

Attached is a document containing presumptive MACT guidance for the polycarbonate production source category. The EPA will continue the development of a proposed rule for polycarbonate production; the statutory deadline for promulgating this rule is November 15, 1997. As this rule is further developed, drafts of the proposed rule will be placed on the TTN for review and comment by interested parties.

PRESUMPTIVE MACT FOR POLYCARBONATES PRODUCTION

Introduction

In 1994, EPA had to postpone work on several of the MACT standards due in November 1997 and November 2000 (the 7-year and 10-year MACT standards) as a result of resource constraints. If the EPA fails to set MACT standards on time, Section 112(j) of the Clean Air Act (Act) requires the States to establish emission limitations using a case-by-case determination of what the Federal standard would have been. Case-by-case MACT determinations under 112(j) will require substantial information and resources from State and local agencies, industry, and environmental groups, and there appears to be a strong incentive for all parties involved to gather information for 112(j) determinations and to promulgate standards on time. The amount of work needed to complete all of the 7-year and 10-year standards on time is difficult to predict; however, the EPA believes that new approaches are needed to reduce the amount of work and time associated with standards development. To achieve this goal, the EPA has initiated a new standard setting process called MACT Partnerships, that involves a partnership with States, industry, and environmental organizations. This process is described in the March 29, 1995 Federal Register.

The MACT Partnerships program involves two phases. The first phase involves the development of a "presumptive MACT." A presumptive MACT is not an emission standard; it serves as a statement of current knowledge of maximum achievable control technologies and a basis for a decision on how to develop the emission standard for the source category involved. The second phase is the formal standard development process. For the second phase, the EPA envisions the use of one of three basic regulatory development paths: adopt-a-MACT, share-a-MACT, or a streamlined-traditional approach. In all cases, EPA would eventually propose and then promulgate the MACT standard.

The adopt-a-MACT and share-a-MACT paths involve agreements with States and industry to take primary or shared responsibility for developing the underlying data and analysis from which EPA would determine MACT. When no suitable partners can be found or a standard appears suitable for development by the traditional process, the EPA would go through a "streamlined-traditional" process of rule development.

Before initiating MACT Partnerships, the EPA had already collected process and emissions information on the polycarbonates source category. This information was the starting point for the development of presumptive MACT. Since the types of emission points in the polycarbonate industry are similar to those in the organic chemical industry, the Hazardous Organic NESHAP (HON) was used as a reference in developing this presumptive MACT. The HON was promulgated on April 22, 1994 (59 FR 19402). The EPA obtained additional information during meetings with States and industry, and on May 17, 1995, the Regulatory Team, consisting of EPA Headquarters, EPA Region IV, Alabama, Indiana, and Texas, determined preliminary presumptive MACT. A list of persons involved in the development of presumptive MACT is given in Table 1.

Table 1. Presumptive MACT Participants

	Name	Affiliation	Phone
Industry	Stephen Capone	GE	413-448-7609
	Bernadine Flood	GE	812-831-4687
	Matt Tanzer	GE	413-448-6355
	Steve Knis	Dow	409-238-7976
	Mark Minnear	Dow	409-238-1695
	George Pavlovich	Miles	412-777-4872
EPA/States	Mike Brooks	Indiana	317-233-5686
	John Bates	Indiana	317-233-4226
	Ronny Watkins	Alabama	334-271-7861
	Robert Todd	Texas	512-239-1281
	Al Stepney	Texas	512-239-1830
	Mark Morris	EPA HQ	919-541-5416
	Susan Wyatt	EPA HQ	919-541-5674
	Linda Anderson-Carnahan	Reg. 4	404-346-3555-4192
	Tony Toney	Reg. 4	404-347-3555-4200
	Walter DeRieux	OECA	202-564-7067

On August 8, 1995, a roundtable meeting was held among all interested parties to obtain feedback on the preliminary presumptive MACT determined by the Regulatory Team. Some of the comments made during the roundtable meeting have been incorporated into this document, while others will require additional research before they can be resolved. The purpose of this document is to present presumptive MACT guidance for the polycarbonates source category, and to describe issues that need to be resolved before proposal and final issuance of a standard. To provide interested parties with the most current information on the polycarbonates MACT standard, this document will be updated as new information is obtained and outstanding issues are resolved.

