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U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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NEW SOURCE CLASSIFICATION CODES FOR PROCESSES WHICH CAUSE HYDROCARBON AND ORGANIC EMISSIONS

by

Norman F. Surprenant and Mark I. Bornstein

GCA Corporation
GCA/Technology Division
Bedford, Massachusetts 01730

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SECTION I

SUMMARY

This report is a summary of the work performed by GCA/Technology Division for the Environmental Protection Agency under Contract No. 68-02-1006, Task Order No. 8, to develop an expanded list of Source Classification Codes for hydrocarbon emission processes. This list is based on knowledge of source activity gained under the following two contracts:

- Contract 68-02-1006, Task Order No. 3, Hydrocarbon Emission Sources in the Metropolitan Boston Intrastate Air Quality Control Region
- Contract 68-02-1376, Task Order No. 6, Hydrocarbon Emission Sources in Rhode Island and Southeastern Massachusetts.

The above two contracts consisted of identifying and analyzing hydrocarbon emission sources. The results were a prerequisite for evaluating stationary source regulations for the development of transportion control strategies.

The main objective of this program was to develop new SCC's that would identify the types of hydrocarbon solvents used in surface coatings, including those used for cleaning and dilution. This report does not and was not intended to develop an exhaustive list of SCC's for all hydrocarbon emitting point sources, but only was intended to provide SCC's for those sources encountered in the two previously mentioned contracts.

SECTION II

DESCRIPTION OF THE WORK PERFORMED

The present SCC listing does not provide any suitable means of coding the types of solvents found in paint, varnish, shellac, lacquer, primer, or enamel. It also does not provide any information about printing operations and the types of solvents most commonly used by the printing industry. After carefully reviewing the information reported in the hydrocarbon questionnaires used in the two contracts, a list of 78 new SCC's was developed for the above classes. An additional 14 other SCC's were developed for five other major categories:

- 3 for Textile Manufacturing
- 1 for Dry Cleaning
- 1 for Degreasing
- 3 for Coating Ovens
- 6 for Adhesives.

All 92 new SCC's are presented in Appendix A.

After receiving approval for the proposed new SCC's, GCA proceeded to make the necessary data corrections to all point sources reported in the above two contracts. New SCC's were assigned and the data was keypunched into NEDS format. Approximately 300 emission points were recoded.

EMISSION FACTORS

Emission factors for surface coatings from paints, varnishes, shellacs, lacquers, enamels, primers, and adhesives are essentially the same. Solvent that is found in the original coating will evaporate. Therefore, the emission factor for a solvent within a coating is 2000 pounds per ton of solvent within the coating. This results in the operating rate on NEDS Card 6 becoming the emission rate.

Emission factors for printing operations, however, will vary depending upon the type of printing press and ink used. See Appendix B for process description. On the average, letterpress and lithographic printing inks contain about 35 percent solvent. Flexographic and gravure printing inks contain approximately 65 percent solvent.[1]

Emissions from textile manufacturing vary depending upon the type of process and material being coated. The reader is referred to the Encyclopedia of Polymer Science and Technology for further information.[2]

EXAMPLE PROBLEM

An example of how the new SCC's should be used is shown in the following illustration.

An automobile manufacturer reports using 100 tons of paint and 25 tons of paint thinner. He has also stated that the paint contains 44 percent solids, 15 percent ethyl acetate, 25 percent toluene, and the remainder an unknown solvent. He reported the thinner he is using to be a 40-60 blend of MEK and toluene respectively.

Using the old NEDS SCC listing, the coding would appear as follows:

	SCC	Operating rate	Emissions (tons/year)
Point Source	4-02-001-01 Evap. - Surface Coating - Paint - General	100	56
Point Source	4-02-009-01 Evap. - Surface Coating - Solvent - General	25	25
	4-02-001-03		

However, using the new SCC listing it would appear as follows based upon the example calculation shown in Table 1.

