

Expert System for Paint VOC/HAP Compliance

Presented by:

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Presentation Outline

- Background
- NESHAPs for Painting and Coating
- Reports (NESHAPs, Title V, TEDI/ESI/TRI etc.)
- Expert System for Paint VOC/HAP Compliance
- Software Demonstration
- Questions / Answers

Background

- Painting/Coating operations emit VOCs, VOHAPs which are regulated by NESHAPs, Title V, and others
- Compliance requires tracking a variety of data, calculations, controls, record-keeping, and reporting
- This is often tedious, error-prone due to complexity, and expensive
- Non-compliance results in major complications

NESHAPs

- Major Source: A source or group of sources under common control that **emits** or has the **potential to emit**,
 - 10 tpy or more of any individual HAP or
 - 25 tpy or more of any combination of HAP.
- Limits on the VOHAP content of 23 types of coatings used at shipyards
- Compliance with the VOHAP limits must be demonstrated on a monthly basis; in some cases, may be more often

Coating Category	grams/liter coating (minus water and exempt compounds)	VOHAP limits ^{a,b,c} grams/liter solids ^d	
		t > 4.5 degrees C (40 degrees F)	t < 4.5 degrees C ^e (40 degrees F)
General	340	571	728
Specialty	--	--	--
Air flask	340	571	728
Antenna	530	1,439	--
Anti-foulant	400	765	971
Heat resistant	420	841	1,069
High gloss	420	841	1,069
High-temperature	500	1,237	1,597
Inorganic zinc high-build	340	571	728
Military exterior	340	571	728
Mist	610	2,235	--
Navigational aids	550	1,597	--
Nonskid	340	571	728
Nuclear	420	841	1,069
Organic zinc	360	630	802
Pretreatment wash primer	780	11,095	--
Repair, maint. of thermoplastics	550	1,597	--
Rubber camouflage	340	571	728
Thermal spray aluminum sealant	610	2,235	--
Special marking	490	1,178	--
Specialty interior	340	571	728
Tack coat	610	2,235	--
Undersea weapons system	340	571	728
Weld-through preconstruction primer	650	2,885	--

