

AP42 Section:	4.2.2.9
Title:	Pressure Sensitive Tape and Labels Background information from June 1981 (last time updated) Draft Section Pressure Sensitive Tape and Label Surface Coating Operations AP42 Emission Factor Rating for Table VOC Species Data Manual Update specific to adhesives

4.2.2.9 Pressure Sensitive Tapes And Labels

Background Documentation June 1981

Title: AP-42 4.2.2.9 Pressure Sensitive Tape and Labels
Enclosure 1: Draft Section
Enclosure 2: AP-42 Emission Factor Documentation
Pressure Sensitive Tape and Label Surface
Coating Operations
Enclosure 3: AP-42 Emission Factor rating for Table 4.10-1
Enclosure 4: VOC Species Data Manual - Update, specific to
adhesives

numbering to be changed

ENCLOSURE 1

DRAFT

Compilation of Air Pollutant Emission Factors for AP-42

4.2.2.9

~~4.10~~ PRESSURE SENSITIVE TAPE AND LABELS ~~SURFACE COATING~~

4.10.1 GENERAL¹⁻⁵

The coating of pressure sensitive tapes and labels (PSTL) is an ~~converting~~ operation, one in which some backing material (paper, cloth, or film) is coated to create a tape or label product that sticks on contact. The term pressure sensitive indicates that the adhesive bond is formed on contact, without wetting, heating, or adding a curing agent.

The products manufactured by the PSTL ~~surface coating~~ industry may ~~have~~ ^{receive} several different types of coatings. ^{applied to them} The two primary types of coatings ~~applied~~ are adhesives and releases. Adhesive coating is a necessary step in the manufacture of almost all PSTL products. It is generally the heaviest coating (typically 0.051 kg/m²) and therefore, results in the highest level of solvent emissions (generally 85 to 95 percent of total line emissions).

Release coatings are applied to the backside of tape or to the mounting paper of labels. The function of the release coating is to allow smooth and easy unrolling of the tape, or removal of the label from the mounting paper. Release coatings are applied in a very thin coat (typically 0.00081 kg/m²), thereby reducing the quantity of emissions in comparison to adhesive coating. ^{there isn't a reduction, but less solvent emission}

Five basic coating processes can be used to apply both adhesive and release coatings. The five processes include:

- solvent-based coating,
- waterborne (emulsion) coating,
- 100 percent solids (hot melt) coating,
- calendar coating, and
- pre-polymer coating.

A solvent-based coating process is used to produce 80 to 85 percent of all products in the PSTL industry. Essentially all of the solvent

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emissions from the PSTL industry result from solvent-based coating. The other four processes either do not emit any solvent or the quantity emitted is insignificant when compared to the level of solvent-based coating emissions. Because of its broad application and significant emissions, solvent-based coating of PSTL products will be discussed in greater detail.

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4.10.2 PROCESS DESCRIPTION^{1,2,5}

