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Comments

of The American Composites Manufacturers Association in Response to OSHA's PSM SBREFA Issues Document and the Report of the Small Business Advocacy Review Panel, Regarding Proposed Revisions to the OSHA Process Safety Management Standard

Submitted with four attachments
to Docket No. OSHA-2013-0200
via www.regulations.gov

1. Introduction

The American Composites Manufacturers Association[1] supports efforts by the Occupational Safety and Health Administration to reduce the risk of major chemical accidents, and appreciates the opportunity to provide comments to the docket for the Small Business Advocacy Review (SBAR) of proposed revisions to the agency's Process Safety Management (PSM) standard.[2] Representatives of several ACMA member companies participated as Small Entity Representatives (SERs) and provided oral and written comments to the SBAR Panel convened to consider potential small business impacts of the possible revisions to the PSM standard summarized in OSHA's *PSM SBREFA Issues Document*.[3] ACMA provides these comments to convey additional information and analysis beyond those submitted by the industry representatives to the SBAR Panel, and further to respond to the Panel's report.[4]

Our comments are provided in detail below, but *in summary*, we argue that composites manufacturing locations present little risk of a major chemical accident. Fire hazards resulting from the storage and processing of flammable liquids at these facilities are significantly lower than hazards presented by the storage of other materials with similar flash points (e.g., neat solvents) or processed using similar techniques (e.g., spray painting). While the raw materials used by composites manufacturers are reactive, the reactions are not violent and do not produce significant hazards. Implementing PSM would provide little or no improvement in workplace safety. These are primarily smaller companies and lack the technical, management and financial resources needed to successfully comply with the PSM standard. These operations should remain exempt from requirements to comply with the PSM standard.

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[1] The ACMA is the national trade association for the composites industry, representing some 3,000 small and medium sized companies using engineered polymers and glass or carbon fiber to make lightweight and durable products such as modular tub/showers, pollution control equipment, fuel storage tanks, wind turbine blades, auto and truck components, ballistic panels, and structural components for highway bridges.

[2] On June 2, 2016 OSHA is initiated a Small Business Advocacy Review Panel in order to get feedback on several potential revisions to OSHA's Process Safety Management Program standard. As an initial rulemaking step, and prior to publication of any changes to existing rules or enforcement policies, OSHA convened the SBAR Panel in accordance with the Small Business Regulatory Enforcement Fairness Act. This Panel consists of members from OSHA, the Small Business Administration's Office of Advocacy, and the Office of Information and Regulatory Affairs in the Office of Management and Budget. The SBAR Panel provided an opportunity for Small Entity Representatives to convey how the Agency's draft conceptual framework may impact small businesses and other small entities, and suggest ways to minimize those impacts while meeting OSHA's statutory goals. The Panel's primary role is to report on the comments of the SERs and its findings as to issues related to small entity impacts and significant alternatives that accomplish the agency's objectives while minimizing the impact on small entities for the Assistant Secretary of Labor.

[3] The *Issues Document* is available at www.regulations.gov/document?D=OSHA-2013-0020-0108.

[4] According to a notice on OSHA's website for the PSM SBAR effort, "[a]ny interested party may submit comments, even those who are not participating as small entity representatives (SERs), and the Agency will include those comments in the public docket…[and] the Agency will consider them in its discretion as resources allow. All such comments can be submitted to OSHA docket OSHA-2013-0020 via the government's e-regulatory portal…. The comment period will last until 2 weeks after the Panel report and will close on August 12." www.osha.gov/dsg/psm/index.html.

1.1. The composites industry

Composite products are made by combining an engineered polymer with reinforcing fibers or functional fillers. The *thermosetting resin* used for most composites manufacturing is a viscous liquid blend of styrene and high molecular weight unsaturated polyester or vinyl ester polymer. After the resin is mixed with the reinforcement or filler and then applied to a *mold* in the shape of the final product, the styrene *cross-links* (forms chemical bonds between) the polymer molecules, *curing* (solidifying) the resin to become a strong, durable, inert product. Some resins are formulated to serve as the protective or pigmented external layer of composite products and are called *gel coats*.

Molding technologies are considered either *open* or *closed*. Open molding includes the application of resin to the mold using a spray gun or bucket-and-brush. Closed molding involves either the manual placement of *paste* or *compound* (resin blended with filler or glass) into a mold that is then closed, or the transfer of resin to a closed mold using a pump or vacuum. Composites manufacturers receive and store resin in 55-gallon drums and 200-gallon totes. Many companies also receive resin in tank wagons and store it in bulk tanks with capacities that often exceed 60,000 pounds (6,500 gallons). Many composites manufacturers have mix rooms, where resin is blended in tanks with fillers, colorants and other substances. Other companies perform mixing operations at the molding station, using 55-gallon drums or other containers as the mixing vessel, using a static in-line mixer, or by spraying streams of two different materials through the same gun so that mixing takes place during the application of resin to the mold. A diagram of composites manufacturing operations is provided in Figure 1.

Most resins used in composites manufacturing exhibit the 88^{o}F styrene flash point and are therefore considered flammable liquids. To improve weatherability or reduce smoke generation when subject to burning tests, some composite products are made with resins or gel coats using methyl methacrylate (MMA) as a partial or complete replacement for styrene. These resins may exhibit the 36^{o}F MMA flash point, but are stored and processed no differently than resins with no MMA.

1.2. PSM changes under consideration

OSHA's *Issues Document* identified a number of potential changes to the PSM standard for which the SBAR Panel sought comments from small business representatives, including these two that are of particular importance to composites manufacturers:

- Clarifying the exemption for atmospheric storage tanks.
- Expanding PSM coverage and requirements for reactivity hazards.

Several of the other proposed revisions identified in the *Issues Document* would be important to us if our operations were to be covered under a revised PSM standard or enforcement policy. However, as we explain below, expanding coverage of the PSM standard to include composites manufacturing operations is unnecessary and would present a significant feasibility challenge for our industry.

We address the atmospheric storage tank exemption – and the applicability of PSM to our industry operations in general – in Section 2. This is followed, in Sections 3 and 4, by our response to the proposed coverage for reactivity hazards and by brief comments on the SBAR Panel's report.

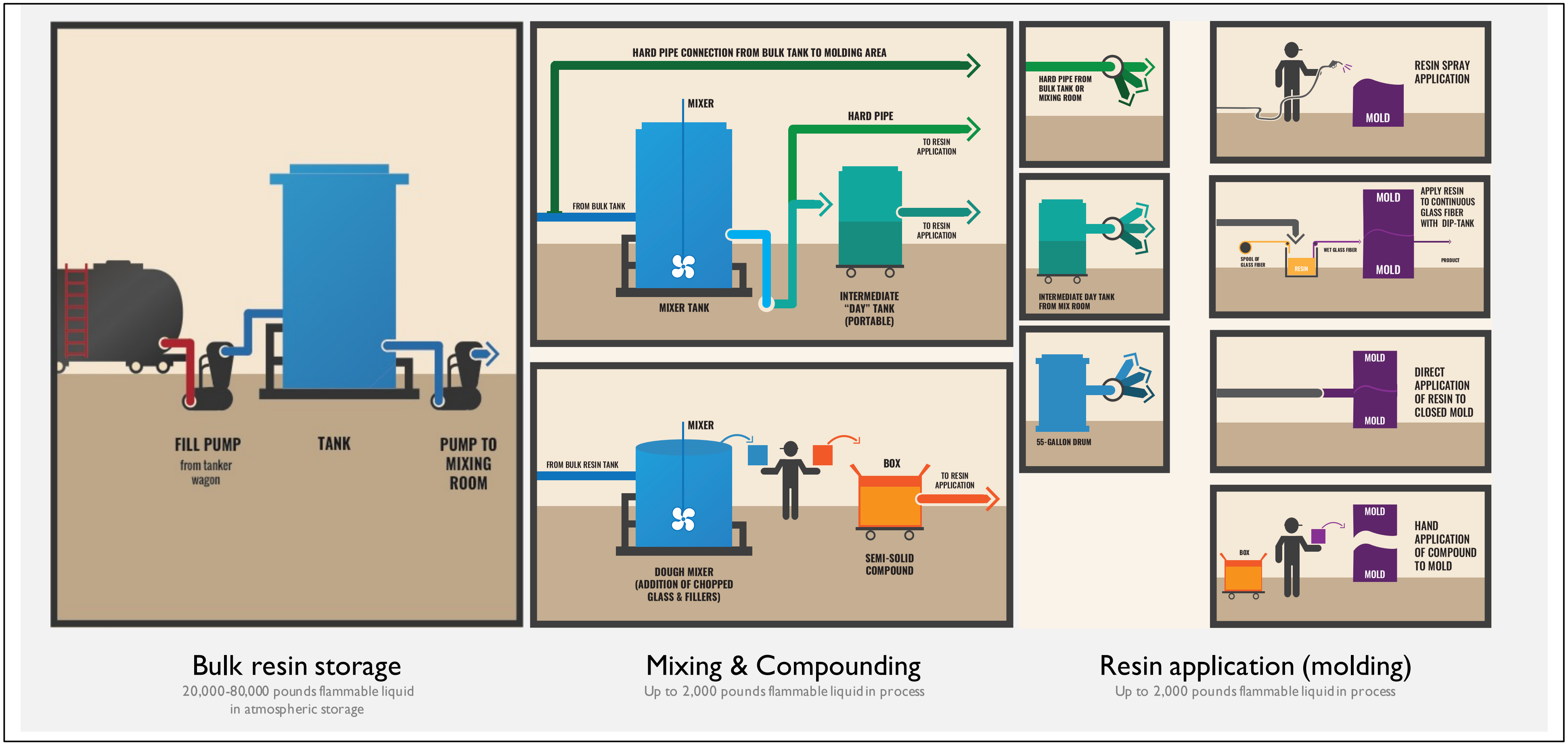

Figure 1. Composites industry operations, showing typical amounts of flammable liquids for small companies.

