VOLUME 3

Safety Assessment
Of
Georgia-Pacific Resins' Facility in Columbus, Ohio

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Prepared for

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In The Court Of Common Pleas, Franklin County, Ohio
Judge Jennifer L. Brunner

Reference
Case No. 98 CVC 05-3535

ROBERTA A. BOOTH, et al., vs
GEORGIA-PACIFIC CORP., et al.

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Executive Summary

GPRI experienced an explosion in a Resin Kettle at their Columbus facility in 1997 that sent fragments and toxic gases into the surrounding neighborhood, which was later evacuated. As the result of a lawsuit, Mark V, Inc. was hired by the Court appointed Liaisons to conduct a safety assessment of the current facility. The primary objective of this assessment was to determine if the current facility has sufficient safeguards to prevent an incident from occurring that would pose a significant risk to the community around the plant.

The method used for this assessment was to evaluate the primary management systems that are used to control the hazards of the process. This evaluation compared what was found in the facility with what would be expected to be found if Recognized And Generally Accepted Good Engineering Practices (RAGAGEPs) were followed. The RAGAGEPs used for this evaluation are appropriate for the design, operation, maintenance and management of chemical facilities like that operated by GPRI. The RAGAGEPs include Codes, Standards, Recommended Practices and Guidelines established by consensus by technical organizations such as, the American Institute of Chemical Engineers (AIChE), the American Society of Mechanical Engineers (ASME), the Instrumentation, Controls, and Automation Society (ISA), and the National Fire Protection Association (NFPA). In addition, the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor require the use of RAGAGEP through their Process Safety Management regulation[1]. This regulation only applies to processes which contain at least the threshold quantity of listed highly hazardous chemicals. The GPRI facility in Columbus is covered by this regulation because of the large quantity of formaldehyde that is in the process. The U.S. Environmental Protection Agency's (EPA) Risk Management Program[2] contains the same requirements as OSHA's PSM program and likewise requires the use of RAGAGEP. The Columbus facility is also covered by this regulation because of the large quantity of formaldehyde in the process.

The primary findings are discussed in this executive summary. Additional findings are discussed in the body of the report.

Piping and Instrument Diagrams (P&IDs):

Piping and instrument diagrams are drawings that are used to show the equipment used in the process, the characteristics of that equipment and the interrelationship between the pieces of equipment. These drawing are the primary tool used to perform a process hazards analysis (discussed later) and perform operator training. They are also referred to by operators when performing tasks shown in their Standard Operating Procedures, and by engineers when considering modifications to the process, troubleshooting and incident investigation. There are also numerous other uses. These drawings are probably the most important of all of the drawings maintained.

These drawings should show all process equipment, including piping and instrumentation, and the characteristics of this equipment. Safety Instrumented Systems

(SIS or safety interlocks), alarms and other information critical to the design, operation or maintenance of the equipment should also be shown.

OSHA cited GPRI following the 1997 incident for failing to have adequate P&IDs. GPRI's P&IDs are still not inadequate. In general: they do not show all of the equipment, or the characteristics of the equipment; Equipment, including piping and instrumentation are not adequately identified; The SISs are not shown; Some equipment referenced in the Standard Operating Procedures is not shown.

GPRI should update all of their P&IDs to ensure that they are accurate and contain all recommended information.

Standard Operating Procedures:

Standard Operating Procedures (SOPs) provide the operators with the information they need for them to safely operate the process. They are also the primary tool that is used to train the operators.

There should be an SOP for performing every phase of operation of the process. These procedures should contain all of the information necessary to accomplish the tasks necessary to safely accomplish the desired operation.

OSHA cited GPRI following the 1997 incident for failing to have adequate SOPs. GPRI's SOPs are still not adequate. No procedures could be found for some sub-tasks that were required to be performed by certain main tasks. In general, the procedures are ambiguous and difficult to follow. They refer the operator to operate equipment that is either not shown, or not adequately identified on the P&IDs. They are not as good a training tool as they should be.

GPRI should update all of their SOPs to ensure that they are accurate, complete and clear.

Electrical Area Classification

Electrical area classification is a method that is used to identify the potential for sparks from electrical equipment igniting flammable gases or vapors that have escaped from the process. If this potential is identified, then special electrical equipment must be used that is designed to minimize the potential for this type of ignition, which may lead to fires and explosions.

There should be documents showing that an electrical area classification analysis was performed, the basis for the analysis and the results of the analysis. The results of this analysis should be incorporated into operating and maintenance procedures and purchasing specification for electrical equipment.

GPRI handles flammable methanol in the Formaldehyde Plants and the Resin Plant. Both plants also handle formaldehyde, which is a flammable gas produced in the Formaldehyde Plants and is released from spilled formaldehyde solutions that could occur in any of the plants. However, GPRI has determined that, in general, the plants do not contain any flammability hazards and as a result the areas are unclassified. As a result, a spill of methanol or formaldehyde in either building could result in a fire or explosion.