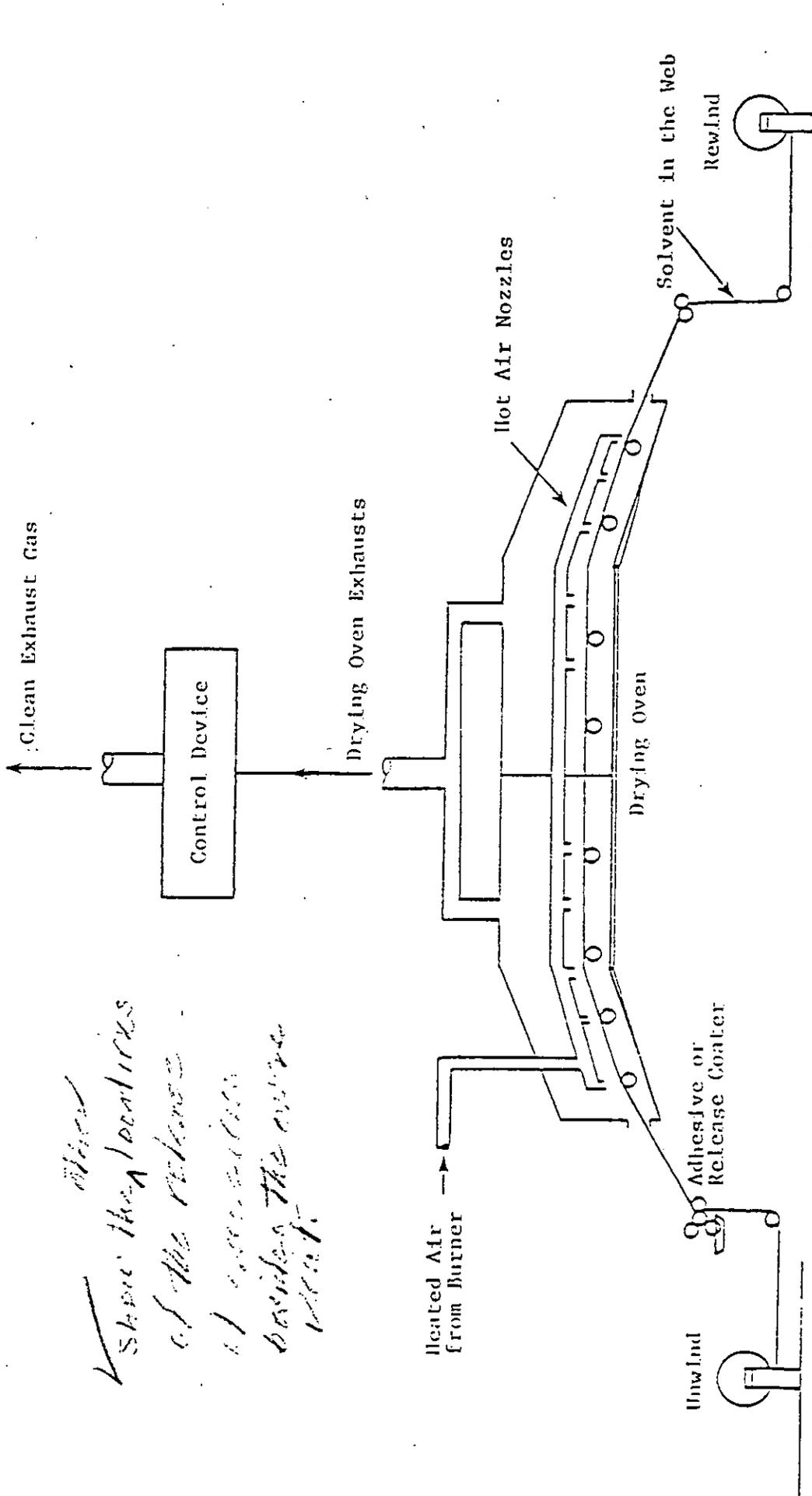
Solvent-based surface coating is (conceptually) a simple process. ~~Most simply~~ a continuous roll of backing material (called ~~the~~ web) is unrolled, coated, dried, and rolled up again. A typical ~~(solvent-based)~~ coating line is shown in Figure 4.10-1. To initiate the coating process the continuous web material is unwound from its roll. From there it travels to a coating head. The solvent-based coating formulation is applied at the coating head. These formulations have specified levels of solvent and coating solids by weight. On the average solvent-based adhesives ^{formulations are} contain approximately 67 weight percent solvent and 33 weight percent coating solids. Solvent-based releases average about 95 weight percent solvent and 5 weight percent coating solids. The solvent portion of the solvent-based coatings includes organics such as toluene, xylene, heptane, hexane, and methyl ethyl ketone. The coating solids portion of the formulations consists of: elastomers (natural rubber, styrene-butadiene rubber, polyacrylates), tackifying resins (polyterpenes, rosins, petroleum hydrocarbon resins, and asphalts), plasticizers (phthalate esters, polybutenes, and mineral oil), and fillers (zinc oxide, silica, and clay).

Three basic categories of coating heads are used in the PSTL industry. The type of coating head used has a great effect on the quality of the coated product, but only a minor effect on overall emissions. The first category operates by applying excess coating to the web, and then scraping it off to a desired thickness. Examples of this type of coater are the knife coater, blade coater, and metering rod coater. The second category of coating head meters on a predetermined amount of coating. Gravure and reverse roll coaters are the most common types in this category. The third category of coating head does not actually apply a surface coating, but rather it saturates the web backing. The most common example in this category is the dip and squeeze coater.

^{movers} After the solvent-based coatings have been applied, the wet web is ~~is~~ ~~(transported)~~ into the drying oven where the applied solvents are evaporated from the web. The ~~most~~ important ^{of drying oven} properties in the operation of a drying oven are:

- the source of heat,
- the temperature profile,

Characteristics?



Show the locations of the release of solvents besides the oven when.

Figure 4.10-1. Diagram of a Pressure Sensitive Tape and Label Surface Coating Line

Delete dots → the residence time, ^{in the dryer air}
the allowable hydrocarbon concentration, and
the oven air circulation.

Two basic types of heating are used in conventional drying ovens, direct and indirect. Direct heating ^{uses} the hot products of combustion gas (blended ~~off~~ with ambient air to the proper temperature) directly into the drying zone. With indirect heating the incoming ^{oven} air stream ^{is heated in a heat} ~~heat~~ with steam or ^{hot} combustion ^{gas} products, but does not physically mix with them. Direct-fired ovens are more common in the PSTL industry because of their higher thermal efficiency. Indirect-heated ovens ^{are less energy efficient} ~~lose efficiency~~ both in the production of steam and in the heat transfer ^{from steam to} oven air.

