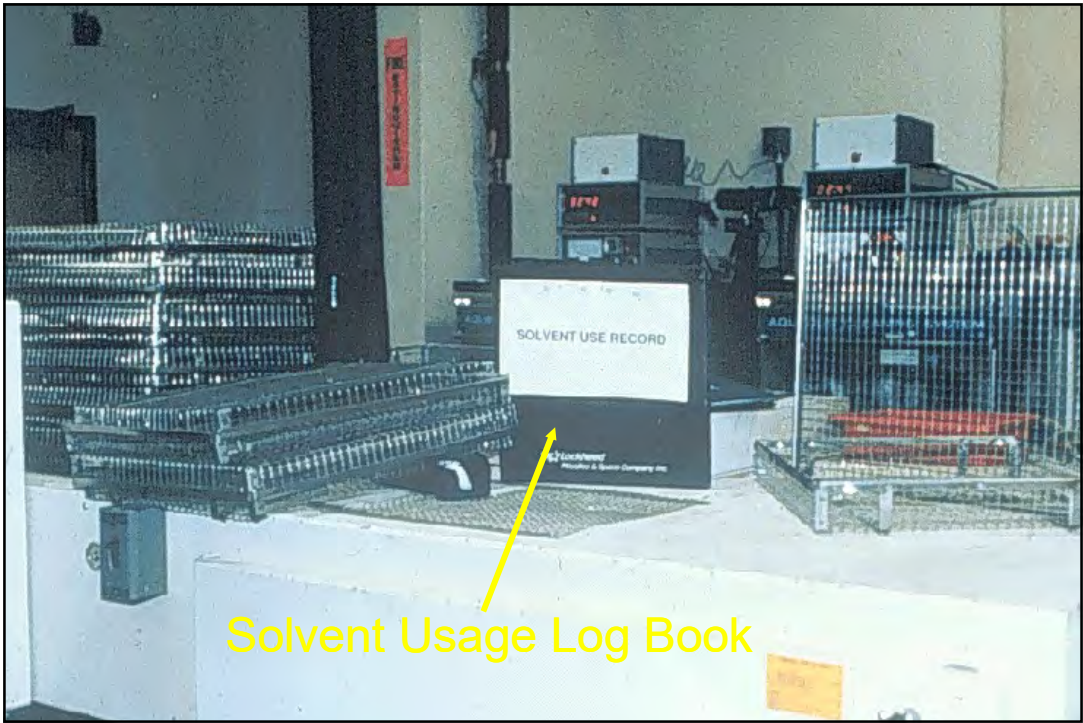
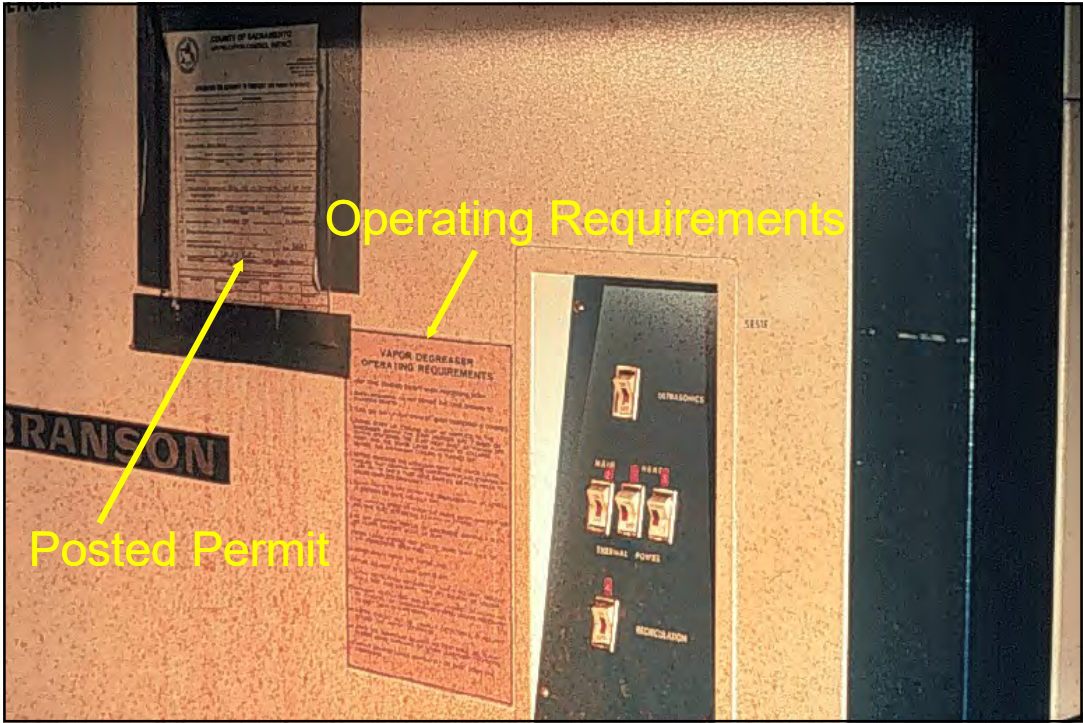
(Sec 500)

Authority To Construct And Permit To Operate

- Specified Conditions
- Maintenance Program
- Monitoring And Records
- Rule Limitations/Violations
- Records Reporting
- Maintenance Logs
- Manuals For O & M



(pp 500-2 &3)



General Requirements

- Operating Conditions
- Solvent Agitation
- Porous Material
- Hoist Speed
- Parts Dry
- Lip Exhaust