2. The atmospheric tank exemption (and, generally, the benefits and costs of PSM)

OSHA provides the following discussion in its *Issues Document*:

> The PSM standard covers processes with 10,000 pounds or more of a flammable liquid or gas, but exempts those "stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration" …. The atmospheric storage tank exemption was originally intended to exclude processes that only involved flammable liquid storage, such as those at a fuel depot or fuel terminal…. However, this intention is not clear in the language of the standard, and an adverse decision by an Occupational Safety and Health Review Commission ALJ suggests that atmospheric storage tanks that are connected to processing operations are exempt from PSM coverage. OSHA is considering changing the language…to limit the exemption to NAICS 4247 Petroleum and Petroleum Products Merchant Wholesalers.[5]

Very few composites manufacturing operations now meet any of the criteria that would make them subject to the requirements of the current PSM standard. But most composites manufacturing facilities have one or more atmospheric storage tanks that contain more than 10,000 pounds of a flammable liquid with these tanks connected to the composites production process in a manner that would make the entire facility subject to PSM if the atmospheric tank exemption were eliminated. Thus, the great majority of the several hundred composites manufacturing facilities in the U.S. are not subject to PSM requirements now, but would be subject to them if the atmospheric storage tank exemption were eliminated.

In the following pages (Sections 2.1 and 2.2) we first argue that composites manufacturing operations present a low risk of serious chemical incident and compliance with the PSM standard would not advance workplace safety, and we then illustrate that PSM compliance would pose a very high cost for these operations. ACMA believes that storage and manufacturing operations at these establishments should continue to remain exempt from the PSM standard, whether through continued application of the atmospheric storage tank exemption or some other mechanism.

2.1. The composites industry presents little risk of major chemical accident

Since the 1950's, small companies have safely manufactured recreational boats, tub/shower units, automotive parts and other composite products. There is no record or history of incidents in our industry suggesting sufficient hazard to justify coverage under the PSM standard. Considering the nature of the materials processed in the composites industry, and how process units are interconnected, our SERs were unable to describe a reasonably plausible scenario where there would be a sudden release of a significant quantity of resin.

Other than bulk resin storage, there is relatively little flammable material contained at these operations. Further, the storage and processing of the resins used in composites manufacturing present a lower degree of hazard than predicted by their flash point, and consequently the NFPA standards for both

[5] *Issues Document*, page 2.

flammable liquid storage and spray finishing (NFPA 30 and 33) contain requirements specifically for the composites industry.[6] To support NFPA adoption of these requirements, ACMA conducted full scale resin storage fire tests,[7] employed an independent fire safety engineer to conduct fire hazards analyses at several composites manufacturing operations,[8] and conducted an extensive test program to determine the workplace atmospheric concentrations of styrene and MMA under worst case processing conditions.[9] OSHA provided guidance clarifying that employers complying with the applicable provisions of NFPA 33 will receive only *de minims* citations if found to be not in compliance with the spray finishing standard at 29 CFR 1910.107.[10]

The photos provided in Figure 2 show a flammability test with resins used in composites manufacturing. Even though there is a significant amount of resin on the floor of the booth when a flame is applied to the spray, there is not the flash of burning vapor that would be expected with solvents, and the spray stops burning as soon as the flame is removed.

Further, resins do not present a reactivity hazard sufficient to warrant coverage under the PSM standard. The cross linking reaction that cures the resin into a solid product only occurs with the addition of heat or polymerization *initiators* (typically low-concentration organic peroxides). Storage and handling of initiators are carefully managed to prevent accidental contamination of resin. Resins are formulated with *inhibitors* that prevent premature polymerization during storage. The temperature of bulk tanks is carefully controlled, and the atmosphere in the tanks managed to prevent inactivation of the inhibitor that may result from insufficient dissolved oxygen in the resin. However, sometimes a tank or drum gets too warm, or inhibitors become less active over time, and the resin *gels* (polymerizes) in storage. This polymerization reaction is very slow. Over a period of weeks or months, the drum or bulk tank will slowly become warm as the resin hardens, and after cooling will have to be opened to allow the gelled resin to be removed and disposed. EPA allows composites manufacturers to process scrap resin, which is classified as a hazardous waste because it is a flammable liquid, by polymerizing it in containers and disposing of the polymerized material as ordinary waste.[11] The occasional tank gelling incident

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[6] In NFPA 30 (2012) see Sections 9.13.5, 16.2.4, 16.5.2.11, and A.16.2.4, and Table 16.5.2.11. In NFPA 33 (2011) see Chapter 17.

[7] "Automatic sprinkler protection of palletized, 55-gallon drum storage of unsaturated polyester resins." *Fire Technology*, No. 42, pp. 161-183 (2006).

[8] "Fire hazard analysis of composites resin manufacturing spray application areas." Report of analysis conducted for ACMA and the National Marine Manufacturers Association. October 19, 2007. Submitted via regulations.gov as Attachment 1 to these comments.

[9] "Vapor Concentration Determination Polyester Resin and Gel Coat Application – Styrene and Methyl Methacrylate Levels in Relation to Lower Flammability Limits". Report of a test conducted for ACMA and the National Marine Manufacturers Association. January 28, 2009 (revision 4). Submitted via regulations.gov as Attachment 2 to these comments.

[10] "Spray finishing operations citation guidance." OSHA letter of interpretation, July 14, 2009. Use Google or Bing to search for "OSHA interpretation 27659".

[11] POLYM treatment of ignitable waste. 62 FR 25998. May 12, 1997. Section IV.D.

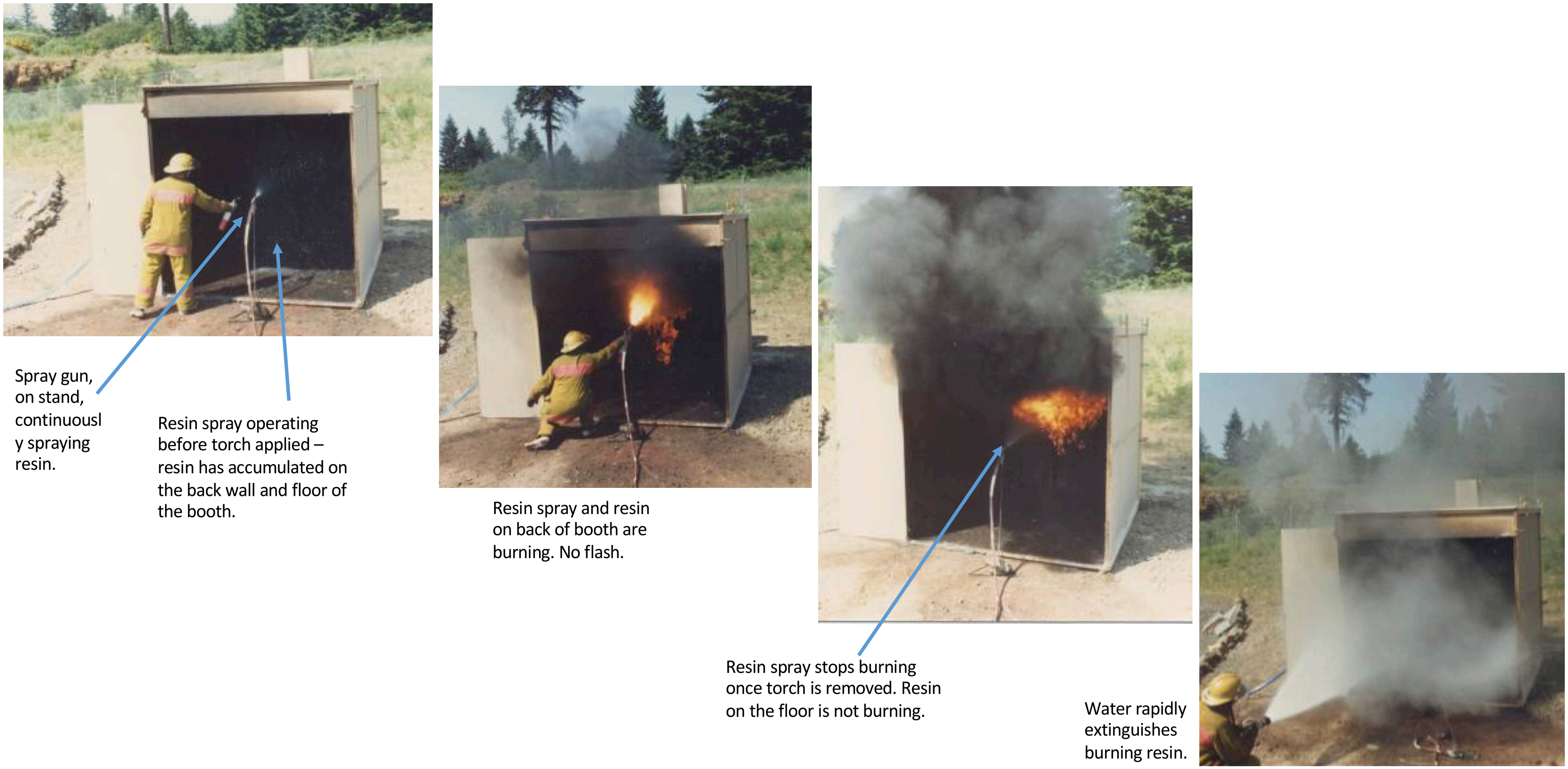

Figure 2. Fire test with spray of polyester resin.

results in the loss of raw material and disrupted production while the storage tank is out of service for cleaning, but there is no damage to buildings and no risk of employee injury.

ACMA's guidelines for bulk resin storage recommend certain design, construction, operation and maintenance procedures that reduce the risk of fire or unwanted polymerization.[12] The guidelines are designed so that compliant storage operations satisfy the applicable provisions of NFPA 30.