Temperature control in the drying ovens is an important consideration in PSTL production. ~~For drying purposes~~ the oven must be at a temperature above the boiling point of the applied solvent. However, the ^{is this word necessary?} average temperature must be controlled so that coating flaws known as "craters" or "fish eyes" will not develop. These flaws develop if the initial ~~web~~ drying ~~step~~ proceeds too quickly. To avoid this problem, ^{are less energy efficient} ~~manufacturers~~ control the oven temperature profile by using multizoned ovens. ⁽³⁾ These ovens are physically divided into several sections, each with its own hot air supply and exhaust. By keeping the temperature of the first zone low, and then gradually increasing ^{in subsequent zones}, uniform drying can be accomplished without flaws. After ~~exiting~~ the drying oven, the continuous web is wound up on a roll ^{and the coating process} ~~finished~~. ^{complete}

4.10.3 EMISSIONS AND CONTROLS

4.10.3.1 EMISSIONS ^{1,6-10}

The only pollutants emitted in significant quantities from solvent-based coating of pressure sensitive tapes and labels are volatile organic compounds (VOC) resulting from solvent evaporation. In an uncontrolled facility, essentially all of the solvent used in the coating formulation is emitted to the atmosphere. Of these uncontrolled emissions, 80 to 95 percent are ^{emitted} ~~contained~~ in the drying oven exhaust. Some solvent (from zero to five percent) can remain in the final coated product, although this solvent will eventually evaporate into the atmosphere ~~with time~~. The remainder of applied solvent is lost from a ^{number of} ~~variety~~ of small sources ^{toward} referred to collectively as fugitive emissions. The major VOC emission points in a PSTL surface coating operation are indicated in Figure 4.10-1.

Fugitive emissions may occur at any point in the solvent handling process, such as:

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- from solvent storage tanks,
 - from equipment cleaning,
 - from miscellaneous spills,
 - from coating formulation mixing tanks,
 - from drying oven leaks, and
 - from the coating operation itself. — meaning?

but source must account for them to accurately report VOC

Fugitive losses from the first five sources are relatively small and are not associated directly with the PSTL surface coating ^{operation} process. For these reasons, emission factors for fugitive emissions from storage, cleanup, mixing, leaks, and spill; are not addressed.

identity poor

Fugitive solvent emissions during the coating process come from the unintentional evaporative loss of solvent around the coating head and from the exposed wet web prior to its entering the drying oven. The magnitude of these losses is determined by the size of the equipment, the line speed, the volatility and temperature of the solvent, and the air turbulence in the coating area.

Is any qualifier word needed? Unintentional is not appropriate

one paragraph (14) (15)

Since the first two factors also determine production rate, an interesting relationship exists. Fugitive emissions increase with increasing web width, but decrease with increasing line speed. Since most production gains are achieved by increasing both web width and line speed, only a small change results in the absolute magnitude of the fugitive emissions. However, since oven emissions increase significantly with increasing production, fugitive emissions decrease when expressed as a percent of the total process emissions. Thus a small coating line might have emissions that are 20 percent fugitive and 80 percent oven, while a large facility would be 5 percent fugitive and 95 percent oven.

some problems with way it is written

The level of fugitive VOC emissions from the coating process can also be affected by the type of coating head used. Coaters which use a pan type feed system expose more area to evaporative loss than those using a nozzle type feed system. Similarly, the more complex coaters with several coating rollers have a much larger exposed area than do simpler designs.

Two ^{basic} other factors which directly influence overall emissions are the weight of the applied coating (coating thickness) on the web and the solvent-to-solids ratio of the coating formulations. Provided the formulation's solvent-to-solids ratio remains constant during coating, any increases in coating weight would produce higher levels of VOC emissions. The solvent-to-solids ratio in coating formulations is not constant industry-wide. This ratio varies widely between products. If the coating weight is held constant, greater emissions will be produced by increasing the weight percent solvent of a particular formulation.

Since names, pan and nozzle, were not described on page 4.10-2 so don't recognize them relative to descriptions on 4.10-2. This needs to be clear.

These two operating parameters combined with line speed, line width, solvent volatility, ~~etc.~~ produce an immense number of potential mass emission situations. For this reason it is very difficult to characterize the emissions of a typical PSTL surface coating operation. Table 4.10-1 presents emission factors for controlled and uncontrolled PSTL surface coating operations. The emission factors presented in Table 4.10-1 attempt to estimate emissions based on the average contribution to total line emissions, of each distinct emission source. Note that the potential amount of VOC emissions from the coating process is equal to the total amount of solvent applied at the coating head.