The Agency wishes to emphasize that this is a guidance document and does not represent a final Agency decision on the emissions limitations that will apply in the MACT standard when it is issued. EPA has not completed all of the administrative requirements necessary to issue a standard for this category. This presumptive MACT guidance is intended to assist State permitting authorities or EPA Regional Offices as they develop case-by-case MACT determinations under either § 112(g) or § 112(j) of the Act. This document should not be treated by EPA, States, or regulated facilities as establishing definitive requirements that must be followed in all cases.

Source Category

Three companies (Bayer, Dow, and General Electric) operate five polycarbonate plants in the United States. The location of these plants and their published production levels are given in Table 2.

Table 2. Polycarbonate Producers

Producer	Location	Capacity (MM lb)¹
Dow	Freeport, TX	115
General Electric	Burkville, AL	240
General Electric	Mt. Vernon, IN	380
General Electric	Pittsfield, MA ²	None published
Bayer	Baytown, TX	185

¹ Chemical Week, November 1995.

² Polycarbonate copolymer plant.

All domestic production of polycarbonates uses interfacial polymerization from bisphenols and phosgene. Other hazardous air pollutants (HAPs) involved in the process include catalysts, solvents (mainly methylene chloride), and polymer wash agents. Appendix A contains a brief description of the polycarbonate production process. There are other polymerization processes for polycarbonate production, but the Regulatory Team has no detailed information on them. This presumptive MACT guidance is based on process and emissions information for the interfacial process, since it is the only process used domestically and it is the only process that was evaluated in establishing this guidance.

Industry has expressed concern about the applicability of the presumptive MACT guidance or the promulgated rule to different, newly developed processes that may be used in the future. The concern is that newly developed processes may be inconsistent with the premise and the control requirements suggested in this MACT guidance, which is based solely on the interfacial process. The Regulatory Team agrees that if there were another process used that emitted HAPs, the guidance in this presumptive MACT may or may not apply to it, and a State permitting authority issuing a case-by-case MACT determination under § 112(g) or § 112(j) would need to consider whether that process was sufficiently similar to the processes in the polycarbonate presumptive MACT guidance to warrant its application or whether a separate case-by-case standard would be appropriate. The EPA will specify definitively the covered processes in the final rulemaking establishing the MACT standard.

Phosgene Production

Phosgene is produced at most plant sites where polycarbonate is produced. Some of this phosgene is used as a feedstock for polycarbonate production, and is fed directly from dedicated phosgene production equipment to polycarbonate production equipment. The phosgene used for polycarbonate production is produced on-site to reduce potential hazards with transportation and storage. Because there is little or no phosgene storage capacity, phosgene and polycarbonate production are integral and production of one cannot occur without the other operating. Since dedicated phosgene production units are integral to the polycarbonate production process, EPA considers such units to be part of the polycarbonate production source category. These units will be subject to the polycarbonate MACT standard, not the HON. Phosgene production units that are not dedicated to polycarbonate production are subject to the HON.

Compounding

Compounding is a process that is not integral to polycarbonate production.

Polycarbonate resin is typically in “flake” form after drying. Compounding consists of the blending, remelting, extrusion, quenching, and pelletizing of the resin. Most compounding is performed at the same site that the resin is produced. However, some compounding is performed at other facilities, and some polycarbonate may be shipped to customers in the flake form. Since compounding is not integral to the process, the Regulatory Team decided to exclude it from the polycarbonate source category in this presumptive MACT guidance. Although the Regulatory Team has no emissions information on compounding, emissions are expected to be low because of the low volatile content of the resin at this stage in the production process. In addition, excluding compounding is consistent with the treatment of compounding in other thermoplastic MACT standards (e.g., proposed Polymers and Resins IV).