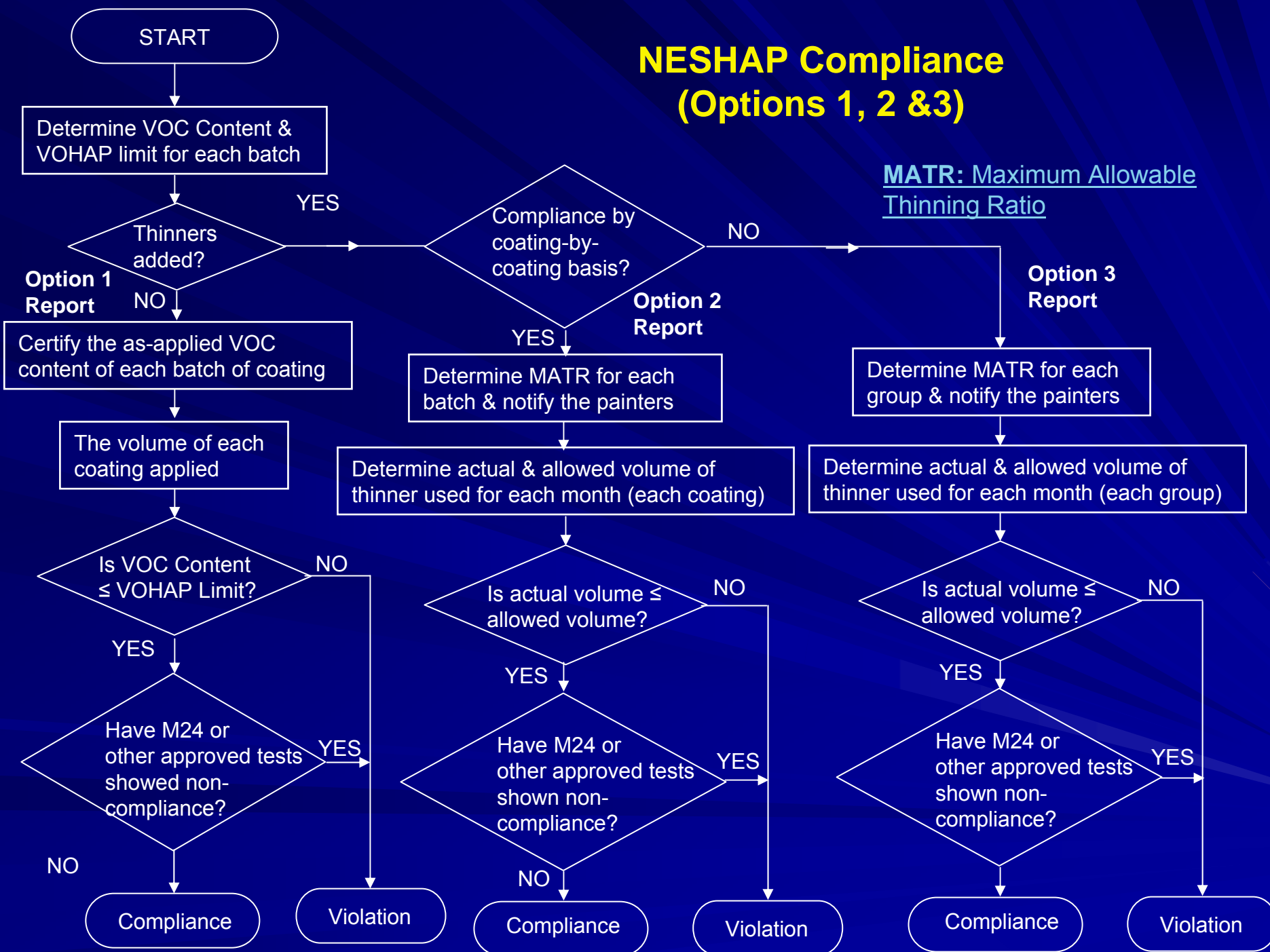
NESHAPs

- The NESHAP requires existing and new major sources to control HAP emissions using MACT
- A variety of HAPs are used as solvents in marine coatings (e.g., xylene, toluene, ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, ethylene glycol, and glycol ethers)
- The potential toxic effects upon exposure to these pollutants include irritation of the eye, nose, throat, and skin and damage to the blood cells, heart, liver, and kidneys
- The objective is to protect the public health by requiring the maximum degree of reduction in emissions of VOHAPs from new and existing sources

NESHAP Reports

- ***Option 1 Compliance (No Thinner):***
 - Certification of the as-applied VOC content of each batch of coating (coating-by-coating)
- ***Option 2 Compliance (with Thinner):***
 - Compliance demonstration for each batch of coating (coating-by-coating)
- ***Option 3 Compliance (with Thinner):***
 - Compliance demonstration by group based on thinner
- ***Option 4 Compliance (VOHAP testing for Options 1-3)***

NESHAP Compliance (Options 1, 2 & 3)



Maximum Allowable Thinning Ratio (MATR)

$$R = \frac{(V_s)(\text{VOHAP limit}) - m_{\text{VOC}}}{D_{\text{th}}} \quad \text{Eqn. 1}$$

where:

- R = Maximum allowable thinning ratio for a given batch (L thinner/L coating as supplied)
- V_s = Volume fraction of solids in the batch as supplied (L solids/L coating as supplied)
- VOHAP limit = Maximum allowable as-applied VOHAP content of the coating (g VOHAP/L solids)
- m_{VOC} = VOC content of the batch as supplied [g VOC /L coating as supplied]
- D_{th} = Density of the thinner (g/L).

If V_s is not supplied directly by the coating manufacturer, the owner or operator shall determine V_s as follows:

$$V_s = 1 - \frac{m_{\text{volatiles}}}{D_{\text{avg}}} \quad \text{Eqn. 2}$$

where:

- $m_{\text{volatiles}}$ = Total volatiles in the batch, including VOC, water, and exempt compounds (g/L coating); and
- D_{avg} = Average density of volatiles in the batch (g/L)

Regulations & Reports

- NESHAPs (National Emission Standards for Hazardous Air Pollutants)
- TEDI (Toxic Emissions Data Inventory): State Specific
- EIS (Emissions Inventory Summary); State Specific
- TRI (Toxics Release Inventory)

Environmental Regulations

- Air Permit
- Wastewater Permit
- HW Generator Permit



Painting



Welding



Blasting



Cutting



Solvent
Degreasing



Combustion
Sources

Pollution Controls



- Air Pollution Controls
- Wastewater Treatment
- Solid Waste Treatment

Release Calculations

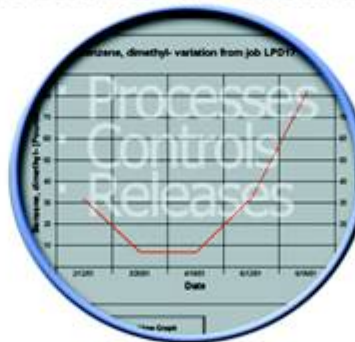
- EPA Emissions Factors
- Mass Balance Approach
- Engineering Methods