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Controls^{1,6-20}

The complete air pollution control system for a modern pressure sensitive tape or label surface coating facility consists of two sections: the solvent vapor capture system and the emission control device. The capture system collects VOC vapors that are emitted from the coating head, the wet web, and the drying oven. The captured vapors are directed to a control device where they are either recovered (as liquid solvent) or destroyed. As an alternative emission control technique, some manufacturers in the PSTL industry are able to use low-VOC content coatings to reduce their VOC emissions. Waterborne and hot melt coatings and radiation-cured pre-polymers are examples of these low-VOC content coatings. Emissions of VOC from such coatings are negligible or zero. Low-VOC content coatings are not universally applicable to every product produced by the PSTL industry. (Presently about 25 percent of the production in this industry can utilize these innovative coatings.)

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Capture Systems - In a typical PSTL surface coating facility the majority of VOC emissions from the coating process are captured in the coating line drying ovens. Large fans are used to direct emissions captured in the drying oven to a control device. In some facilities a portion of the drying oven exhaust is recirculated back into the oven instead of being sent on to a control device. Recirculation is used to increase the VOC concentration of the drying oven exhaust gases going to the control device. (Isn't there a limit for explosion safety?)

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The predominant aspect of capture in a PSTL facility involves the capture of fugitive VOC emissions. Basically three techniques can be used to collect fugitive VOC emissions from PSTL coating lines. The first technique involves the use of floor sweeps and/or hooding systems around the coating head and exposed coated web. Fugitive emissions which are collected in the hoods can be directed into the drying oven and on to a control device or they can be sent directly into the control device.

The second capture technique involves totally enclosing the entire coating line or the coating line application and flashoff areas. By

Table 4.10-1. EMISSION FACTORS FOR PRESSURE SENSITIVE TAPE AND LABEL SURFACE COATING OPERATIONS
Emission Rating Factor: C

Emission Points	Normethane VOC Emissions ^a		
	Uncontrolled	85% Control	90% Control
	kg/kg	kg/kg	kg/kg
Drying Oven Exhaust ^b	0.80-0.95	—	—
Fugitives ^c	0.01-0.15	0.055-0.095	0.0025-0.0425
Product Retention ^d	0.01-0.05	0.01-0.05	0.01-0.05
Control Device ^e	—	0.045	0.0475
Total Emissions ^f	1.0	0.15	0.10

^aMass of volatile organic compounds (VOC) emitted per mass of total solvent used are more accurate factors. Solvent is assumed to consist entirely of VOC.

^bBased on References 1, 6, 7, and 9. Dryer exhaust emissions depend on coating line operating speed, frequency of line downtime, coating composition, and oven design.

^cDetermined by difference between total emissions and other point sources. The magnitude of these losses is determined by the size of the line equipment, the line speed, the volatility and temperature of the solvents, and the air turbulence in the coating area.

^dBased on References 6, 7, and 8.

^eBased on capture and control device efficiencies - see note f. Emissions are residual content in captured solvent laden air vented after treatment.

^fUncontrolled coating lines eventually emit one hundred percent of all solvents used. Controlled coating line emissions are based on an overall reduction efficiency which is equal to capture efficiency times control device efficiency. For 85 percent control, the capture efficiency is 90 percent with a 95 percent efficient control device. For 90 percent control, the capture efficiency is 95 percent with a 90 percent efficient control device. See References 1, 10, 16, 17, and 18.

The values in the table are accurate. This is because the capture efficiency is 90% and the control device efficiency is 95%.

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maintaining a slight negative pressure within the enclosure, a theoretical capture efficiency of 100 percent is possible. Again the captured emissions are directed by fans into the oven or on to a control device. The third capture technique is an expanded form of total enclosure. ~~With the third technique,~~ the entire building or structure which houses the coating line acts as a total enclosure. The entire room air is vented to a control device. The maintenance of a slight negative pressure ensures that very few emissions would be escaping the room.

The efficiency of any vapor capture system is highly dependent on its design and its degree of integration with the coating line equipment configuration. While striving to achieve maximum vapor capture, the design of any system must be ~~versatile enough to allow safe and adequate access to the coating line equipment during maintenance periods.~~ The system must also be designed to protect workers from exposure to unhealthy concentrations of the organic solvents used in these surface coating processes. The efficiency of ^{well designed} these combined dryer exhaust and fugitive capture systems, ~~in the PSTL industry, has been determined to be 95 percent, in a well designed facility.~~

Control Devices - The control devices and/or techniques that may be used to control captured VOC emissions from ~~PSTL surface coating~~ can be classified into two categories: solvent recovery and solvent destruction. ~~Presently in the PSTL industry,~~ fixed-bed carbon adsorption is the primary solvent recovery technique used. In fixed-bed adsorption the solvent vapors are first adsorbed onto the surface of activated carbon. Following adsorption the solvent is regenerated by using steam. Solvent recovered in this manner may be reused in the coating process or sold to a reclaimer. The efficiency of carbon adsorption systems can reach 98 percent, however, a 95 percent efficiency is more characteristic of continuous long term operation.