GPRI should reevaluate the electrical area classification of their plants taking into consideration the findings in this report. GPRI should then take the appropriate actions based on the results of that analysis.

Process Hazards Analysis:

A Process Hazards Analysis (PHA) is a structured method that is used to identify: the hazards of the process; potential deviations from intended operation; the consequences of those deviations; the safeguards that are provided to protect against the hazards; and the adequacy of those safeguards. If it is determined that the safeguards are inadequate, actions are taken to improve the existing safeguards or add additional safeguards.

Some type of PHA is usually performed several times during the initial design of the process to ensure that the design minimizes risks to personnel and the surrounding community. PHAs are also revalidated every three to five years after the process has been placed in operation to ensure that it is still valid based on new information that has been learned about the chemicals in the process, the technology of the process and the equipment in the process. A PHA is also performed prior to making any changes to the process chemistry, technology, equipment or procedures to ensure that the change does not introduce any new hazards, or that the new hazards have adequate safeguards. The PHA is the primary tool used to ensure that the process is safe to operate.

OSHA cited GPRI following the 1997 incident for failing to perform adequate PHAs. GPRI performs a PHA for each plant every three years, but they still are inadequate. Their most recent PHAs: contain inaccuracies about the safety systems provided; provide lists of safeguards with no information about the design basis or adequacy of the safeguards; lists as safeguards equipment which is not a safeguard for the particular deviation and consequence being evaluated; overlook some of the hazards created by a safeguard; underestimate the consequences of deviations from design intent; overlooks some consequences of deviations and does not adequately identify the equipment that is being evaluated.

One of the major shortcomings of the PHAs is the failure of GPRI's team to adequately determine if the safeguards provided are sufficient.

It appears that the presumption is made that the safeguards are very reliable, which may not be the case. For example, there are two resin plant safeguards used to prevent a runaway reaction from causing fire and explosion. These are pressure relief rupture disks and an acid quench system.

- The rupture disks vent into a scrubber that is not protected by a pressure relief device. No documentation has been found to show the design basis for the rupture disk system or that the scrubber system is capable of handling the reaction products at the high rate they are generated, without exploding. OSHA cited GPRI following the 1997 incident for failing to provide the design and design basis for the kettle pressure relief systems.

- The acid quench system is dependent on numerous pieces of equipment functioning as designed. If some of these systems fail, the acid quench will not be able to enter the kettle and stop the runaway reaction.

OSHA also cited GPRI following the 1997 incident for failure to have an adequate ventilation system for the control room. However, the ventilation system is still inadequate. The control room makeup air comes from a location very close to potential sources of formaldehyde fumes, the doors are not closed and sealed, the room is not maintained under a positive pressure, and there are no systems to prevent the entry of hazardous vapors or warn of their presence.

GPRI should review and update the way that they conduct PHAs and revalidate the PHAs for each plant.

After providing GPRI with a Draft report in March of this year, they were asked to review it and provide a list of the findings that were incorrect because we did not have all of the information or we interpreted something wrong, or any other reason. When we met in June to receive their comments, they provided us with a list of the recommendations that they did not agree with. During this meeting and a subsequent meeting in August, there was very little discussion about the findings. For the most part, I think it is accurate to say that GPRI does not object to the findings. Most of their concerns were about the recommendations. As shown in Table 1 in the Appendix, GPRI does not agree with most of the recommendations made in this report. However, they have agreed to review and address 21 of the recommendations. Most of their responses are in the columns showing that they disagree with the recommendation (16) or that they are already in compliance (56). In most cases, they argue that the RAGAGEPs used to determine the gaps in their management systems either do not apply or are above and beyond what they consider to be required. They have even prepared a document which rationalizes their reasoning for not feeling that they are obligated to follow the RAGAGEPs (Guidelines) established by the American Institute of Chemical Engineers, who is recognized by OSHA and the rest of the world as the foremost authority on the design, operation, maintenance and management of chemical facilities. OSHA considers these Guidelines to be RAGAGEP and has issued citations when they were not complied with. GPRI has also rationalized that RAGAGEPs from other internationally recognized organizations do not need to be followed. If this attitude does not change, we should not expect to see any significant further improvements in the safety of the Columbus facility.

The final recommendations in this report ultimately reflect the author's independent assessment.

The potential for another kettle explosion has been significantly reduced by installing a computer control system in place of the manual system that was used before. This system provides improved reliability, reduces the potential for human errors and includes enhanced safeguards. However, GPRI has not documented the level of risk that remains for a similar accident in the future. No significant improvements have been made to the Formaldehyde Plants. The documents show that improvements are needed to control the hazards in those plants. In most cases, the documents reviewed for the formaldehyde plants had more deficiencies than those for the Resin Plant.

Additional work is needed in several areas to improve the management systems used to control the hazards in the Resin Plant. In many cases, these are the same

management systems that OSHA found to be deficient, and cited GPRI for, as a result of the 1997 incident.