(Sec 500)

Cold/Vapor Degreasers

- Container
- Cover
- Drag Out/Drying Rack
- Control Equipment
 - Freeboard Ratio
 - Refrigerated Freeboard Chiller
 - Carbon Adsorption
 - Other Control Methods



(Sec 500)

Conveyorized Degreasers

- Hood
- Drying Tunnel
- Silhouetting

(Sec 500)

Equipment Breakdown

- Typical Conditions
- Breakdown Records
- Breakdown Repair



CALIFORNIA RACT/BARCT

- Covers All Types Of Cleaners
- Equipment Standards
- Operating Standards
- Prohibitions
- Exemptions

Federal NESHAPS/MACT For Halogenated Compounds (40 CFR 63 Subpart T)

- Applicability
- Exemptions
- Standards
- Tests, Recordkeeping & Reporting
(Sec 500)

Halogenated Solvents, NESHAP Degreasing

Applicability

- Sources (regardless of annual emissions) using:
 - Batch Cold Cleaning Machines
 - Batch Vapor Cleaning Machines
 - In-line Vapor Cleaning Machines Using:
 - Methyl Chloride
 - Trichloroethylene
 - Carbon Tetrachloride
 - Perchloroethylene
 - 1,1,1-trichloroethane
 - Chloroform

Hal. Sol. NESHAP - Degreasing

Exemptions

- Total concentration of one or more of the six solvents must exceed five percent by weight for the rule to apply
- Does not apply to hand wiping
- Contains 2 gallons or Less

Hal. Sol. NESHAP - Degreasing

Standards - Batch cold Cleaners

- Must use a tightly fitting lid that is kept closed except when loading or unloading, and a one inch layer of water on solvent surface; or
- Must use a tightly fitting lid that is kept closed except when loading or unloading and have a freeboard ratio of > 0.75 ; or
- Remote reservoir machines must employ a tightly fitting lid over sump and lid must be kept closed except during parts cleaning

Hal. Sol. NESHAP - Degreasing

Standards - Batch cold Cleaners - work practices for control options 2 and 3

- Collect & store waste solvent in closed containers;
- Flushing in freeboard area only;
- Drain cleaned parts for 15 seconds or until dripping stops, whichever is greater;
- Clean spills immediately;
- Store rags in covered container;
- Minimize solvent agitation to avoid splashing;
- Control room drafts when cover is open; and
- Cleaning of sponges, fabric, wood & paper products is prohibited.

Hal. Sol. NESHAP - Degreasing

Tests, Recordkeeping & Reporting
Batch Cold Cleaning - One Time

- Initial compliance report stating required covers are free of holes, cracks or other emission impacting defects.

Hal. Sol. NESHAP - Degreasing

Standards - Batch Vapor & In-line Vapor Cleaners
Option 1 & 2 equipment design requirements

- Idling and downtime cover, or reduced room draft
- Freeboard ratio ≥ 0.75
- Automated parts handling with velocity ≤ 11 ft/Min
- Device to shut off sump heater if vapor level rises above primary condenser
- If lip exhaust is used, collected vapors must be routed to a carbon adsorber.

Hal. Sol. NESHAP - Degreasing

Standards - Batch Vapor & In-line Vapor Cleaners

Work practice standards

- Maintain equipment as recommended by manufacturer
- Minimize air disturbances in the machine room
- Minimize air disturbances due to parts movement
- Minimize solvent loss due to spraying operations
- Reduce pooling of solvent on and in parts
- Follow proper startup and shutdown procedures
- Follow proper solvent transfer procedures
- Store waste solvent in a closed container
- Do not clean absorbent materials
- Be prepared to take and pass an operator test.

Hal. Sol. NESHAP - Degreasing

Standards - Batch Vapor Cleaners with Air/Solvent Interface of $\leq 13 \text{ ft}^2$ - Acceptable Control Options

0.045 lbs/hr ft² of solvent - air interface area or

- Working mode cover and freeboard ratio of 1.0 and superheated vapor
- Super heated vapor and freeboard refrigeration
- Working mode cover and freeboard refrigeration
- Refrigerated freeboard and reduced room draft
- Freeboard ratio of 1.0 and refrigerated freeboard
- Refrigerated freeboard and dwell
- Freeboard ratio of 1.0 and reduced room draft and dwell
- Refrigerated freeboard and carbon adsorber
- Freeboard ratio of 1.0 and super heated vapor and carbon adsorber

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Standards - In Line Vapor Cleaners Acceptable Control Options

0.021 lbs/hr ft² of solvent - air interface area or

- If installed before August 29, 1995
 - Freeboard ratio of 1.0 and superheated vapor
 - Freeboard ratio of 1.0 and freeboard refrigeration
 - Freeboard refrigeration and dwell
 - Carbon adsorber and dwell
- If installed after August 29, 1995
 - Super heated vapor and refrigerated freeboard
 - Freeboard refrigeration and carbon adsorber
 - Super heated vapor and carbon adsorber.

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Tests, Recordkeeping & Reporting

Batch Cold Cleaning

- Log of new solvents and discontinued solvents
- Calculations showing three month average monthly emission of less than 30.7 lbs per ft² per month

Hal. Sol. NESHAP - Degreasing

Tests, Recordkeeping & Reporting

In Line Cleaning

- Log of new solvents and discontinued solvents
- Calculations showing three month average monthly emission of less than
 - If installed before August 29, 1995
 - 31.4 lbs per ft² per month
 - If installed after August 29, 1995
 - 20 lbs per ft² per month