The primary solvent destruction technique used in the PSTL industry is thermal incineration. ~~Thermal incineration of VOC emissions from PSTL surface coating~~ ^{which} can be as high as 99 percent efficient. ~~However,~~ ^{experience,} continuous long term operation of incineration devices has shown that 95 percent efficiency is more characteristic. Catalytic incineration ~~could~~ ^{can} also be applied to control VOC emissions from this industry with the same success as thermal incineration, however, no catalytic devices have been identified in the ~~PSTL~~ industry.

The performance of carbon adsorption and thermal incineration control techniques on PSTL coating VOC emissions ~~was~~ ^{has been} determined to be equal. Control device emission factors presented in Table 4.10-1 represent the residual vapor content left in the solvent-laden ^{exhaust} air stream after treatment.

*Part of this
is already in the fact sheet
for the factors table.*

Overall Control - The overall ^{emission} reduction efficiency for VOC emission control systems is equal to the capture efficiency times the control device efficiency. Emission factors for two control levels are presented in Table 4.10-1. The 85 percent control level represents 90 percent = 85.5% capture with a 95 percent efficient control device. The 90 percent control level represents 95 percent capture with a 95 percent efficient = 90.25% control device. This 90 percent level corresponds to the application of best demonstrated technology evaluated by EPA for PSTL surface coating processes.

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ENCLOSURE 2

AP-42 EMISSION FACTOR BACKGROUND DOCUMENTATION PRESSURE SENSITIVE TAPE AND LABEL SURFACE COATING OPERATIONS

This section contains the data and calculations used in determining the VOC emission factors for pressure sensitive tape and label (PSTL) surface coating operations. The emission factors are presented in Table 4.10-1 of AP-42. VOC emissions are the only air pollutants discussed. The reasoning and assumptions used in selecting the emission factors are presented in this documentation.

The emission factors are expressed as a ratio of the mass of VOC emitted per mass of total solvent used. Where applicable, ranges were given to show the degree of variability involved in the large variety of PSTL coating operations. Only a single factor is given for control device emissions, however, because this factor is set by the capture and control device efficiencies inherent in the two control levels (85 and 90 percent) examined. Emissions from uncontrolled coating lines are described as occurring from drying oven exhausts, fugitive solvent vapors, and from solvent retained in the product. For controlled coating lines, the drying oven exhaust emissions are replaced by much lower control device outlet emissions. Each category of emission factors is discussed below.

I. Uncontrolled Emission Factors¹⁻⁵

Emission factors for uncontrolled coating lines are based on the combination of information from EPA's Control Techniques Guideline (CTG) document for surface coating and information on coating line emissions obtained from various tape and label manufacturers. The primary assumption applied to this information was that 100 percent of the total solvent used at the coating line is vaporized and emitted to the atmosphere. Information from several coaters of pressure sensitive tape and label products indicates that from 80 to 95 percent of the total solvent used is emitted through drying oven exhausts. Although no hard data existed on product solvent retentions, manufacturers in the tape and label industry estimated the retention to be from one to five percent of the total solvent used. This retention range was assumed to remain the same in both the controlled and uncontrolled cases. The fugitive emission factors were determined from data submitted by tape and label coaters and by estimating the differences between total emissions and other point source emissions. Factors such as line speed, web width, solvent volatility, solvent temperature, and coating head configuration all affect fugitive emission levels. A summary of all point source emission factors for the PSTL industry is given below:

<u>Emission Points</u>	<u>kg/kg (lb/lb)</u>
Drying Oven Exhaust	0.80-0.95
Fugitives	0.01-0.15
<u>Printed Product</u>	<u>0.01-0.05</u>
Total Emissions	1.00

Facility: Individual coating line.

II. Eighty-five Percent Controlled Emission Factors¹⁻⁶

Emission factors representing 85 percent overall control are based on existing coating lines which are equipped with older-type design VOC control systems. In the 85 percent case only drying oven exhausts are captured. No test data are available for these type controlled coating lines. The overall control efficiency and control device efficiency were determined from recommendations presented in EPA's CTG document on the PSTL industry, from VOC control information submitted by various PSTL firms, and from limited test data on older PSTL facilities.