Environmental Releases



- Air Emissions
- Wastewater
- Solid/Haz. Waste

Environmental Performance



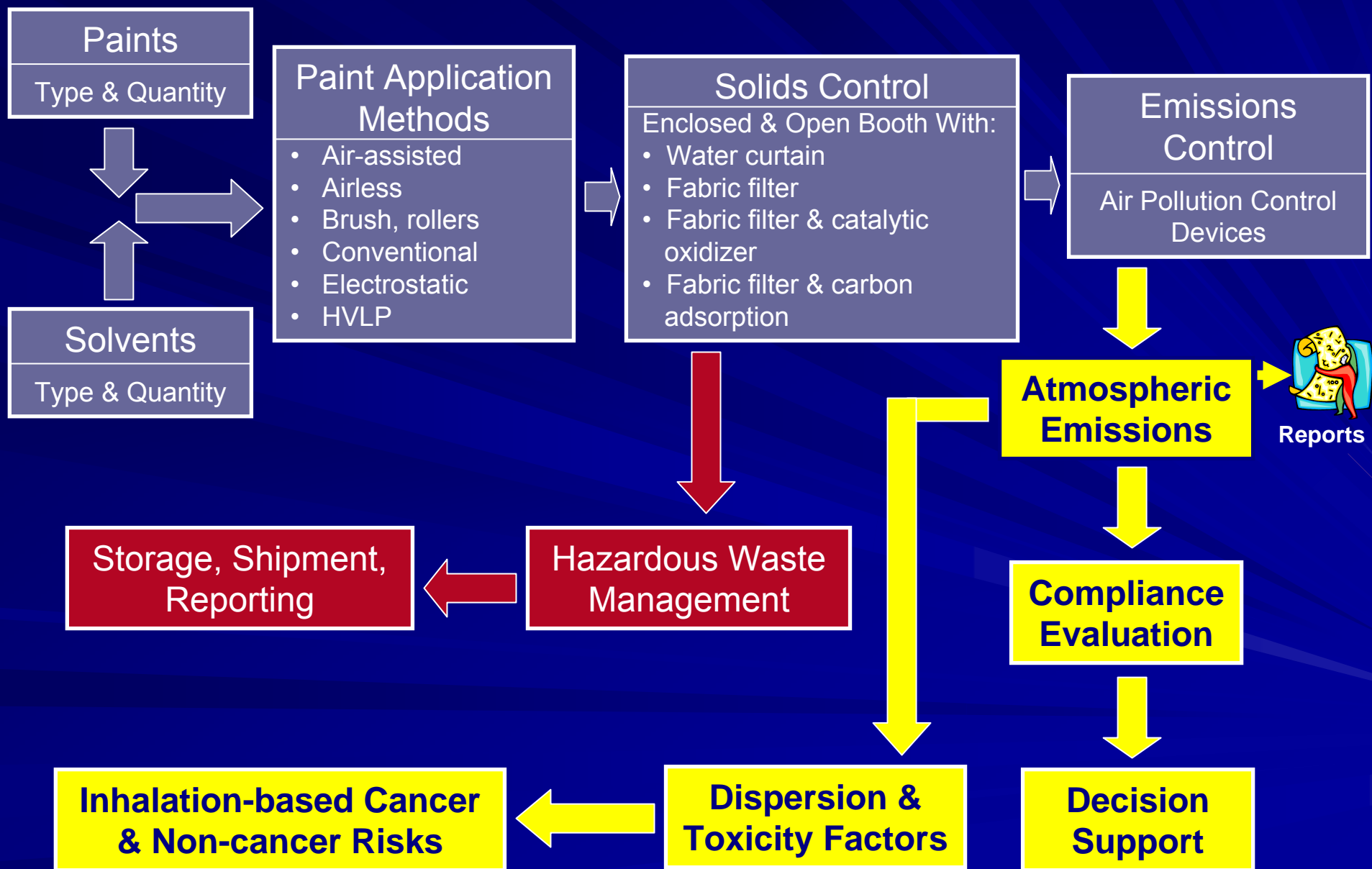
Compliance Reports (EPA/State)

The logo for "expert EMS" features a stylized lighthouse icon to the left of the text "expert" in red and "EMS" in blue. Below the logo is the text "An Expert Environmental Management System for Shipyards".

expert
EMS

An Expert Environmental
Management System
for Shipyards

Paint VOC/HAP Compliance



ES for VOC/HAP Compliance: Salient Features

- Web-based, automated (knowledge-based) system
 - Only Internet browser required
 - Access from anywhere (paint shops; home; road; airport; handheld organizers with internet access)
- In addition to VOCs, this system also manages HAPs, NESHAP compliance, reports (Title V, federal, state etc.), residual risk, decision support
- Compatibility with other databases and ERPs (SAP and Oracle)

ES for Paint VOC/HAP Compliance: Components and Features

- Onetime input
 - Sources, stacks, and control equipment
- Continuous input
 - Usage: Paints, Thinners, Cures; MSDS
- Output: Automated reports
 - NESHAP; EIS; TEDI; Title V; Risk Reports (Actual; Potential); TRI; Tier II
- Analysis: Decision support
 - Compliance (NESHAP; Title V); Trends; Cleaner Alternatives; Many others

Analysis / Decision Support

- Historical trends
- Comparisons
 - Year to Year
 - Source to Source
 - Paint type to Paint type
 - Job to Job
- Limits vs. actual (midway in a year / anytime)
- Planning and P2 implementation
- Troubleshooting
- Emission calculator

Benefits of Expert System for Paint VOC/HAP Compliance

- Time
- Productivity
- Data in one place
- Reports anytime
- Cleaner alternatives
- Cont. status on emissions vs. limits
- Preparedness
- Audit assistance
- Public relations
- Concessions from EPA and others
- Job-wise data
- Paint-wise data
- Location-wise data
- Training
- Cost savings
- Stress reduction
- Better decisions
- Emission calculator and forecasting
- Liability reduction
- Waste / risk reduction
- Several others

Expert System for Paint
VOC/HAP Compliance
Demo