Chlorine and Carbon Monoxide Production

Chlorine and carbon monoxide are used in the production of phosgene. Chlorine and carbon monoxide are produced at most of the plant sites where polycarbonate resin is produced; however, some of the chlorine and carbon monoxide is used to produce phosgene for purposes other than polycarbonate production. The production of chlorine and carbon monoxide do not appear to be integral to the polycarbonate production process; therefore, the Regulatory Team decided to exclude them from the polycarbonate source category in this presumptive MACT guidance.

Polycarbonate Polysiloxane Copolymer Production

Polycarbonates are produced using continuous processes and batch processes. Four of the five plants produce polycarbonate continuously either by truly continuous processes, or by operating several batch reactors such that at least one reactor is always producing polycarbonate (“continuous-batch”). Continuous and continuous-batch processes create HAP emissions on a continuous basis. For the purposes of this guidance, continuous processes include both continuous and continuous-batch processes. One of the five plants produces a family of polycarbonate polysiloxanes (PC/PS), a type of copolymer, on an intermittent (noncontinuous) basis. The PC/PS copolymer facility operates as a batch operation. The batch process used to produce the PC/PS copolymer does not create HAP emissions on a continuous basis. Because of the cyclical nature of the emissions from the PC/PS copolymer process, the Regulatory Team believes that the regulatory requirements for continuous processes may not be applicable to batch operations; therefore, the Regulatory team believes that batch processes require a separate standard.

Definition of Sources

Similar to the HON definition of source for the Synthetic Organic Chemical Manufacturing Industry, the Regulatory Team decided for purposes of this presumptive MACT guidance to define the polycarbonates “source” as the process vents, storage vessels, wastewater collection and treatment, and equipment leaks in the HAP-emitting polycarbonate production processes that are located in a single facility covering a contiguous area under common control. The HON definition of source contains several exemptions, including research and development processes. EPA will examine similar exemptions when defining the affected source in the proposed polycarbonates rule. When the definition of source was chosen in the HON, the Administrator considered statutory requirements, legal history, Congressional intent, and technical concerns regarding implementation and enforcement of the rule. This source definition allows flexibility in compliance, such as emissions averaging. EPA intends to develop an

approach to emissions averaging akin to the HON emissions averaging provisions in the proposed polycarbonates MACT standard.

Floor

The five domestic polycarbonate plants have relatively low emissions. Most emissions from storage and process vents are either recovered or destroyed by combustion. Wastewater is stripped, and the stripped organics are typically either recovered or destroyed. Most equipment (valves, pumps, etc.) is subject to the HON because of the methylene chloride present in most process streams. There are few streams that do not contain methylene chloride.

According to the Act, standards for existing sources that are in categories containing fewer than 30 sources have to be at least as stringent as the average emission limitation achieved by the best performing 5 sources. Most emission limitations in air rules for these types of units are not in the form of numerical rate emission limits; rules typically consist of applicability criteria (“cutoffs”) used to determine which emissions “sources” will be controlled, and technology or performance requirements for those emissions sources meeting the criteria. The presumptive MACT floor included in this document is based on such applicability criteria and control requirements. The maximum degree of reduction in emissions that is deemed achievable for new sources must be at least as stringent as the emission control that is achieved in practice by the best controlled similar source.

Continuous Process Vents

As discussed above, some plants reduce their emissions using recovery systems. Process vents are defined in the HON as gas streams that are either discharged directly to the atmosphere or discharged to the atmosphere after diversion through a recovery device. Using this definition, the Regulatory Team determined the floor for polycarbonate process vents by examining the level of control present after recovery.

Using data on HAP flow rates and air flow rates obtained by Section 114 responses, combustion Total Resource Effectiveness (TRE) indices for polycarbonate process streams were calculated, and are given in Table 3.