The overall control efficiency is based on a control device efficiency of 95 percent and a capture system efficiency of 90 percent. The control device (either fixed-bed carbon adsorption or incineration) efficiency was reported to range between 90 and 99 percent. A 95 percent efficiency was chosen as a control level representative of normal long-term operation. No method was available to directly calculate the efficiency of the solvent vapor capture system. However, from back calculating by dividing the overall control efficiency by the control device efficiency, a solvent vapor capture system efficiency of 90 percent should be expected.

There are three major emission points in a PSTL coating line. The emissions from the first point, the control device outlet, were determined by knowing the capture system efficiency and the control device efficiency as follows:

$$\begin{aligned}
 \text{Control Device} \\
 \text{Emission Factor} &= (\text{Capture Efficiency}) \times (1 - \text{Control Device Efficiency}) \\
 &= 0.90 \quad \times \quad (1 - 0.95) \\
 &= \underline{0.045 \text{ mass VOC emitted/mass total solvent used}}
 \end{aligned}$$

The control device outlet emission factor is not a range because a specified quantity (90 percent) of emissions is directed to a device which controls the emissions to a specified level (95 percent).

The emission factors for the second point, product solvent retention, were determined from data gathered from PSTL companies. Industry sources reported that, depending on the particular product, solvent retentions range from one to five percent of the total solvent used at the coating line. The emission factors for the third point source, fugitives, were determined by calculating the difference between total emissions and other point source emissions. All point source emission factors under 85 percent control are summarized as follows:

<u>Emission Point</u>	<u>kg/kg (lb/lb)</u>
Fugitives	0.055-0.095
Product Retention	0.01-0.05
<u>Control Device</u>	<u>0.045</u>
Total Emissions	0.15

Facility: Individual coating line controlled by fixed-bed carbon adsorption or incineration with no provisions for fugitive vapor capture.

III. Ninety Percent Controlled Emission Factors ⁷⁻¹⁴

Emission factors representing 90 percent overall control are based on the best demonstrated control technology for PSTL coating line emissions. In this system fugitive VOC emissions as well as drying oven exhausts are captured. The data base consists of short-term EPA test results and long-term plant data from two PSTL facilities. The short-term test data results were based on gas-phase analyses of the solvent laden air streams in and out of the control devices. This test supported the EPA contention that VOC control devices are at least 95 percent efficient. Long-term plant data from the same tested facility indicated that overall control efficiencies of from 79.9 to 99.9 percent were being achieved. The lower figure of 79.9 is not typical of the tested facility. The use of activated carbon past its replacement point caused the control system efficiency to degrade. Long-term data from a second facility indicated that an overall control efficiency of 93 percent is achievable. Both sets of long-term data were based on overall solvent volume material balances. The combination and analysis of the long-term data results demonstrates that on the average, 90 percent overall control is reasonable for new facilities in this industry.

The 93 percent overall control efficiency of the second facility was in part achieved by a control device which had a reported efficiency of 97 percent. By calculating back, a corresponding capture system efficiency of 95 percent can be obtained. The best demonstrated capture technology is represented by this system.

For 90 percent control the total mass emission factor is 0.10. The control device outlet emission factor was determined by knowing the capture system and control device efficiency as follows:

$$\begin{aligned}
 \text{Control Device Emission Factor} &= \left(\frac{\text{Capture Efficiency}}{\text{Efficiency}} \right) \times \left(1 - \frac{\text{Control Device Efficiency}}{\text{Efficiency}} \right) \\
 &= 0.95 \times (1 - 0.95) \\
 &= \underline{0.0475 \text{ mass VOC emitted/mass total solvent used}}
 \end{aligned}$$

The emission factors for the product solvent retention source were assumed to be the same as for the uncontrolled and 85 percent control cases. The fugitive emission factors were again determined by the difference between total emissions and other point source emissions. A summary of the emission factors for the 90 percent control case is given below:

<u>Emission Point</u>	<u>kg/kg (lb/lb)</u>
Fugitives	0.002-0.042
Product Retention	0.01-0.05
<u>Control Device</u>	<u>0.0475</u>
Total Emissions	0.10

Facility: Individual coating line controlled by modern solvent vapor capture system and either fixed-bed carbon adsorption or incineration.