2.2. PSM compliance would be very costly for small composites manufacturers

We start our discussion on the costs of PSM compliance by comparing OSHA's cost estimates with the results of our own effort to estimate PSM compliance costs for small composites manufacturers. We are here responding to the seventh of the agency's questions for the SERs provided in the *Issues Document*.[13]

> *7. Are OSHA's cost estimates for the proposed change consistent with your industry's experience? In your response please elaborate as specifically as possible.*

This question is difficult, if not impossible, to answer for at least two reasons. First, it is not clear what OSHA would estimate the costs to be for composites manufacturers specifically to comply with PSM requirements if these small businesses were to be made subject to the PSM standard. OSHA has not recognized the possibility that composites manufacturers constitute an industry that could be subject to PSM, and has not estimated potential compliance costs specifically for this industry in either the Agency's original 1992 PSM economic analysis or the current *PSM SER Background Document*.[14] Second, the composites manufacturing industry has little, if any, experience regarding the costs for facilities in this industry to comply with PSM because virtually no facilities in the industry have been subject to PSM under the current standard. We will provide some detail on each of these two points.

2.2.1. OSHA has not estimated PSM compliance costs for the composites industry

OSHA has not addressed the composites manufacturing industry explicitly in either the Agency's original 1992 cost analysis for the original PSM standard or in the more recent cost analysis considering potential changes to the standard and to applicability of the standard as would result if the atmospheric storage tank exemption were eliminated. It is furthermore not clear in either of these analyses which among the various other industries or NAICS/SIC codes for which OSHA has estimated costs the Agency might consider as best representing composites manufacturers. And, even if we were to choose a specific industry analyzed in OSHA's 1992 or current economic analyses as representative of composites manufacturers (e.g., perhaps SIC Group 308, Miscellaneous Plastic Products, in the 1992 analysis; and perhaps NAICS 326, Plastics and Rubber Products Manufacturing in the current analysis),[15] OSHA's

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[12] *ACMA bulk resin storage guidebook*. Submitted via regulations.gov as Attachment 3 to these comments.

[13] Our responses to OSHA's six other questions for SERs regarding the atmospheric storage tank exemption are provided in Section 2.3.

[14] *PSM SBREFA SER Background Document*, www.regulations.gov/document?D=OSHA-2013-0020-0107.

[15] We would guess that SIC 308 and NAICS 326 might include more composites manufacturers than any other SIC/NAICS groups that OSHA has analyzed, although both groups include many companies that are not composites manufacturers.

documentation in each analysis is limited and it is not apparent what values the Agency would assign for composites manufacturing for the many data elements needed in the Agency's model for estimating compliance costs for a specific industry – for example, typical facility sizes, complexity of the production process, degree to which consultants rather than in-house staff will be needed, historical frequency of incidents, usage of contractors as well as employees, availability of different levels of engineering staff in-house, etc. In many instances, OSHA's judgments about the particular cost model data elements that the Agency made for SIC Group 308 and/or NAICS 326 – even if these industries were judged overall as generally the best for representing composites manufacturers – are quite inappropriate for representing composites facilities and operations specifically. To cite several examples, in the 1992 cost analysis, OSHA estimated that establishments in SIC Group 308 have the following characteristics – but we believe that composites manufacturers typically have characteristics quite different from these that OSHA has assumed:

- *Average number of employees*. OSHA assumed that large plants in this SIC Group have 50 employees and small plants have 10. The 11 SER facilities, in contrast, have between roughly 25 and 125 employees. OSHA's figure of 10 employees would be slightly too small as representing a small composites manufacturing facility, while OSHA's figure of 50 employees would be much too small as representing a large composites facility. The average number of employees across the 11 SER facilities is approximately 60.
- *Average number of processes*. OSHA assumed that large plants in this SIC Group have an average of 9 processes and small plants have an average of 2. If the SERs' 11 facilities were to be covered by PSM because the atmospheric tank exemption was removed, most would likely have only one large process that would include virtually the entire facility as being connected to the bulk resin storage tanks and/or very near the connected units. A couple of facilities might have a few more than one process per facility, with the additional processes involving portions of the operation that were not hard pipe-connected and were separated from other portions by substantial firewalls. A composites facility also might have more than one process if it performed additional processes involving composites finishing and/or non-composites processes conducted in the facility's building in addition to the basic composites production process.
- Avera*ge process complexity*. OSHA assumed that both large and small plants in SIC Group 308 have "low" average process complexity. This judgment of OSHA's has a large impact on the Agency's PSM compliance cost estimates – in general, OSHA presumes that a high complexity process involves four times the workload for completing a PSM task as does a low complexity process, and a medium complexity process is thought to entail three times the workload as a low complexity process. These multiplicative factors may or may not be reasonable, but in our view OSHA's thought process in assessing how the nature of the covered process affects the costs to perform PSM tasks for that process is incomplete. OSHA views process "complexity" as a factor that affects compliance workload and costs "in terms of temperature and pressure variation, chemical reaction, input and output flows, and other factors."[16] In several examples, OSHA cites

[16] OSHA's 1992 Economic Analysis, page B-14.

some of the "other factors" that may constitute additional dimensions of "complexity" and thus may also affect the number and sophistication of the labor hours required to complete each of the various PSM tasks. A meat industry process that involves only "manual/mechanical slaughtering and assembly line processing" with very limited possibilities for release of highly hazardous substances is classified as "low-complexity". A process in the fabricated structural metal products industry is classified as "medium-complexity" because it involves frequent handling and perhaps release/exposure for five different hazardous substances. (Presumably OSHA would classify a process involving only one hazardous substance as "low-complexity", while a process involving many hazardous substances would be classified as "high-complexity").

Applying this set of concepts in judging the degree of "complexity" in a process, OSHA would likely consider composites manufacturing facilities as involving low complexity processes, as the Agency judged to be the case for SIC Group 308, Miscellaneous Plastic Products. The composites manufacturing process involves mostly a single relatively straightforward chemical reaction (cross-linking of polymers), no significant variation in temperature and pressure and rather wide tolerances, only a few classes of hazardous substances (resins, peroxide initiators, and solvents for finishing and cleanup), and minimal if any use of substances that are highly reactive, explosive or toxic.

In fact, though, we would consider the typical composites manufacturing process to be "high complexity" rather than "low complexity" due to the large number and substantial diversity of discrete items of equipment involved in the composites manufacturing process. OSHA does not appear to have considered these two factors – number and diversity of process units – in defining process complexity as a driver of PSM workload. In manufacturing composites, the hazardous substances are used in and flow through many different process units involving many different activities. Bulk resin is unloaded into storage tanks that involve valves and fill gauges and overflow alarms. Resin may then be transferred from bulk tanks through pumps, pipes and valves or by other less automated means into other vessels such as mix tanks, day tanks, totes and drums. Filler and other substances will be added and mixed by various means at various points. The mixed resin or compound then arrives by various means at a wide variety of application stations where the it is applied to the mold in a variety of ways, ranging from hand application with brushes to application with hand-held spray guns to batch injection into various sorts of closed molding machines to carefully metered continuous feed to large, sophisticated machines for filament winding or pultrusion. Gel coat and finishing can then involve additional operations and additional hazardous substances, stored, transported and applied in different ways from those used for the resin. It would not be unusual for a composites manufacturing operation to involve more than forty very different pieces of process equipment and controls. If the process is subject to PSM, each of these pieces of equipment will need its own written operating procedures, its own assessment relative to RAGAGEP, its own mechanical integrity procedures, its own section of training material, and so forth. The large volume and diversity of the process units in the composites manufacturing process will mean that many of the tasks required for PSM compliance for a single process will need to be completed many times, once for each of the units. In developing our own estimates for the workload involved in completing the various PSM tasks, we have found consistently that our workload estimate is much closer to the Agency's estimate for a "high complexity" process than to the Agency's estimate for a "low complexity" process. We suggest that OSHA would be able to estimate the workload required to perform most PSM tasks much more accurately if the Agency were to recognize the number and diversity of process units as a dimension of process complexity.

In sum, the first reason that we have great difficulty in directly answering OSHA's question as to whether OSHA's cost estimates for PSM compliance are consistent with the composites manufacturing industry's cost experience is that OSHA has not estimated compliance costs specifically for the composites industry. OSHA has not recognized that the composites industry is one that would likely be subject to PSM if the atmospheric storage tank exemption were eliminated, and OSHA has not estimated the potential compliance costs for this industry if it were to be subject to PSM. Nor has OSHA provided any indication about which other industry for which compliance costs have been estimated might be chosen as providing the best representation of what compliance costs might be for the composites manufacturing industry. More composites manufacturing companies are likely found in the Miscellaneous Plastic Products industry than in any other industry group for which OSHA has estimated compliance costs, but we believe after evaluating the details underlying OSHA's cost estimates for this particular industry that it would not represent the composites manufacturing industry at all accurately. We can't answer OSHA's question directly because we do not know what OSHA has estimated or would estimate compliance costs for the composites industry to be.

We strongly suggest, if OSHA persists in proposing to remove the atmospheric tank exemption and thereby subject the great majority of composites manufacturing facilities to PSM, that the Agency explicitly estimate the resulting compliance costs for the composites manufacturing industry. This industry cannot be accurately represented by reference to NAICS or SIC codes. Composites manufacturers categorize themselves for NAICS purposes by the primary product that they manufacture, which may be anything from boats to recreational vehicles to architectural pieces to underground storage tanks and many more. The following are the NAICS codes most frequently used by composites manufacturers:

326199-All Other Plastics Product Manufacturing
336612-Boat Building
327991-Cut Stone and Stone Product Manufacturing
326130-Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing
326122-Plastics Pipe and Pipe Fitting Manufacturing
326191-Plastics Plumbing Fixture Manufacturing
336214-Travel Trailer and Camper Manufacturing

ACMA tries to discourage anyone from using particular NAICS or SIC codes to represent composites manufacturing activities, or from looking at NAICS or SIC codes to learn anything about this industry. With the exception of boat building, these are very heterogeneous categories and composite manufacturers are at most a small subset of the companies reporting with these codes. The composites manufacturing industry should be characterized for economic analysis purposes based on the relatively consistent nature of the manufacturing process across the facilities within the industry, not based on the likely grossly dissimilar nature of the average facilities in one or another NAICS/SIC code within which several dozen composites manufacturing facilities may be found.