Table 3. Process Vent TRE Indices

Plant	Stream	Tons/Yr	TRE	% Control
1	Vents/Tanks	1914	0.1	98
2	Vents*	18	0.9	98
	Vents/Tanks	24.4	9.6	98
3	Recovery	7.6	5.8	0**
	Recovery*	3.3	5.0	0**
4	Recovery	8.5	6.3	0**

* These streams are nonhalogenated by the HON definition.

** These plants actually reduce emissions using solvent recovery. The control efficiency of 0 indicates that emissions are not reduced beyond recovery.

The HON TRE equation and coefficients were used to calculate these indices, which are used as applicability criteria for this presumptive MACT guidance. TRE indices are indicators of the cost-effectiveness of controlling a gas stream; the higher the index, the higher the cost of controlling the stream. The average TRE indices of plant 1 and plant 2 are 0.1 and 5.3, respectively; the level of control is 98%. The average TRE index of these two plants (TRE=2.7) is the cutoff for existing process vents. The floor calculated in this guidance for process vents would require that all existing vents with TRE indices less than or equal to 2.7 be controlled to 98% or greater. For new sources, the floor cutoff TRE is 9.6 and the control requirement is 98%.

Batch Process Vents

The Regulatory Team has not determined a floor or presumptive MACT for batch process vents. EPA will obtain data and determine a floor and MACT for batch process vents in the proposed polycarbonate MACT standard.

Storage Tanks

Table 4 gives the tank sizes and vapor pressures for the storage tanks in the polycarbonates source category.

Table 4. Storage Tank Data

Size Range	M Gallons	vp, psia	% Control	Contents	
>40,000 gal	43	10.3	98	solvent	avg. vp 7.6
	85	9.5	98	solvent	
	160	6.4	98	solvent	
	85	6.4	98	solvent	
	85	6.4	98	solvent	
	40	6.4	98	solvent	
20,000 - 40,000 gal	25	13.3	95*	solvent	avg vp 6.8
	25	13.3	95	solvent	
	25	13.3	95	solvent	
	27	9.9	98	solvent	
	22	9.5	98	solvent	
	20	9.2	95	solvent	
	20	9.2	95	solvent	
	20	8.1	95	solvent	
	20	8.1	95	solvent	
	27	6.4	98	solvent	
	25	0.32	95	solvent	
	27	0.3	98	solvent	
	20	0.3	95	solvent	

	20	0.3	95	solvent	
	20	0.3	95	solvent	
	27	0.09	0	chainstop	
<20,000 gal	18	13.3	95	solvent	avg vp 6.0
	3	6.8	95	solvent	
	15	6.4	98	solvent	
	2	5.4	95	solvent	
	4	4	95	solvent	
	6	0.9	0	solvent	
	6	0.45	0	catalyst	
	12	0.3	0	solvent	
	8	0.04	95	chainstop	

* Recovery systems are assumed to achieve at least 95% control.

The tanks are divided into three groups based on size; these groupings are the same as those used in existing storage tank rules and those used in the development of the floor for the HON. Within each size group the tanks are listed in decreasing order of vapor pressure. The floor cutoffs were determined by taking the average vapor pressure of the tanks that are currently controlled. The average vapor pressures are: 6.0 pounds per square inch absolute (psia) for small tanks (<20,000 gallons); 6.8 psia for medium tanks (between 20,000 and 40,000 gallons); and 7.6 psia for large tanks (\geq 40,000 gallons). Since emissions from medium and small tanks are currently being reduced both by combustion and recovery systems, there are different levels of control. The arithmetic average of these efficiencies would yield an impractical efficiency; therefore, the mode (95%) is used as the floor control level for medium and small tanks. The floor level of control for large tanks is 98%. For new tanks the vapor pressure cutoffs are 0.3 psia for medium and small tanks, and 6.4 psia for large tanks; the floor control requirements are the same as those for the existing tank size ranges.

Equipment Leaks

As discussed above, methylene chloride process equipment at polycarbonate plants is subject to subpart I of the HON. The remaining equipment at polycarbonate plants is not typically part of a leak detection and repair (LDAR) program, although some components are affected by New Source Performance Standards (NSPS) for equipment leaks. The floor for equipment leaks is no control for existing and new sources.