References

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ENCLOSURE 3

AP-42 EMISSION FACTOR RATING FOR TABLE 4.10-1

There are about 100 plants presently operating in the pressure sensitive tape and label surface coating industry. Emission control performance data were obtained from three of these plants.¹⁻⁵ Significant data on uncontrolled emissions were obtained during plant visits with several members of this industry.⁶⁻¹⁰ In addition, EPA's CTG document covering the tape and label industry was consulted.¹¹ The overall rating of the emission factors presented in Table 4.10-1 is based on the following itemized ratings for each data source:

<u>Data Source</u>	<u>Performance Period</u>	<u>Rating</u>
EPA Emission Test - Shuford Mills, Inc.	4 runs during a 4 day period	B
Plant Operating Data - Adhesives Research, Inc.	4 weeks	A
Plant Operating Data - Shuford Mills, Inc.	15 months	A
Plant Operating Data - Avery International	12 months	B
Combined Industry Sources ⁶⁻¹⁰		C
EPA CTG Document		C
Overall Rating:		<hr/> C

The emission control performance results can be divided into two categories depending on the method used to obtain the results. The first category contains all results from the plant operating data sources. The plant operating data results were determined by overall liquid solvent volume balances. The volume balance results for all three plant operating data sources were determined over relatively long-term periods (hours and days). Short-term operating data can be misleading because of variations in coating operations, the numerous types of tape and label products coated, and the solvent hold-up volume of fixed-bed carbon adsorption systems. Long-term operating data provide a better representation of achievable control levels because longer averaging periods allow sufficient time for process fluctuations to average-out.

The second category of performance results contains gaseous emissions data from an EPA source test of a tape coating facility. The gaseous emissions of both a fixed-bed carbon adsorber and a thermal incinerator were tested. Although these tests were performed by standard EPA test methods, they were only performed for short test periods. The conclusions drawn from the data results may not be completely indicative of the long-term system performance. For this reason this data source was assigned a "B" rating.

The data results for two of the three plant operating data sources were reported in enough detail for adequate validation. This validation combined with the long-term nature of these data sources resulted in them being given an "A" rating. The third plant operating data source was not given an "A" rating because the reported results were not adequately documented.

Information developed from contacts and plant visits with tape and label coaters was used to estimate uncontrolled emission factors presented in Table 4.10-1. A portion of this industry information was generated from companies' own in-house testing. The remainder was based on the various companies' engineering analyses and experience with particular coating operations. Although the information is generally reliable and consistent, it was given a "C" rating because the companies could not verify the emission estimates with hard test data.

The emission factors derived from EPA's CTG document were not based on emission test data or long-term plant operating data. This data source was rated "C" because control performance information was based on engineering analysis and visits to well-controlled plants. The information in the CTG data source is more representative of older tape and label surface coating facilities, therefore, the 85 percent controlled emission factors were based in part on this data source.

The emission factors presented in Table 4.10-1 were given an overall rating of "C". There are four primary reasons why an overall "C" rating was selected. First, the uncontrolled emission factors were based in part on the "C" rated industry information data source. Secondly, the 85 percent controlled emission factors were based in part on the "C" rated CTG data sources. Thirdly, emission factors were based on "A" and "B" rated data which came from only a small sampling of the total number of tape and label facilities. Lastly, actual emission factors can vary widely in this industry depending on the type of product being coated, the fluctuation of process parameters (line speed, web width, etc.) and the efficiency of capture and control device systems.

References

1. Fairheller, W.R. Monsanto Research Corporation. Pressure Sensitive Tapes and Labels Draft Emission Test Report. EPA Contract 68-02-2818 Work Assignment 21. June 1979.

2. Letter from Hilton, G.C., Shuford Mills, Inc. to Johnson, W.L., U.S. Environmental Protection Agency. March 20, 1980. (ESED Confidential File).
3. Letter from Hilton, G.C., Shuford Mills, Inc. to Johnson, W.L., U.S. Environmental Protection Agency. April 14, 1980. (ESED Confidential File).
4. Letter and attachments from Miller, R.E., Adhesives Research, Inc. to Nelson, T.P., Radian Corporation. June 18, 1979.
5. Letter and attachments from North, C.R., Avery International to Goodwin, D., U.S. Environmental Protection Agency. April 29, 1980.
6. Nelson, T.P., Radian Corporation. Plant Trip Report, Adhesives Research, Glen Rock, PA. February 16, 1979.
7. Letter and attachments from Phillips, Frank, 3M Company to Harris, G.E., Radian Corporation. October 5, 1978. (Docket A-79-38 Confidential File).
8. Letter and attachments from Baxter, R.F., Avery International to Harris, G.E., Radian Corporation. October 16, 1978. (Docket A-79-38 Confidential File).
9. Harris, G.E., Radian Corporation. Plant Trip Report, Shuford Mills, Hickory, NC. July 28, 1978.
10. Nelson, T.P., Radian Corporation. Plant Trip Report, Avery International, Painesville, OH. July 26, 1979.
11. Control of Volatile Organic Emissions from Existing Stationary Sources - Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks. U.S. Environmental Protection Agency. Research Triangle Park, NC. Publication No. EPA-450/2-77-008. May 1977. p. 5-4.