	SCC	Operating rate	Emissions (tons/year)
Point Source	4-02-001-03 Evap. - Surface Coating - Paint - Ethyl acetate	15	15
Point Source	4-02-001-05 Evap. - Surface Coating - Paint - Toluene	25	25
Point Source	4-02-001-99 Evap. - Surface Coating - Paint - Solvent - General	16	16
Point Source	4-02-009-18 Evap. - Surface Coating - Solvent - MEK	10	10
Point Source	4-02-009-22 Evap. - Surface Coating - Solvent - Toluene	15	15

Table 1. EXAMPLE CALCULATION

For 100 tons paint:		
(44% solids)(100 tons paint)	=	44 tons solids
(15% ethyl acetate)(100 tons paint)	=	15 tons Ethyl acetate
(25% Toluene)(100 tons paint)	=	25 tons Toluene
Total tons of known material	=	84 tons
(100 tons - 84 tons) = 16 tons unknown solvent		
For 25 tons thinner:		
(40% MEK)(25 tons thinner)	=	10 tons MEK
(60% Toluene)(25 tons thinner)	=	15 tons Toluene

REFERENCES

1. U.S. EPA. Systems and Costs to Control Hydrocarbon Emissions from Stationary Sources. Report No. EPA-450/2-74-006, September 1974.

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5. Salomon, Gerrard, et al. A Compilation of Solvents for Flexographic and Gravure Inks. American Inkmaker, February 1969. p. 28-38.

6. Exhaust Gases from Combustion and Industrial Processes. Engineering Science Inc. Washington, D.C., 1971.

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APPENDIX A

PROPOSED NEW SCC's

Class I	Class II	Class III	Class IV	Factor	Units
Industrial process	Textile manufacturing	Rubberized fabrics			
3	30	002	99[a] Other/not specified		Tons processed
			01 Impregnation		Tons processed
			02 Wet coating		Tons processed
			03 Hot melt coating		Tons processed
Point source evaporation	Cleaning solvent	Dry cleaning			
4	01	001	01[a] Perchloroethylene	210	Tons cloths cleaned
			02[a] Stoddard	305	Tons cloths cleaned
			99 Other/not classified		Tons cloths cleaned
Point source evaporation	Cleaning solvent	Degreasing			
4	01	002	06 Toluene		Tons solvent used

[a]Already existing on SCC file

Class I	Class II	Class III	Class IV	Factor	Units
[illegible] evaporation	Surface coating	Paint			
4	02	001	01[a] General	1120	Tons coating
			02 Acetone	2000	Tons solvent in coating
			03 Ethyl acetate	2000	Tons solvent in coating
			04 MEK	2000	Tons solvent in coating
			05 Toluene	2000	Tons solvent in coating
			99 Solvent general	2000	Tons solvent in coating
Point source evaporation	Surface coating	Varnish/shellac			
4	02	003	01[a] General	1000	Tons coating
			02 Acetone	2000	Tons solvent in coating
			03 Ethyl acetate	2000	Tons solvent in coating
			04 Toluene	2000	Tons solvent in coating
			05 Xylene	2000	Tons solvent in coating
			99 Solvent general	2000	Tons solvent in coating

[a]Already existing on SCC file

Class I	Class II	Class III	Class IV	Factor	Units
Point source evaporation	Surface coating	Lacquer			
4	02	004	01[a] General	1540	Tons coating
			02 Acetone	2000	Tons solvent in coating
			03 Ethyl acetate	2000	Tons solvent in coating
			04 Isopropyl alcohol	2000	Tons solvent in coating
			05 MEK	2000	Tons solvent in coating
			06 Toluene	2000	Tons solvent in coating
			07 Xylene	2000	Tons solvent in coating
			99 Solvent general	2000	Tons solvent in coating
Point source evaporation	Surface coating	Enamel			
4	02	005	01[a] General	840	Tons coating
			02 Cellosolve acetate	2000	Tons solvent in coating
			03 MEK	2000	Tons solvent in coating
			04 Toluene	2000	Tons solvent in coating

[a]Already existing on SCC file

Class I	Class II	Class III	Class IV	Factor	Units
Point source evaporation	Surface coating	Enamel			
4	02	005	05 Xylene	2000	Tons solvent in coating
			99 Solvent general	2000	Tons solvent in coating
Point source evaporation	Surface coating	Primer			
4	02	006	01[a] General	1320	Tons coating
			02 Naphtha	2000	Tons solvent in coating
			03 Xylene	2000	Tons solvent in coating
			04 Mineral spirits	2000	Tons solvent in coating
			05 Toluene	2000	Tons solvent in coating
			99 Solvent general	2000	Tons solvent in coating
Point source evaporation	Surface coating	Adhesive			
4	02	007	01 General		Tons coating
			02 MEK	2000	Tons solvent in coating
			03 Toluene	2000	Tons solvent in coating