OSHA should analyze costs and economic impacts for the composites manufacturing industry after developing a set of model facilities that have been designed specifically to represent the nature, size, and production process of facilities in this particular industry. We believe it is extremely important for OSHA to analyze the costs and impacts of potential PSM regulatory changes on the composites manufacturing industry specifically because this industry appears likely to be one of the most highly affected by the potential removal of the atmospheric storage tank exemption. OSHA's current analysis of the impact of this regulatory change omits consideration of the composites manufacturing industry while addressing ten other industries that would appear to face costs and impacts much smaller than the composites manufacturing industry.[17]

We guess that roughly 200 small entity composites manufacturing facilities might be made subject to PSM if the atmospheric storage tank exemption were removed. If so, inclusion of composites manufacturing would increase by perhaps 50% OSHA's estimate for the total number of affected small entity establishments and would increase by perhaps 60% OSHA's estimate for the total number of affected small entity employees (assuming an average of 60 employees per small entity composites manufacturing facility). Composites manufacturing would be the single most highly affected industry by either of these criteria. Furthermore, there are probably at least several dozen small entity composites manufacturers with fewer than 20 employees that have bulk resin atmospheric storage tanks that would make them subject to PSM if OSHA adopted the proposed regulatory change, and OSHA appears substantially incorrect in the Agency's claim that there will be none.

Absent analysis of costs and economic impacts for the composites manufacturing industry specifically, OSHA could not be said to have performed a credible or reasonably complete analysis of the impacts of the proposed removal of the atmospheric storage tank exemption, one of the several most important of OSHA's potential changes to the standard.

2.2.2. The industry has no experience with PSM on which to base a cost estimate

The second reason we have difficulty in answering OSHA's question is because the question refers to this "industry's experience" regarding PSM compliance costs. This industry has little such experience because few, if any, composites manufacturing facilities have been subject to PSM and have incurred costs to comply with the standard. None of the 11 facilities represented by the SERs are now subject to PSM, since each has much less than 10,000 pounds of flammable liquids in a single process at one time exclusive of the quantities of flammable liquids in atmospheric bulk resin storage tanks. We believe that only an exceptionally large composites manufacturing facility would have more than 10,000 pounds of flammable liquids in a single process exclusive of bulk atmospheric resin storage tanks.

Notwithstanding these two reasons why we are unable to answer OSHA's question directly, we have attempted to answer the question as best we can.

2.2.3. Our best estimate of PSM compliance costs

We estimate the average cost per facility across the SERs' 11 composites manufacturing facilities to be about $61,000 per year for compliance with both the existing and the potential new PSM requirements.

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[17] See page 36 of the *Background Document*.

OSHA estimated in its *Background Document* that facilities in NAICS 326 (Plastics and Rubber Products Manufacturing, the NAICS grouping among those that OSHA analyzed that might be most representative of the composites manufacturing industry) would incur compliance costs somewhere between approximately $21,000 per year (for small facilities averaging 14 employees) and $82,000 per year (for large facilities averaging 307 employees).[18] OSHA's cost estimates for small and for large facilities in this NAICS grouping thus bracket the average of the SERs' cost estimates for composites manufacturers, a reasonable result insofar as the average number of employees at the SERs' facilities is approximately 60, which represents roughly the geometric mean between OSHA's small and large model facility sizes. In sum, OSHA's cost estimates for the composites manufacturing industry to comply with the proposed changes to the PSM standard (the proposed changes would make most composites manufacturing facilities subject to PSM for the first time) are roughly consistent with the SERs' cost estimates. These figures are shown in the Table 1.

In finding that OSHA's PSM compliance cost estimates for an industry perhaps like composites manufacturing are roughly similar to the SERs' cost estimates, we do not mean to imply that we believe OSHA's estimates are reasonably accurate. To the contrary, we believe there are substantial errors of fact or judgment in OSHA's methods for estimating the costs of PSM compliance for composites manufacturing or an industry like it, and it is only due to happenstance – perhaps due to countervailing impacts of multiple errors – that OSHA's estimates appear at all similar to ours. For example, OSHA's assumption about the number of covered processes per facility appears to cause a substantial overestimate of compliance costs for composites manufacturing, while OSHA's assumptions regarding average process complexity have a large impact in the opposite direction.

In addition to estimating the costs for potential PSM compliance for the 11 facilities, the SERs have provided information that suggests that these costs could have a significant adverse economic impact on these small businesses. The SERs provided information on the average annual revenues generated over the past two years by each of the 11 facilities. A comparison of the estimated annual costs of compliance for each facility against its average annual revenues indicates that compliance costs would amount to 0.3% to 1.3% of these facilities' revenues. Across the 11 facilities, compliance costs would amount to an average of 0.8% of the facilities' revenues. If profits for each facility were 5% of its revenues, then annual compliance costs:

- Would exceed 5% of average annual profits for each of the 11 facilities;
- Would exceed 10% of average annual profits for 7 of the 11 facilities;
- Would exceed 20% of average annual profits for 5 of the 11 facilities; and
- Would average 16% of average annual profits across the 11 facilities.

These comparisons of compliance costs against indicators of these small businesses' ability to bear these costs often exceed OSHA's traditional thresholds signifying potential concern about economic feasibility (1% of revenues, 10% of profits, or 5% of profits for small entities). We question whether compliance with a PSM standard revised as OSHA is considering would be economically feasible for small entity

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[18] Table IV-2b and Table IV-4b. *PSM SBREFA SER Background Document*.

11 Composites Manufacturing Facilities Owned by the SERs' Companies Average Annual Costs Over 10 Years for PSM Compliance -- Comparing the SERs' and OSHA's Estimates			
SERs' estimates based on ACMA workload model	Cost/yr for existing PSM req'ts	Cost/yr for possible new req'ts	Avg total cost/yr across 10 years
Facility #1	$34,377	$15,500	$49,877
Facility #2	$37,147	$16,616	$53,763
Facility #3	$73,683	$27,829	$101,512
Facility #4	$37,708	$15,798	$53,507
Facility #5	$45,665	$19,109	$64,775
Facility #6	$35,030	$13,637	$48,667
Facility #7	$36,381	$15,355	$51,736
Facility #8	$48,369	$17,932	$66,302
Facility #9	$37,396	$17,345	$54,741
Facility #10	$31,149	$14,779	$45,929
Facility #11	$58,852	$19,281	$78,132
Average:	**$43,251**	**$17,562**	**$60,813**
avg # of employees across these 11 facilities:	about 60		
OSHA's estimates based on PSM RIA: NAICS 326	Initial cost	Annual cost	Avg total cost/yr across 10 years
small facility (14 employees)	$51,683	$17,439	**$20,863**
large facility (307 employees)	$207,278	$68,423	**$82,309**

Table 1. Average annual costs - comparing OSHA's and the SERs' estimates.

composites manufacturers. We do not believe that the minimal health and safety benefits that might be expected if composites manufacturers were to be subjected to PSM requirements would outweigh the substantial costs and adverse economic impacts on small entities in this industry.

2.2.4. The SER compliance cost estimates and comments on OSHA's estimates

In this section we describe how the SERs and ACMA have developed our compliance cost estimates for the 11 facilities, and we provide some commentary about the respects in which we believe our cost estimates are likely to be more accurate than OSHA's. We are also providing a copy of our Excel spreadsheet workload model for estimating the costs for a composites manufacturing facility to achieve first-time and continuing compliance with the PSM standard if revised as OSHA is considering. The model includes full detail on how OSHA would estimate costs for a facility to comply with each PSM requirement and how and why we estimate costs differently.[19]

[19] The Excel file with our cost model was submitted via regulations.gov as Attachment 4 to these comments.

ACMA convened a work group that assisted the SERs in estimating the costs for each of their 11 composites manufacturing facilities if these facilities needed to comply with PSM. The work group consists of five members:

- Two health and safety consultants who have worked extensively with composites manufacturing companies and with ACMA. Both of these individuals have assisted industries other than composites manufacturing with PSM compliance issues. (Neither they nor any other consultants that we are aware of have assisted composites manufacturing companies with PSM compliance.) These individuals have first-hand knowledge about the characteristics of composites manufacturing processes and the level of effort and skills required to accomplish the various PSM tasks.
- A composites industry SER, though he is not employed by a composites manufacturing company. Instead, this individual is the production manager and PSM lead for one of the leading U.S. chemical manufacturing companies that supplies resins to the composites manufacturing industry. This individual manages his company's compliance with the PSM standard, and interacts frequently with his composites industry customers to provide information and training regarding safe and proper use of resins. He also has close knowledge about the effort and resources needed to establish and maintain compliance with PSM for composites and related industries.
- A regulatory economist with substantial experience in estimating the costs for manufacturing and other industries to comply with environmental, health and safety regulations. This individual has worked on several regulatory analysis projects for the composites manufacturing industry, as well as for many other industries.
- An ACMA staff person with expertise on composites industry health and safety issues.