Wastewater

Most wastewater streams are stripped, and the stripped organics are either recovered or destroyed. The Regulatory Team does not have data on the flow rates and concentrations of most of the wastewater streams; therefore, a floor for wastewater has not been established.

Table 5 summarizes the polycarbonates floor determination.

Table 5. Floor Summary

Emission type	Existing Source Floor		New Source Floor	
	Applicability	Control	Applicability	Control
Storage	≥40k gal, vp≥7.6 psi	98%	≥40k gal, vp≥6.4 psi	98%
	20k-40k gal, vp≥6.8 psi	95%	<40k gal, vp≥0.3 psi	95%
	<20k gal, vp≥6 psi			
Continuous Process Vents	tre≤2.7	98%	tre≤9.6	98%
Batch Process Vents	Not Determined			
Equipment Leaks		None		None
Wastewater	Not Determined			

Presumptive MACT Guidance

Presumptive MACT was determined by considering the environmental and cost impacts of regulatory alternatives more stringent than the floor. In most cases presumptive MACT is the floor; however, presumptive MACT for storage tanks and equipment leaks is more stringent than the floor.

Continuous Process Vents

In the HON, MACT for process vents is 98% control for vents with TRE indices less than or equal to 1. The polycarbonate process vent floor would require 98% control for vents with TRE indices less than or equal to 2.7 (for existing vents), and is more stringent than the HON (i.e., it would require control of more vents). Since MACT in the HON was based on consideration of environmental and cost impacts, and since the polycarbonates floor is more stringent than HON MACT, presumptive MACT for polycarbonate process vents is the floor. In other words, based on decisions in the HON, options more stringent than the floor for polycarbonates would have costs considered to be unreasonable for the emissions reductions achieved.

Batch Process Vents

As discussed above, the Regulatory Team has not determined the floor for batch process vents. The Regulatory Team has not determined presumptive MACT for batch process vents, but the EPA will determine MACT for the proposed polycarbonate rule.

Storage Tanks

Applicability

Based on consideration of environmental and cost impacts, the vapor pressure cutoff for existing large tanks in the HON is 0.75 psia, and existing medium and small tanks are subject to no control requirements in the HON. The polycarbonate floor cutoff for large tanks is 7.6 psia. This value is high because most of the liquids stored are high vapor pressure solvents. Since it was determined in the HON that it is cost-effective to control tanks at lower vapor pressures, the presumptive MACT vapor pressure cutoff for large tanks is 0.75 psia. Presumptive MACT cutoffs for medium and small tanks at polycarbonate plants are the same as the floor.

For new sources, an option more stringent than the presumptive MACT floor can be found in the volatile organic liquid NSPS (40 CFR 60, Subpart Kb). Like the HON, environmental and cost impacts were analyzed to determine the cutoffs for the NSPS, which are 0.75 psia for large tanks, and 4.0 psia for medium tanks. The NSPS has no requirements for tanks smaller than 20,000 gallons. Since the 0.75 psia cutoff was determined to be cost-effective in the NSPS, the presumptive MACT cutoff for new large tanks is also 0.75 psia. For new tanks smaller than 40,000 gallons, the presumptive MACT floor cutoffs are lower and, therefore, are the presumptive MACT cutoffs.

Control Requirements

Based on environmental and cost analyses performed for existing EPA storage tank air rules, controlling storage tanks beyond 95% is not cost-effective. This level of control is less stringent than the polycarbonate floor for existing large tanks; therefore, the floor (98%) is presumptive MACT. Presumptive MACT for existing smaller tanks (<40,000 gallons) is the floor, since it is not cost-effective to be more stringent than the floor. Presumptive MACT for new large tanks is 98%; for small tanks it is 95%.