ENCLOSURE 4

VOC SPECIES DATA MANUAL - UPDATE

EPA 450/4-80-015

The following is a list of suggested revisions to section 4-02-007, Surface Coating - Adhesive:

Process Description

- Reference: Add superscript 4
- Paragraph 1, 2nd sentence revision: "Adhesive surface coating involves the application of a bonding agent for the purpose of adhering materials together."
- Paragraph 1, add sentences after 2nd sentence: "The surface coating of pressure sensitive adhesives is a converting operation in which some backing material (paper, cloth, cellophane, etc.) is coated one or more times to create a pressure sensitive tape or table product that sticks on contact. The term pressure sensitive indicates that the adhesive bond is formed on contact, without wetting, heating, or adding a curing agent."
- Paragraph 1, last sentence: Add mention of Reference 4 and correct typographical error in the word "further."
- Paragraph 6 (Roller Coating), Add after last sentence: "Detailed explanations of the various types of roll coaters used for adhesive surface coating applications are provided in Reference 4."

Emissions

- Reference: Add superscript 5
- Paragraph 4, 2nd sentence revision: "Solvent emission rates from these operations may also be estimated by the methods mentioned in AP-40 (Ref. 1) and AP-42 (Ref. 5)."

Controls

- Reference: Add superscripts 6 and 7
- Paragraph 2, 2nd sentence revision: "Incineration can also be used to achieve solvent vapor control efficiencies of 90% or greater. Incineration may be the preferred control method if

the solvent vapors to be controlled contain high levels of entrained particulates, the vapors consist of several solvents, or if solvent recovery is not economically justifiable."

- Paragraph 3 (Process Modification), 1st and 2nd sentence revisions: "Appropriate substitutes for organic solvent-based coatings exist in the form of waterborne, 100 percent solids, and radiation-cure coatings. With the exception of some waterborne coatings, these innovative types of substitute coatings contain no organic solvent, therefore, no solvent emissions result from their use. Waterborne coatings which contain some solvent, will only have minimal VOC emissions."
- Paragraph 3, last sentence: Delete the word "solvent"

References

- #2: need to revise to be more specific?
- Additional:
- 4. Pressure Sensitive Tape and Label Surface Coating Industry - Background Information for Proposed Standards. U.S. Environmental Protection Agency. Research Triangle Park, NC. EPA-450/3-80-003a. September 1980. pp. 3-1, 3-8 to 3-11.
- 5. Reference 2, September 1981, Section 4.10.
- 6. Reference 4, p. 4-2.
- 7. Reference 4, p. 3-25 to 3-33.

The following is a list of suggested revisions to section 4-02-008, Surface Coating - Coating Ovens:

Process Description

- Reference: Add superscript 3
- Paragraph 1 revisions: "Surface coating ovens are used to dry, bake, cure, or polymerize applied surface coatings. These ovens use heat or irradiation to accomplish the intended process. Heat is used when the intent is to dry or evaporate organic solvents from the coated surface. Irradiation is used when the intent is to induce chemical changes or cross-linking between coating constituents."
- Paragraph 3: Add mention of Reference 3

Emissions

- Reference: Add superscript 4
- Paragraph 3: Add mention of AP-42 (Ref. 4)

Controls

- Reference: Add superscript 5
- Paragraph 1 revisions: "Effluent streams from solvent-based surface coating ovens that contain a mixture of organic vapors and aerosols can best be controlled through the use of incineration equipment."
- Paragraph 2: Make a continuation of paragraph 1
- Add a new paragraph 2: "Effluent streams which contain only organic vapors can be equally well controlled with either carbon adsorption or incineration. Carbon adsorption may be the preferred technique if the recoverable solvent has a significant economic value."

Process Modification

- Reference: Add superscript 6
- Paragraph 1 revisions: "Appropriate substitutes for organic solvent-based coatings exist in the form of waterborne, 100 percent solids, and radiation-cure coatings. With the exception of some waterborne coatings, these innovative types of substitute coatings contain no organic solvent, therefore, no solvent emissions result from their use. Waterborne coatings which contain some solvent, will only have minimal VOC emissions."

References

- Additional:
3. Pressure Sensitive Tape and Label Surface Coating Industry - Background Information for Proposed Standard. U.S. Environmental Protection Agency. Research Triangle Park, NC. EPA-450/3-80-003a. September 1980. pp. 3-4, 3-8 to 3-14.
 4. "Compilation of Pollutant Emission Factors," U.S. Environmental Protection Agency. Research Triangle Park, NC. September 1981. AP-42, Section 4.10.
 5. Reference 3, p. 4-2.
 6. Reference 3, p. 3-25 to 3-33.