The group developed a model for estimating the costs for a composites manufacturing facility to comply with the requirements of the PSM standard. The model is patterned closely after the analysis that OSHA performed in estimating compliance costs for the original PSM standard in the Agency's 1992 analysis and the further analysis that the Agency provided recently in estimating the costs of the potential revised PSM provisions. Our model is a spreadsheet workload model that uses Microsoft Excel:

- We identify each task that a facility subject to PSM must complete in order to comply with the standard.
- For each task, we estimate the number of labor hours required to perform the task or the portions of the task one time, and we identify the job categories of the employees (e.g., production worker, senior engineer, manager) who would be needed to provide these labor hours.
- We identify a set of facility-specific variables that will affect the costs for a facility to comply with PSM, including, for example, hourly wage or salary rates at the facility for each category of employee, benefits overheads applied to wages or salaries, facility characteristics that affect how often a PSM task will need to be performed for compliance (e.g., the number of covered

processes at a facility directly affects the number of process hazard analyses that will need to be done; the number of facility employees and the number of contract workers used by the facility will directly affect the costs to provide the various sorts of required PSM training for employees and contractors), and other facility characteristics that affect the manner in which each PSM task will be performed (e.g., to what degree will the facility use outside consultants rather than in-house staff to perform the PSM tasks).

- We identify how often each PSM task will need to be performed over the ten-year period after a facility is made subject to PSM (e.g., once, annually, every three years, etc.)

The work group developed a survey that the SERs answered for their 11 facilities that provided the facility-specific information (e.g., number of employees at the facility and their job categories, hourly wage rates, etc.) needed to apply the model and estimate costs for each facility. The survey also provided additional information that the SERs and ACMA have used in developing comments about the potential changes to the PSM program, including block flow diagrams for each facility, information about flammable liquid release incidents at the facility, information about whether the facility might be reconfigured to avoid having more than 10,000 pounds of flammable liquids in a process and what the impacts of such a change might be, and more.

After the necessary facility-specific data is entered into the initial worksheet in the model, the model processes all of the information described above and then estimates the costs for the facility to comply with each of the requirements of the PSM standard. The model estimates separately the costs for the facility to meet each of the requirements of the existing PSM standard and each of the potential new PSM requirements, and then the sums these figures to estimate the total costs for the facility to meet all the requirements of the existing standard total costs and all the requirements of the potential new standard. Similar to the manner in which OSHA has estimated PSM compliance costs, the model is designed to estimate these costs over the ten-year period after a facility is made subject to PSM. In contrast to the Agency's approach where capital costs are annualized and costs in future years are discounted, we instead sum the nominal costs in each of the ten years and divide by ten to obtain an undiscounted average cost per year.

A member of the ACMA work group developed draft PSM compliance cost estimates for each of the SERs' 11 composites manufacturing facilities by entering the data obtained from the survey for that particular facility. Each SER then reviewed the draft estimates for his or her facility(s), revised the survey input data and workload factors in the model as he or she judged appropriate for the particular facility(s), and developed with the work group member a final cost estimate for each facility. We have conducted this cost-estimating process on a confidential basis. Only the SER for a particular facility and the single workgroup member knows the model inputs and results and the cost estimates for that particular facility. We have reported the cost estimates for the 11 facilities on a blinded basis – neither the SERs nor ACMA (nor OSHA when the Agency reviews this information) can know which of the facility cost estimates shown in the table above applies for any specific facility. We are thus providing for OSHA's review a copy of the model that is configured to estimate the costs for a hypothetical composites manufacturing facility –not for one of the 11 actual SER facilities – to comply with the current and the potential new PSM requirements.

We conclude our comments on the potential costs for small entity composites manufacturing facilities to comply with the proposed revisions to the PSM standard with several observations. We can provide further information to support these observations if OSHA wishes.

2.2.5. Concluding comments on cost of PSM

The ACMA workgroup and SERs identified four important tasks that small entity composites manufacturers will need to perform if they must comply with PSM – but which OSHA has not included in the Agency's analysis. We estimate substantial costs for each of our industry's affected facilities to complete these tasks, and we provide further details in our cost model:

- *Understand the PSM regulation and its requirements*. Read the regulation, read explanatory materials (e.g., PSM Background Document for SERs, additional OSHA information, Georgia Tech training material, etc.) with the aim of understanding how the regulation applies to your facility and what you will need to do to comply. Decide who among the current senior staff you will designate as PSM program manager for your facility, or hire an individual for whom managing the PSM process will be a major element of his or her job duties.
- *Identify and evaluate PSM consultants and contract with one*. The consultant will guide and assist facility personnel as needed in complying with the PSM standard and performing the required tasks. None of the SERs report currently having an individual on site at the facility who is sufficiently knowledgeable and experienced with PSM or similar activities as to lead the compliance effort for the facility without outside assistance. A senior manager for the facility will need to identify consultants who might be able to play this role, evaluate them, and choose and contract with one. SERs for 5 of the 11 facilities reported that they would need a consultant to advise and help lead the PSM process, but would be able to do most of the detailed work (e.g., develop required process safety information, evaluate process equipment relative to RAGAGEP) in-house. SERs for 6 of the 11 facilities reported that they would have more extensive need for consulting assistance – to advise and lead, and also a consulting team would be needed to do much of the detailed work. Only one of the 11 SERs reported that s/he knows of a consultant who might be capable of leading PSM activities at the facility; ten of the 11 SERs did not know of any consultant who might be helpful in this regard.
- *Hire or designate an individual to serve as PSM program manager for the facility*. Meeting the PSM requirements, both initially and then on a continuing basis, requires an individual who is committed to making the process work and integrating it effectively into the facility's operations. A successful program will also require consistent support from the facility's owners and top management. The best way to assure that a PSM program will have the attention and commitment it needs will be to assign responsibility for its management explicitly to a single individual (who has appropriate experience) for whom making the PSM program successful is a substantial portion of that individual's job description. PSM cannot be initiated and continued successfully unless it has a "champion" at the facility – it cannot be managed effectively by different individuals each independently managing one or another of the many PSM tasks. Since none of the SERs report that they have a single individual with appropriate expertise and

sufficient time available to perform this function, this individual will almost certainly need to be a new hire.

- *Evaluate and acquire PSM software*. One of the facility's managers will need to evaluate the variety of PSM and/or safety management systems software and choose one to acquire and use. A good software package will facilitate performance of many PSM tasks (PHAs, training, contractors, hot work permits, certifications, preparation of block flow diagrams, PNDs, etc.) as well as planning, scheduling, updating, coordinating and record keeping. Conscientious use of good PSM software will substantially simplify management of change and compliance audits.

From surveying the SERs and work group discussions, we also learned that many of the assumptions and estimates that OSHA made for other industries regarding PSM workload elements would be quite inaccurate if applied to the composites manufacturing industry. In addition to the points that we cited earlier (starting on p. 8), relative to the other industries that OSHA analyzes specifically, small entity composites manufacturers typically:

- Use contractors (who will need training and consultation regarding PSM activities) for in-plant activities less frequently;
- Will need to use consultants to lead and perform PSM tasks much more frequently;
- Make fewer significant process modifications (pre-startup safety review) and fewer changes to process chemicals, technology, equipment and procedures, and facilities that affect a covered process (management of change);
- Do less hot work;
- Have a history of many fewer incidents that could have resulted in catastrophic releases of highly hazardous chemical in the workplace; and
- Have both a greater number and diversity of equipment units in a typical covered process.

We suggest again, if OSHA moves forward with the proposal to remove the atmospheric storage tank exemption, that the Agency estimate the resulting compliance costs and economic impacts for the composites manufacturing industry specifically, while using information and assumptions that accurately characterize this industry.

2.3. OSHA's Questions for SERs regarding the atmospheric tank exemption

In the *Issues Document*, OSHA poses seven questions for the SERs regarding the potential change to the atmospheric tank exemption.[20] Based on information provided by the six composites manufacturing SERs specifically for the 11 production facilities owned by these SERs' companies, we provide answers to the first six of OSHA's questions in this section. Our response to the seventh question, on cost of compliance, was provided in Section 2.2.

[20] *Issues Document*, p. 3.

1. Do you store flammable liquids in atmospheric tanks?

All 11 facilities store flammable liquids, specifically various resins used as the primary component in the production process, in atmospheric storage tanks. The tanks usually include bulk resin storage tanks and drums and totes, and may include also various mix tanks and day tanks. Small quantities (far less than 10,000 pounds) of flammable liquids other than resins – perhaps organic peroxide initiators and solvents such as acetone – may also be stored in various small containers that could be classified also as atmospheric storage tanks. Ten of the 11 facilities have bulk resin storage tanks, each of which exceeds 10,000-pound capacity. (A tanker load of resin is typically 42,000 pounds. Resin purchased by less-than-full tanker costs about 5% more, and in drums about 10% more, than when purchased by the full tanker load.)

2. Would you consider the atmospheric storage tank exemption applicable to your process?

Yes.

If so, why?

Excluding resin in the atmospheric storage tanks, each of the 11 facilities has much less than 10,000 pounds of flammable liquids in the production process. The resin is a flammable liquid with boiling point well above the ambient temperatures encountered in these manufacturing facilities. Ten of the 11 facilities have one or more bulk resin storage tanks that are not chilled or refrigerated and that are connected to the composites production process at each facility, and each of these tanks has capacity exceeding 10,000 pounds and often contains bulk resin in amount exceeding 10,000 pounds. The one facility that does not have a bulk resin storage tank uses drums and totes for resin storage, with the total amount of resin contained in these vessels and elsewhere in the process amounting to less than 10,000 pounds at all times. Across the 10 facilities with bulk resin storage tanks, there are at least 20 such tanks.

If you have an atmospheric storage tank: Is it connected to other equipment or stand alone? Please describe the connected equipment.

Among the 10 facilities with atmospheric storage tanks for bulk resin, nine of the ten have hard pipes connecting the tanks to composites production processes. Connected to these pipes may be additional tanks (mix tanks, day tanks) and a wide variety of resin application equipment (e.g., spray guns for open molding, closed molds, pultrusion or filament winding equipment, etc.). Most of these facilities also sometimes fill from the bulk storage tanks other vessels that are portable and not permanently connected to the bulk tanks, including drums, totes and day tanks, and these portable temporary storage vessels will then be moved to the application area of the facility to provide resin or compound for the application stations. See the schematic diagram of a typical composites production process provided as Figure 1 (p. 3).