Equipment Leaks

On September 12, 1989, EPA established a committee to negotiate a new approach for control of emissions from equipment leaks. The requirements of the rule negotiated by this committee constituted MACT for equipment leaks in the HON. These requirements were selected as presumptive MACT for polycarbonates. As discussed above, most of the equipment at polycarbonate plants is already subject to the HON. After the compliance date of the polycarbonate MACT standard, the equipment that is currently subject to the HON will be subject only to the polycarbonates MACT standard.

At least one plant expressed interest in different equipment leak requirements. They suggested a possible statistical method of leak monitoring instead of the monitoring of all equipment. By this method, a representative sample of equipment is monitored; if this sample were to exceed some allowable leak level, then equipment outside the sample would be monitored. Such a method was considered in the development of the negotiated rule for the HON, but was not selected as MACT. At least one State expressed concern about the possible confusion and enforcement difficulties associated with having several different equipment leak rules. For this reason, and since the Regulatory Team is reluctant to change the requirements that were negotiated in the HON for most of the equipment at polycarbonate plants, the HON equipment leak requirements were selected as presumptive MACT.

Wastewater

As noted above, the Regulatory Team has not established a floor for wastewater. However, since MACT for wastewater in the HON was based on consideration of environmental and cost impacts, the HON wastewater provisions can be considered presumptive MACT for polycarbonate wastewater streams. It is important to note that the HON, as promulgated on April 22, 1994, is currently under revision. The wastewater provisions of the HON are expected to change. The revised HON wastewater provisions are considered to be presumptive MACT for polycarbonates.

Tables 6 and 7 present presumptive MACT for existing and new sources.

Table 6. Presumptive MACT Guidance for Existing Sources

Emission type	Existing Source Floor		Presumptive MACT	
	Applicability	Control	Applicability	Control
Storage	≥40k gal, vp≥7.6 psi	98%	≥40k gal, vp≥0.75 psi	Floor
	20k-40k gal, vp≥6.8 psi	95%	<40k gal, vp≥4 psi	
	<20k gal, vp≥6 psi		Floor	
Continuous Process Vents	tre≤2.7	98%	Floor	
Batch Process Vents	Not Determined			
Equipment Leaks		None	HON LDAR	
Wastewater	Not Determined		HON	

Table 7. Presumptive MACT Guidance for New Sources

Emission type	New Source Floor		Presumptive MACT	
	Applicability	Control	Applicability	Control
Storage	≥40k gal, vp≥6.4 psi	98%	≥40k gal, vp≥0.75 psi	Floor
	<40k gal, vp≥0.3 psi	95%	Floor	
Continuous Process Vents	tre≤9.6	98%	Floor	
Batch Process Vents	Not Determined			
Equipment Leaks		None	HON LDAR	

	New Source Floor	Presumptive MACT
Wastewater	Not Determined	HON

Monitoring, Recordkeeping, and Reporting

The Regulatory Team intends to include monitoring, recordkeeping, and reporting provisions in the polycarbonates MACT standard that are similar to those in the HON. In the HON, process vents with TRE indices less than or equal to one are subject to the control requirements of the rule. Engineering assessment can be used to determine the inputs of the TRE equation; however, if the resulting index is less than or equal to 4, then actual measurements of the inputs must be performed, and the index recalculated. Also, streams with indices less than or equal to 4 must be monitored because the variability of process parameters may result in a TRE index that would require that the stream be controlled. EPA did not have information on all processes and streams when the HON was developed. Since EPA did not have sufficient information on the variability of streams covered by the HON, a TRE index “cushion” of 3 was selected (TRE index range between the control TRE cutoff of 1 and the monitoring cutoff of 4). The Regulatory Team has information on polycarbonate process vents, and these streams are not likely to have variations in flow or concentration that would result in a wide range of TRE indices. Therefore, the Regulatory Team recommends that States use a TRE “cushion” of 2. Since the presumptive MACT TRE index cutoff for control of existing process vents is 2.7, the Regulatory Team recommends that States require streams with TRE indices less than or equal to 4.7 be monitored, and those above 4.7 not be monitored.