[a]Already existing on SCC file

Class I	Class II	Class III	Class IV	Factor	Units
Point source evaporation	Surface coating	Adhesive			
4	02	007	04 Benzene	2000	Tons solvent in coating
			05 Naphtha	2000	Tons solvent in coating
			99 Solvent general	2000	Tons solvent in coating
Point source evaporation	Surface coating	Coating oven			
4	02	008	01[a] General		Tons coating
			02 Dried, < 175°F		Tons coating
			03 Baked, > 175°F		Tons coating
			99 Other/not classified		Tons coating
Point source evaporation	Surface coating	Solvent			
4	02	009	01 General	2000	Tons solvent
			02 Acetone	2000	Tons solvent
			03 Butyl acetate	2000	Tons solvent
			04 Butyl alcohol	2000	Tons solvent
			05 Carbitol	2000	Tons solvent
			06 Cellosolve	2000	Tons solvent
			07 Cellosolve acetate	2000	Tons solvent
			08 Dimethyl-formamide	2000	Tons solvent

[a]Already existing on SCC file

Class I	Class II	Class III	Class IV	Factor	Units
Point source evaporation	Surface coating	Solvent			
4	02	009	09 Ethyl acetate	2000	Tons solvent
			10 Ethyl alcohol	2000	Tons solvent
			11 Gasoline	2000	Tons solvent
			12 Isopropyl alcohol	2000	Tons solvent
			13 Isopropyl acetate	2000	Tons solvent
			14 Kerosene	2000	Tons solvent
			15 Lactol spirits	2000	Tons solvent
			16 Methyl acetate	2000	Tons solvent
			17 Methyl alcohol	2000	Tons solvent
			18 MEK	2000	Tons solvent
			19 MIBK	2000	Tons solvent
			20 Mineral spirits	2000	Tons solvent
			21 Naphtha	2000	Tons solvent
			22 Toluene	2000	Tons solvent
			23 Varsol	2000	Tons solvent
			24 Xylene	2000	Tons solvent
Point source evaporation	Printing press	Letterpress			
4	05	002	01 General	700	Tons ink
			02 Kerosene	2000	Tons solvent in ink
			03 Mineral spirits	2000	Tons solvent in ink
			99 Solvent general	2000	Tons solvent in ink

[a]Already existing on SCC file

Class I	Class II	Class III	Class IV	Factor	Units
Point source evaporation	Printing press	Flexographic			
4	05	003	01 General	1300	Tons ink
			02 Carbitol	2000	Tons solvent in ink
			03 Cellosolve	2000	Tons solvent in ink
			04 Ethyl alcohol	2000	Tons solvent in ink
			05 Isopropyl alcohol	2000	Tons solvent in ink
			06 N-propyl alcohol	2000	Tons solvent in ink
			07 Naphtha	2000	Tons solvent in ink
			99 Solvent general	2000	Tons solvent in ink
Point source evaporation	Printing press	Lithographic			
4	05	004	01 General	700	Tons ink
			02 Mineral spirits	2000	Tons solvent in ink
			03 Isopropyl alcohol	2000	Tons solvent in ink
			99 Solvent general	2000	Tons solvent in ink

[a]Already existing on SCC file

Class I	Class II	Class III	Class IV	Factor	Units
Point source evaporation	Printing press	Gravure			
4	05	005	01 General	1300	Tons ink
			02 Dimethyl-formamide	2000	Tons solvent in ink
			03 Ethyl acetate	2000	Tons solvent in ink
			04 Ethyl alcohol	2000	Tons solvent in ink
			05 Isopropyl alcohol	2000	Tons solvent in ink
			06 MEK	2000	Tons solvent in ink
			07 MIBK	2000	Tons solvent in ink
			08 Mineral spirits	2000	Tons solvent in ink
			09 N-propyl alcohol	2000	Tons solvent in ink
			10 Toluene	2000	Tons solvent in ink
			99 Solvent general	2000	Tons solvent in ink

[a]Already existing on SCC file

APPENDIX B

DESCRIPTION OF PRINTING OPERATIONS

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There are four main types of printing operations; letterpress, lithographic, flexographic and gravure.