What is the quantity of flammable liquid stored in the atmospheric tank?

Each of the at least 20 atmospheric bulk resin storage tanks at the 10 (of 11) composites manufacturing facilities with such tanks has capacity exceeding 10,000 pounds. Most of these tanks have capacity between 35,000 and 65,000 pounds. At any point in time they may be filled to varying degrees depending on the balance at that time between resin delivery and usage, but each facility with such tanks will usually have more than 10,000 pounds of bulk resin in storage at any one time.

3. Has your facility had incidents of flammable material release from an atmospheric storage tank? If so, what were the consequences?

Yes. The SERs for each of the 11 facilities provided incident information for each facility's operating lifetime or the past 20 years, whichever is less. A summary of the information provided by the SERs on incidents at these facilities can be found in Table 2 starting on p. 25.

4. How much would it cost to bring the tank(s) into compliance with PSM?

The SERs have not answered this question. Since nearly all of the atmospheric bulk resin storage tanks at the SERs' facilities are connected directly via hard pipe to the remainder of these facilities' production processes, the important question is not how much it would cost to bring the *tanks* into compliance with PSM, but instead how much it would cost to bring the *entire processes* into compliance with PSM. Elimination of the atmospheric tank exemption would make the entire production process subject to PSM, not the tanks alone. We provide information below regarding the SERs' estimates for the cost of compliance with PSM for their entire processes.

5. If an atmospheric storage tank was not exempted, would a connected process now reach the threshold quantity (10,000) of flammables and be covered by PSM?

Yes. Each of the 10 SER facilities with one or more bulk resin storage tanks is not now (with the atmospheric storage tank exemption in force) subject to PSM because each such facility has less than 10,000 pounds of flammables in connected processes, excluding the bulk tank contents. If the atmospheric tank exemption were removed, each of these 10 facilities owned by the SERs' companies would be covered by PSM, because the heretofore exempted tanks would bring the total volume of flammables in connected processes to more than 10,000 pounds. The 11^{th} of the SERs' facilities does not have atmospheric storage tanks for bulk resin, is not now subject to PSM, and would not be subject to PSM if the atmospheric storage tank exemption were removed. This facility, however, would be subject to PSM if it were to add a bulk tank for resin storage, which the facility's owner is considering.

If so, how much would it cost to bring the process in compliance with PSM?

As describe earlier (in Sections 2.2.3 and 2.2.4), a workgroup of five experts has developed a workload model to estimate the costs of PSM compliance for composites manufacturing facilities. The SERs provided the facility-specific information needed to apply the model to their 11 facilities and have estimated the costs to comply with PSM at these facilities as would be necessary if the atmospheric storage tank exemption were eliminated. The average annual costs per facility to comply with the existing PSM requirements are estimated at $43,250/year and an additional $17,560/year to comply with the additional PSM requirements that OSHA is considering. The average annual total cost per facility to comply with both the existing and the potential new PSM requirements would be $60,810 per year. The average annual total compliance costs range across the 11 facilities from a low of $45,900 to a high of more than $101,500 per year.

6. Are there any special circumstances specific to small entities the Panel should consider with respect to this option?

Yes. The composites manufacturing SERs operate production processes that are inherently low risk due to both the limited flammability and low reactivity of the polyester and vinyl ester resins that are used, and the already very well controlled character of the processes. There is no need for, and there would be little benefit to, the substantial PSM analysis and documentation requirements that would ensue if the atmospheric storage tank exemption were eliminated for bulk resin tanks. The small businesses that operate composites manufacturing facilities employ very few people at these facilities other than production workers, managers and administrative, sales, and maintenance staffs. We asked in a survey of the 11 small entity composites manufacturing facilities how they would accomplish the required PSM tasks if the facilities were to be subject to the standard:

- Only 1 of the 11 facilities has an individual on-staff who would be sufficiently knowledgeable about PSM activities to be able to lead Process Hazard Analyses and other required elements of the PSM program. The knowledgeable individual at this single facility is currently fully occupied with other important duties. At all 11 facilities, either a costly consultant or a new hire would be needed to lead PSM activities. The new hire, if that approach were taken, would also be costly because such an individual sufficiently qualified for this position would need to be employed on a full-time basis, yet the work involved in managing and performing many of the PSM responsibilities would amount to less than one FTE.
- Only 2 of the 11 facilities has an individual on-staff, such as an engineer, who would be capable of performing PSM activities such as developing a block flow diagram for the production process, writing a protocol for safely cleaning the resin storage tanks periodically, or evaluating the tanks relative to RAGAGEP. Again, costly consultants or new hires or perhaps training and education of existing employees would be necessary.
- None of the 11 facilities reported that they could perform all or nearly all PSM activities in-house. Five of the 11 facilities reported that they would need a consultant to advise and help lead PSM activities, but that they would be able to do most of the detailed work in-house. Six of the 11 facilities reported that they would need a consultant to advise and lead, and that a consulting team will also be needed to do much of the work.
- Only one of the 11 facilities reported that they knew of a consultant or firm that could advise and assist with PSM compliance. Management at 10 of the 11 facilities would need to spend substantial time in finding, evaluating, contracting with and managing an appropriate consultant.

In short, the substantial analytical and documentation requirements of PSM are well beyond the capabilities of the on-board staff at small entity composites manufacturing facilities, and costly and extensive help would be needed from consultants and/or new hires if these facilities were to become subject to the standard.

Note that OSHA has estimated costs for performing many PSM tasks by assuming that a few hours will be needed per process from a variety of specialized personnel – Level III Drafter, Levels III through VI

Engineers, Clerical/typist – that very few small entity composites manufacturers will have on board at their facility. The total hours required that OSHA would estimate as needed in any single such specialized job category for PSM compliance across all tasks would amount to much less than one FTE in that job category. It is thus not reasonable to expect the employer to make a new full-time hire in each job category to provide the needed specialized labor. A small composites manufacturer would have several options that would be much costlier per hour than OSHA estimates for obtaining the much less than one FTE needed in each of these job categories:

- Use consultants instead;
- Use more qualified/higher paid employees who might be able to perform the required lower level specialized functions;
- Share a qualified employee across multiple facilities (if the manufacturer does indeed have multiple facilities), in which case additional facility-to-facility travel costs will be incurred; or
- Hire, train, let go, rehire a series of temporary or part-time personnel to perform these functions as the need arises.

Several composites manufacturing SERs have noted these difficulties that they will face in providing relatively few hours of labor in several specialized job categories. Costs will be higher than OSHA estimates.

The lack of experience with the PSM program, the lack of qualified staff to implement it, and the substantial cost of obtaining consultants or new hires to perform the tasks involved in PSM compliance would lead many small entity composites manufacturers to consider avoiding bulk storage of resin as a means of avoiding applicability of the PSM requirements. However, use of drums and totes rather than bulk tanks to supply the resin for composites production processes would have serious adverse impacts on both health and safety and the economics of these small businesses. The cost of resin is approximately 10% higher when received by drum compared to tank wagon.[21] Accidents (e.g., punctures, spills, overfilling) in loading and off-loading are far more likely for drums and totes than for tanker trucks and bulk storage tanks. Moving drums and totes throughout the plant would then also result in more accidents and releases than piping the resin from storage to the application areas. Drums and totes and fork lifts and other equipment to move them would take up space and crowd already-busy application areas, resulting in more opportunities for accidents. The valves on totes also open and close in the opposite direction from most other valves, and there is some history of employees failing to remember which direction to turn the valves to shut off totes. This likelihood of increased accident rates in using drums and totes rather than bulk resin storage combined with the increased cost of purchasing resin in small containers rather than tanker-loads would give small business composites

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[21] One of the composites industry SERs provided this analysis: Switching from bulk tanks to drums would increase resin cost by approximately 10%. In addition, the cost of the drum freight verses the cost of a tanker load would add an additional 3%; loss of resin left in drums vs resin residual in bulk tanks would probably be another 2%; the extra cost per tanker of drums verses the cost of bulk tank off loads would be another 2% because off-loading drums would take more employee time than hooking up to off load resin tanker; delivery of a half load of resin vs a full load of resin would increase by 5%; none of these cost incorporated the cost of worker's compensation injuries dealing with 500 pound drums. All told, switching to drums is likely to cost between $75,000 and $150,000 for this company.

manufacturers a difficult choice between incurring the substantial costs of complying with PSM and incurring the substantial costs of avoiding the necessity of complying with PSM.

3. Expanding PSM coverage and requirements for reactivity hazards

OSHA provides the following discussion in its *Issues Document*:

> The PSM standard covers certain chemicals considered to be reactive due to instability. The standard does not address chemicals which pose other sorts of reactivity hazards, such as those associated with the generation of heat or toxic products when combined with other chemicals. OSHA is interested in expanding PSM to cover these additional reactivity hazards. OSHA is considering the addition of language…that would extend coverage to processes that mix substances with a listed functional group, when the heat of reaction is above 100 kcal/mol or if the reaction generates a toxic product and the substance is at the threshold quantity. The list of functional groups and threshold quantities would be included in an appendix to the standard. OSHA is considering adopting this list from New Jersey Toxic Catastrophe Prevention Act (TCPA) Guidance…. Under this modification, facilities may need to conduct a heat of reaction analysis and calculate the maximum attainable temperature (MAT) for each reaction vessel for all reactive hazard substance (RHS) mixtures. They would also be required to document all calculations.[22]

Composites manufacturers routinely mix two types of materials possessing chemical functional groups specified in the TCPA guidance: unsaturated polyester and vinyl ester resin and organic peroxides. The heat of reaction upon mixing these chemicals is well below the proposed 100 kcal/mol threshold, and no toxic byproducts are produced. ACMA supports the proposed revision, provided employers are able to rely on available *objective data* to determine if their mixing of substances generates sufficient heat of reaction to trigger PSM requirements.[23] We propose that the analytical report shown in Figure 3 should provide just such objective data, and that composites manufacturers should be able to use this report in that capacity if they obtain it from their suppliers or other sources such as ACMA's website.