Another difference between the HON and the standard being developed for polycarbonates is the monitoring of parameters used to demonstrate compliance. In the HON, the source owner/operator establishes a range of parameter values within which rule compliance is achieved. If the source operates outside this established range, then the source is in violation of the required operating conditions; however, the source is not considered to be in violation of the emission standard. Sources are allowed a specified number of excused “excursions,” or periods during which they operate outside the established parameter range. Also, periods when a parameter is outside the established range during start-up, shutdown, or malfunction do not count toward the number of excused excursions (as long as the source operates in accordance with its start-up, shutdown, and malfunction plan). Current EPA policy states that excursions not covered under the start-up, shutdown, and malfunction plan will be considered violations of the emission standard.

States should refer to the General Provisions for § 112 (40 CFR Part 63, Subpart A) for guidance on startup, shutdown, and malfunction provisions, and make adjustments as appropriate for the polycarbonate production process. The Regulatory Team received input from industry regarding the need to simplify the monitoring, recordkeeping, and reporting requirements under the polycarbonate standard. The Regulatory Team will continue to examine ways to simplify monitoring, reporting and recordkeeping requirements, and encourages States to seek ways to simplify these requirements in case-by-case MACT determinations.

APPENDIX A

POLYCARBONATE PRODUCTION FACILITY PROCESS DESCRIPTION

The following is a brief, generic description of the interfacial polycarbonate production process that is the subject of this presumptive MACT. This description is necessarily general and may therefore differ in some respects from any one polycarbonate production facility in the category. The two main steps in interfacial polycarbonate production are production of phosgene, which is then used to produce the end-product resin.

Phosgene Production

As explained in more detail in the presumptive MACT guidance, phosgene production is an integral part of the polycarbonate production process. In the process, carbon monoxide and chlorine are reacted in the phosgene plant to produce phosgene. This phosgene is distilled to remove impurities, and then condensed into liquid. Minimal quantities of liquid phosgene are stored to minimize the potential of an accidental release. Due to the small amount of phosgene storage capacity, the phosgene manufacturing unit is an integral part of the polycarbonate production process such that the polycarbonate plant cannot operate without the concurrent operation of the phosgene production unit. The liquid phosgene from the phosgene production unit is vaporized and supplied as a vapor to the polycarbonate production unit. Any uncondensed, inert carbon monoxide from the process is directed through a scrubbing system to remove any residual phosgene and is subsequently oxidized in a flare or incinerator.

Phosgene production equipment is typically located within contained enclosures, which are maintained at a slightly negative pressure. These enclosures are designed to minimize the potential for an accidental release to the atmosphere. They are not designed to function as emission control equipment. Nevertheless, all air evacuated from the enclosures is directed through a scrubber system. The scrubber circulates a dilute caustic solution, which is used to neutralize any phosgene which may have been released from equipment leaks inside the enclosures.

Resin Production Facility

In the polycarbonate production process, bisphenol-A powder is mixed with water or caustic and other additives and conveyed as slurry into a reactor. The reactor is then charged with phosgene, methylene chloride, caustic, catalysts, chainstoppers, and possibly other additives to begin the reaction. Any off-gas vented from the reactor is contained and treated in one of two ways. In one process, it is condensed to recover phosgene and methylene chloride, with non-condensables directed to a scrubber. Methylene chloride is then recovered from the scrubbed non-condensable stream. In the other process, vents from the reactors are directed only to a phosgene scrubber.

The polymer solution leaving the reactors is purified. Emissions from the purification process are also treated in one of two ways. One process condenses and recovers methylene chloride and catalyst to allow for reuse. The other process directs the vent emissions to a thermal oxidizer for destruction. The aqueous phase is directed to a stripper, from which emissions can be either condensed or destroyed.

The polycarbonate solvent solution is then sent to a recovery process where additional

methylene chloride is removed, condensed, and stored for reuse. Vent gases from this process are either directed to additional recovery or to a thermal oxidizer. The resin is finally dried and stored in silos.