Letterpress, the oldest printing process, is defined as printing from raised type. The process is based on the simple stamping principle and produces a high quality of print on almost any type of paper or board. There are essentially three types of letterpresses in commercial use; platen, flat-bed and web rotary. Platen presses can print a variety of jobs, from a simple one-color to multicolor. The flat-bed press is widely used in printing catalogs, books and booklets. The web rotary press consists of two cylinders, one for the plate and the other for impression. This equipment is capable of very high speeds and is used for publications, packaging and commercial printing.

Lithographic printing is based on the principal of oil and water immiscibility. The level printing surface is prepared chemically resulting in the image area accepting oleophilic ink and the nonprinting area accepting water. Lithography has many advantages. Plate making is simple, fewer mechanical operations are required and it is economical for short runs.

Flexographic printing is a special form of relief printing. A flexible typographic rubber plate is mounted on a cylinder and is used to transfer the lacquer-type ink. This type of operation allows printing on hard surfaces, such as plastic films, calendered papers and metallic foils. Equipment for flexographic printing is divided into two classes; stack presses and common-impression equipment. In stack presses each color has its own unit consisting of fountain, roller, plate cylinder and impression cylinder. In common-impression, one large cylinder is used for several printing units, and is particularly useful for the decoration or plastic films.

Gravure printing utilizes a recessed surface for transferring the lacquer-type ink. It is the only process in which the ink film does not contact a flexible synthetic roller. Gravure ink is instant drying and the polymers must be preformed to be useful. The resins must be tack free and have excellent solvent release properties. Unlike other printing processes, the pressure is not transmitted through the ink film; instead it is only on the cyclinder plate, impression roller and substrate.

Certain types of inks are used with certain methods. Table 2 indicates the range of percent solvent content in inks for two drying methods versus the four printing processes. [4,5,6]

Table 2. PERCENTAGE OF SOLVENT CONTENT FOR TWO DRYING METHODS VERSUS FOUR PRINTING PROCESSES

Drying method	Letter-press	Flexographic	Litho-graphic	Gravure
Evaporation	--	Solvent base (40-75%)	--	40-75%
Heat set	~10%	Water base (0-30%)	~16%	--

The flexographic and gravure process account for approximately one-third of all inks used. They mainly use solvent-based inks containing 40 to 75 percent solvent, which is then evaporated on drying. Water-base inks are also coming into use in the flexographic process. Some of these water-base inks also contain solvent (0 to 30 percent) for faster drying. The screen process uses oil and lacquer-type inks which contain 0 to 60 percent solvents. However, this class accounts for less than 6 percent of the national total solvent used for inks. Letterpress and lithographic inks, which account for about one-third of the total inks used, are oil-based and emit some solvents when heat-set letterpress or heat-set web offset is used. Alcohol type solvents are also used in the water fountain for the lithographic process. [3,4,5,6,7]

National total solvent used, which is also the amount emitted, for inks, has been estimated for 1967 to be 170,000,000 lb. Applying the accepted annual growth rate of 7 percent for flexogravure, the solvent usage breakdown is given in Table 3 for 1967 and 1972.[8]

Table 3. NATIONAL SOLVENT USAGE
(tons/year)

Solvents	1967	1972
Oil inks	25,000	35,000
Flexographic/gravure	55,000	77,000
Other	5,000	7,000

Oil inks are mostly used in publications of periodicals and books and in commercial printing, SIC 272 to 275. Flexographic and gravure printing is mostly used in industries making miscellaneous converted paper products and paperboard containers (SIC 264 and 265).

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16. ABSTRACT

This report is a summary of the work performed on two contracts which consisted of identifying and analyzing hydrocarbon emission sources. The results were a prerequisite for evaluating stationary source regulations for the development of transportation control strategies.

The main objective of this program was to develop new SCC's that would identify the types of hydrocarbon solvents used in surface coatings, including those used for cleaning and dilution. This report does not and was not intended to develop an exhaustive list of SCC's for all hydrocarbon emitting point sources, but only was intended to provide SCC's for those sources encountered in the two previously mentioned contracts.

17. KEY WORDS AND DOCUMENT ANALYSIS

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