4. Comments on the SBAR Panel Report

ACMA very much appreciates the efforts of the SBAR Panel to solicit, consider and fairly summarize the recommendations of small companies including composites manufacturers. The large majority of composites manufacturers are small companies, and the issues identified by the SERs are likely relevant to our entire industry.

In general, we are very supportive of the Panel's report.[24] Here we provide two brief comments.

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[22] *Issues Document*, pp. 6-7.

[23] A similar approach is allowed under OSHA's recently revised standard for respirable crystalline silica. Employers can use objective data to determine if their workplace exposures will be below the silica action level and are thereby exempt from the rule. See 29 CFR 1910.1053(a)(2).

[24] The Panel's report is in the form of an August 1, 2016 letter from the Panel to David Michaels, Assistant Secretary for Occupational Safety and Health. www.regulations.gov/document?D=OSHA-2013-0020-0116.

Based on comments from several SERs, in its report the Panel recommends OSHA consider a definition of a "storage tank" as one that is not permanently connected to process units, and that these tanks might be excluded from PSM requirements.[25] It is our view that *permanent connections* between storage tanks and process units significantly contribute to the improved safety resulting from bulk resin storage compared to storage in drums and totes. Using flexible temporary hoses to remove resin from a storage tank would largely undercut the safety benefits of having a bulk storage tank, as damaged hoses and connections, or failure to follow procedures regarding the connection and disconnection of tanks and process units, could contribute to an increase in incidents. We also believe implementing this recommendation could lead to confusion and uncertainty regarding what counts as a "temporary" connection.

The Panel report refers to an SER's comment that "polyurethane" resin is a safe substance and storage of this material should not be covered under PSM. We believe the SER in this case was referring to *polyester* resin.[26]

5. Conclusion

Composites manufacturers support OSHA in its mission to improve workplace health and safety. We encourage the agency to adopt feasible new requirements when needed to address hazards such as storage and processing of flammable liquids and reactive materials.

However, composites manufacturers should continue to be exempt from any revised PSM standard. Our industry has a long history of safe manufacturing by small companies, and does not present a risk sufficient to warrant coverage under the PSM standard. Further, the majority of composites manufacturers lack the resources compliance would require.

[25] See Panel report, pp. 5 and 26.

[26] Panel report, p. 6.

ASHLAND

To: John Schweitzer
American Composites Manufacturers Association

SUBJECT: Heats of Reaction of Unsaturated Polyesters/Vinyl Esters with Organic Peroxides

Reported by: Roman Loza – Composite Polymers
Thomas Grentzer – Analytical Services & Technology

xc: Fred Good

Report Date: June 22, 2016 J

RESULTS

Sample Identification	DSC Measured Heat of Reaction (joules / gram)	Calculated Heat of Reaction for resin & styrene (kcal / mole)	Calculated Heat of Reaction for resin & styrene (kcal / mole-unsaturation)
GP Laminating Resin-1	300	15.74	
GP Laminating Resin-2	310	16.42	
GP Laminating Resin-3	301	17.84	
Specialty Laminating Resin-1	317	16.72	
Specialty Laminating Resin-2	327	17.46	
EVER-1	355	18.18	16.01
EVER-2	338	21.22	16.90
UPR-1	283	19.45	12.60
UPR-2	387	22.42	14.98

EXPERIMENTAL DSC MEASURED HEAT OF REACTION
The heats of reaction for the reported samples were measured via the TA Instruments Q2000 DSC using hermetically sealed aluminum pans. The liquid sample was tested immediately after catalyzation. The samples were heated at 10°C/minute from -50°C to 250°C (1st Scan), cooled at

10°C/minute to -50°C and was retested (2nd Scan). The DSC cell was purged with helium at a rate of 25cc/minute to prevent moisture condensation during cooling.

CALCULATED HEAT OF REACTION BASED ON FORMULATION

The calculated heat of reaction expressed in kcal/mole was derived from the measured heat of reaction (expressed in J/gram) using the conversion factor 0.000239006 kcal/J.

The molecular weight of the unsaturated polyester polymer (number average) was taken from GPC analysis. The molecular weight of the vinyl ester polymer was calculated using charge amounts of the constituent raw materials. The final molecular weight of the resin used in the heat of reaction calculation is then 1/(sum of moles of polymer and moles of styrene per unit weight of resin). These results are shown in the third column.

A second calculation was done using the results from the two UPR and two EVER entries in which the total moles of unsaturation per unit weight of resin was used in place of the moles of polymer. These results are shown in the last column.

Figure 3. Heats of reaction of unsaturated polyesters/vinyl esters with organic peroxide.

Table 2. Incident data reported by SERs.

Facility 1
3 - Number of incidents over past 20 years
6 - Number of years this facility has been producing composites, if there have been less than 2 years of operating experience
<u>Incident #1</u>
Approximately January 2012, we had a fire in the gel coat booth. Likely caused by a rag that had initiator chemical on it and it was left on the floor overnight. The following morning maintenance personnel was arriving at the factory and smelled something burning. When Max S entered the factory he noticed a small fire in the gel coat spray booth. He put it out with a fire extinguisher. After looking into the incident it was believed that the initiator caused the rag to spontaneously combust and started a fire, burning one of the booth walls that at the time was made of wood and paper. Since then we have set up protocol to dispose of rags with any type of chemicals in a fire proof trash container. We have also purchased metal trash cans with a safety lids (Cease Fire Container) that help prevent fires as well. Proper safety training was put in place to provide proper information for handling, clean up, and proper disposal of hazardous chemicals and a refresher training is done every year.
<u>Incident #2</u>
October 17, 2012. An electrical fire was caused by an malfunction on a hydraulic lift in the lamination booth. The fire marshal explained that there was probably some arching that was taking place on the lift electronics / motor. The acetone VOC residual vapors could have been part of the ignitor and the wood and paper walls used on the booth were considered the fuel for the fire. The acetone is no longer discharged on the floor to clear the lines on the guns and we replaced with paper & wood with metal walls for all of the booth walls. Additionally, we have removed the hydraulic lifts and replaced them with pneumatic lifts.
<u>Incident #3</u>
Spring 2013. Chemical spill of resin in the HazMat room. The employees mixed a batch of resin, left it unattended which allowed it to overflow and dumped approx. 4 fifty-five gallon barrels worth of resin. Followed protocol to collect the spilled resin (squeegee's & shovels) placed resin in empty 55 gal barrels. Recycled it in production. Procedure changed to ALWAYS be attending during the transferring from mix tank to day tank.

Facility 2
7 - Number of incidents over past 20 years
>20 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience
<u>Incident #1:</u>
What happened? Overfilled the resin tank. (this has happened probably 5 times)
What were the results? Resin overfills the tank and is contained in the block building.
Were there any legal consequences? No
How (if at all) might this incident have been prevented? Either some sort of automatic shut off valve or better operator attention.
Were any changes made to reduce the likelihood of a reoccurrence? Procedures were written to include staying at the filling location throughout the process.
<u>Incident #2:</u>
What happened? Out of spec resin was being catalyzed (hardened) in a tub when the tub broke. This spilled resin onto the ground. The then over catalyzed resin ignited and caught on fire. The fire was extinguished and the resin cleaned up and catalyzed.
What were the results? Tub filled with catalyzed resin.
Were there any legal consequences? No
How (if at all) might this incident have been prevented? Less Catalyst in the mixture.
Were any changes made to reduce the likelihood of a reoccurrence? We catalyze in smaller amounts (5 gal) when necessary.
<u>Incident #3:</u>
What happened? Catalyst inadvertently entered a mix tank. The temperature of the mix tank combined with the catalyst caused the entire tank to harden.

Table 2. Incident data reported by SERs.
What were the results? Trashed the mix tank. Were there any legal consequences? No How (if at all) might this incident have been prevented? Keep Catalyst far from the mixing area. Were any changes made to reduce the likelihood of a reoccurrence? Signage was created to indicate keeping any catalyst from the mixing area. **Facility 3** 2 - Number of incidents over past 20 years >20 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience <u>Incident #1:</u> What happened? Fire at the resin pump station What were the results? Resin pumps were destroyed. Water damage to process controls. Were there any legal consequences? No How (if at all) might this incident have been prevented? The fire department determined that the fire started in a garbage can in the area. We found out people had been smoking in the plant. The fire started during a break on second shift, so it had time to build since the area was unattended. The sprinklers and lack of material limited the spread of the fire. The fire did not affect the mix/day tanks behind the fire wall Were any changes made to reduce the likelihood of a reoccurrence? We now have a separate dry fire protection system for that area that can be activated thermally and manually, allowing us to react more quickly to a fire in that area than the ceiling sprinklers, and without the collateral damage. Major organizational changes were made on the 2nd shift. <u>Incident #2:</u> What happened? Storage tank was overfilled. What were the results? Less than 100 gallons spilled. This was pumped into drums, cleaned with absorbents, and the resin and absorbents disposed of as hazardous waste. Were there any legal consequences? No. The tanks are in a diked area that contained the spill. How (if at all) might this incident have been prevented? The driver unloading the tank wagon could/should have stopped his pump when he activated the high level alarm. Were any changes made to reduce the likelihood of a reoccurrence? We monitor the unloading of resin, and know ahead of time if the load will fit in the tank, or if some needs to be diverted into the second tank. We also have better delivery flexibility with our vendors. **Facility 4** 1 - Number of incidents over past 20 years 14 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience <u>Incident #1:</u> What happened? Fire at Gel Coat pumps, caused by a catalyst leak. What were the results? Pumps and controls destroyed Were there any legal consequences? No How (if at all) might this incident have been prevented? Monitoring Were any changes made to reduce the likelihood of a reoccurrence? Checked before and after each shift. **Facility 5** 1-Number of incidents over past 20 years >20 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience <u>Incident #1:</u> What happened? During plant closure, new air walls to collect particulate were being installed. The plant had an existing water wash system and wet dust had collected at the bottom of the collection bin. An employee was

Table 2. Incident data reported by SERs.
instructed to clean the collected wet particulate matter from the bin so that the maintenance staff could begin taking it apart and installing the new air wall device. When the welder started cutting the old metal to remove small amounts of dust residual ignited. What were the results? The grinding booth was equipped with an automatic sprinkling system which immediately came on and put the small dust fire out before the community fire department arrived onsite. Were there any legal consequences? No, fire was contained onsite in a small area of the facility. How (if at all) might this incident have been prevented? The supervisor in charge of this project could have verified prior to releasing the removal and construction team in to the area that all the dust had been properly removed. Employees designated with the responsibility of maintaining the new air walls are trained in the hazards, the proper use, and proper maintenance to prevent future incidents. Supervisors conduct visual inspections to make sure proper maintenance and operational instructions are being followed. Were any changes made to reduce the likelihood of a reoccurrence? Employees designated with the responsibility of maintaining the new air walls are trained in the hazards, the proper use, and proper maintenance to prevent future incidents. Supervisors conduct visual inspections to make sure proper maintenance and operational instructions are being followed. **Facility 6** 0 - Number of incidents over past 20 years 17 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience **Facility 7** 3 - Number of incidents over past 20 years >20 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience Incident #1: What happened? We had an employee who wanted to short cut is cleaning duties to leave earlier. He took acetone to clean the area with, when the policy and procedure was to use aqueous cleaners. When using acetone, he splashed another employee with the acetone on his pant leg. This employee was on his way to punch out and leave for the day. When the employee walked by the breakroom a designated smoking area another employee was leaving lighting a cigarette and the vapor trail caught on fire causing the employees clothes to ignite. What were the results? All employees in area acted quickly to stop drop and roll the employee putting the fire out. Employee suffered minor burns. Were there any legal consequences? No legal How (if at all) might this incident have been prevented? Better monitoring of employees during clean up. Making the entire inside of the building no smoking instead of just in designated areas. Were any changes made to reduce the likelihood of a reoccurrence? NO SMOKING POLICY was changed to include entire inside of building. Acetone was locked up and only authorized employees may get to take back to the spray application areas. All employees taking acetone must sign out how much they are taking, the reason, and the area and they must sign their name. Incident #2: What happened? Incident 2 did not happen at our facility. It happened at a facility we were using as a subcontractor. Because we had knowledge of the incident we wanted to make sure we would not have a similar incident. At this facility they had external mix spray application equipment which was hooked up to catalyst. The spray gun was leaking catalyst and the operator set it down on a metal drum. Catalyst is reactive with metals and this created a fire. The fire was put out by the local fire department and contained to the area, but could have been a much bigger incident. What were the results? There was no immediate effect on our facility because it was not owned and operated by our company

Table 2. Incident data reported by SERs.

Were there any legal consequences? Not that we know of.
How (if at all) might this incident have been prevented? In an effort to make sure this type of incident didn't happen at our facility, we contacted our catalyst supplier and they come in on a regular basis and train our employees on the specific hazards, handling and storage. During this training and an internal audit we discovered that the pump holders were not coated like the actual pumps and any leaks of catalyst could create reaction to the metals causing a fire, explosion or otherwise. We worked with suppliers and the manufacturers of the chemicals and the pump holders to come up with a specific coating to prevent this issue. All employees are trained onsite on proper handling of catalyst and only designated employees work on catalyst pumps and equipment.
Were any changes made to reduce the likelihood of a reoccurrence? See above.
Incident #3:
What happened? Resin drum was puncture while moving into lamination back up gun area.
What were the results? Resin drum was quickly placed in an over-pack drum to prevent leakage on the floor.
Were there any legal consequences? NO
How (if at all) might this incident have been prevented? Employees are trained in proper movement of chemicals throughout the plant. Only designated employees are trained on the forklift. In this instance one of the drum fork arms was starting to rust and had somehow got bent. When lifting the drum with it, it punctured a small hole into the drum. Resin material is very thick so only a couple drops came out while getting the over-pack drum. Continuous training to make sure employees understand the importance of inspecting the equipment being used in production. Management oversight to randomly check inspection reports to make sure employees are just marking down random responses.
Were any changes made to reduce the likelihood of a reoccurrence? Training programs and added to the maintenance department inspection check list.

Facility 8
2 - Number of incidents over past 20 years
4 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience
Incident #1:
What happened? The resin supplier was delivering resin and offloading to the storage totes, the shut off valve was turned the wrong direction and this allowed resin to flow onto the containment floor.
What were the results? Less than 5 gallons of resin leaked onto the floor. Plant Manager in charge activated our spill response plan and the resins were squeegeed off the floor collected into a bucket, strained out and usable product was used in the process. Contaminated product with dirt and debris in it was used to make parking bumpers because those didn't require cosmetic perfection.
Were there any legal consequences? NO
How (if at all) might this incident have been prevented? Training had been conducted with all employees who off load. This particular incident was related to the supplier and tanker personnel not being supervised.
Were any changes made to reduce the likelihood of a reoccurrence? Procedures were put in place to make sure that all loads have a trained and designated employee during all off loads.
Incident #2:
What happened? Employee was off loading resin tanker into totes and turned shut off valve the wrong way which opened the tank.
What were the results? 5 to 10 gallons of resin spilled onto the containment floor. It was immediately cleaned up. Employee forgot that the valve on the totes turn the opposite direction than normal shut off valves. Employee had been trained and had conducted these duties before without incident.
Were there any legal consequences? NO
How (if at all) might this incident have been prevented? Regular reviews could help but we can't control human error. This employee was very knowledgeable about the process and had done this process many times.
Were any changes made to reduce the likelihood of a reoccurrence? Bulk storage tanks were installed to help eliminate confusion on tanker loads filling totes.

Table 2. Incident data reported by SERs.

Facility 9
32 - Number of incidents over past 20 years
>20 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience
Our incidents have been extremely limited. Over the past 20-years, we have experienced just two reportable spills of gasoline or diesel (less than 10-gallons each time). In both cases the spills were reported to the appropriate agency, clean-up was done internally, and the material disposed. Costs were less than $1,000 each time with no legal ramifications. No changes were needed as a result.
Other incidents, associated with polyester and vinyl ester resin have occurred, on average 1-2 per year. These incidents are typically small spills within the facility that are related to buckets being tipped over, drum dispensers sticking and being left unattended, dispensing systems malfunctioning and the like. In each case a full incident investigation is completed and changes to process/procedures are made to avoid reoccurrence. Such cases typically result in the need to dispose of hazardous waste. Total cost, including disposal, likely is in the $2,000-$2,500 range, including personnel time. Never have there been any legal ramifications or any environmental impact.

Facility 10
4 - Number of incidents over past 20 years
>20 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience
<u>Incident #1:</u>
What happened? Fire in the back office. A foam blanket was left lying again a space heater over the weekend.
What were the results? Small fire in the back office
Were there any legal consequences? No
How (if at all) might this incident have been prevented? Turn off all space heaters when leaving.
Were any changes made to reduce the likelihood of a reoccurrence? Removed all space heaters.
<u>Incident #2:</u>
What happened? Small fire in layup room from static electricity from someone walking across the floor and washing their gun in acetone sent a spark to the acetone on the floor.
What were the results? Small fire that was extinguished by fire extinguisher located in that area.
Were there any legal consequences? No
How (if at all) might this incident have been prevented? Not sure, this was a pretty unusual event caused by dry weather.
Were any changes made to reduce the likelihood of a reoccurrence? No, other than just be cautious on dry days.
<u>Incident #3:</u>
What happened? Filling a drum of resin with the piped in resin hose, the person left the drum unattended and the drum spilled over.
What were the results? A lot of resin spilled on the floor
Were there any legal consequences? No
How (if at all) might this incident have been prevented? Not leave the drum unattended.
Were any changes made to reduce the likelihood of a reoccurrence? Yes, it is against the rules to leave drums being filled unattended.
<u>Incident #4:</u>
What happened? Worker failed to shut the valve off to the gelcoat gun, which cause gelcoat to dispense out when the shop air was turned on.
What were the results? Gelcoat mixed with catalyst causing the floor and gun to smolder.
Where there any legal consequences? No
How (if at all) might this incident have been prevented? Correct procedures performed when shutting down equipment at night.

Table 2. Incident data reported by SERs.
Were any changes made to reduce the likelihood of a reoccurrence? Supervisor to double check all equipment before leaving. **Facility 11** 6 - Number of incidents over past 20 years >20 - Number of years this facility has been producing composites, if there have been less than 20 years of operating experience What happened? Moving totes, the tote slipped off the forklift and tipped over. What were the results? Resin spill Were there any legal consequences? No How (if at all) might this incident have been prevented? More careful when moving the tote Were any changes made to reduce the likelihood of a reoccurrence? Reviewed forklift training tape. Incident #4, & 5: What happened? When filling the drum from the tank, the drum overflowed What were the results? Resin spill on the floor Were there any legal consequences? No How (if at all) might this incident have been prevented? Not to leave the drum while being filled Were any changes made to reduce the likelihood of a reoccurrence? Policy put in place Incident #6: What happened? When filling a drum from a tote resin was spilt What were the results? Resin spill on the floor Were there any legal consequences? No How (if at all) might this incident have been prevented? Be more careful when pouring resin Were any changes made to reduce the likelihood of a reoccurrence? Pour resin while in a containment area.