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## THE USE OF OZONE IN EMBALMING ROOMS: A CRITICAL STUDY

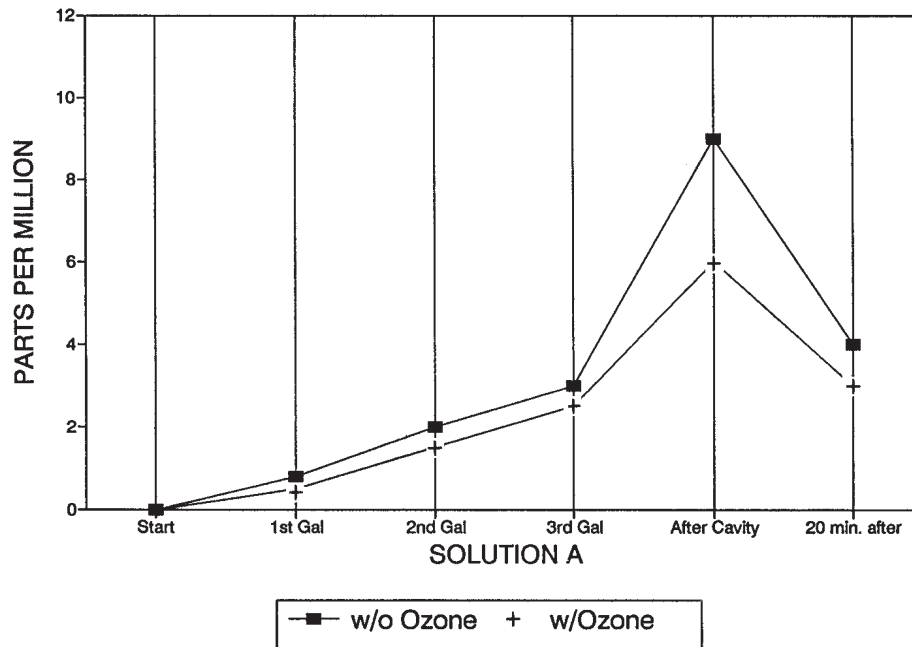
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### Part 2

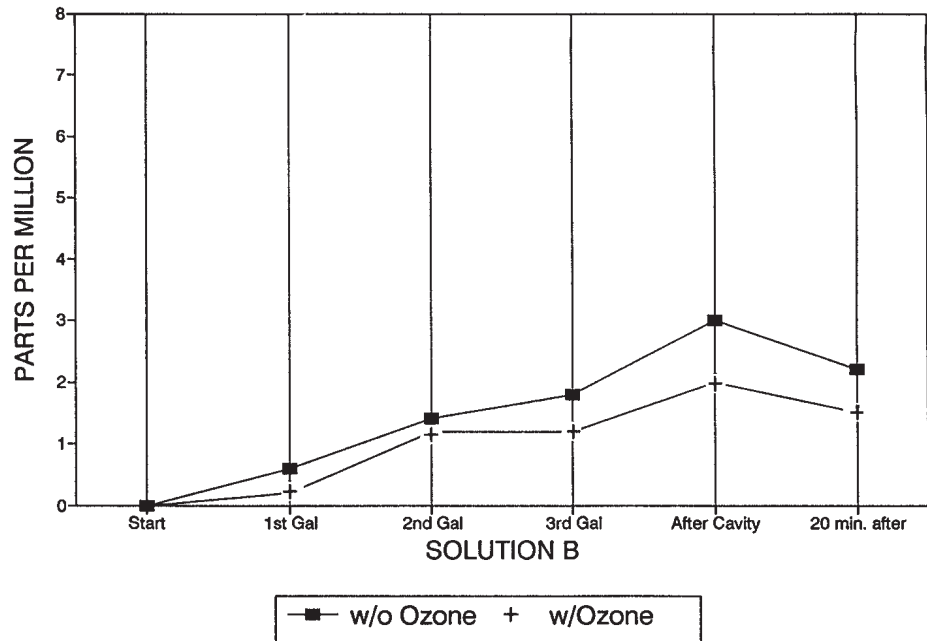
**DISCUSSION:** A reexamination of Table 1 and Graphs 1 and 2 indicates that ozone reduces formaldehyde exposures a maximum of only 35%. The effect of ozone is far less than we expected prior to the study. Ozone appears to be a poor substitute for adequate ventilation with proper vapor control techniques which can reduce formaldehyde exposures up to 85%. The results during our testing show far less effectiveness of ozone in reducing formaldehyde concentrations in the air than other unpublished studies have indicated. These studies, supplied by the manufacturers, show 50% or greater effectiveness in reducing formaldehyde exposures in various situations. We were unable to duplicate these findings despite using the ozone generator on maximum output settings. Comparison between tests conducted under differing experimental settings is very difficult. Differences in room size, ozone generators, fluid type and quantity used, embalming time frame and embalmer technique and type and placement of formaldehyde monitors all result in variables that are difficult to assess. The manufacturers stress the importance of the height setting of the ozone generator in the overall effectiveness of the generators. During our testing the generator was situated 5 feet from the floor, essentially at embalming table height. Formaldehyde and ozone both being heavier than air would sink to the lower levels of the room during an embalming. Positioning of the ozone generator at a higher level might have increased the relative effectiveness observed.

Ozone appears to be relatively ineffective in reducing exposure to formaldehyde after spills in embalming rooms. Reexamination of Table 2 indicates that formaldehyde concentrations are only reduced a maximum of 30% and it required an hour to accomplish that reduction. Compared to ventilation, ozone is ineffective as a chemical mop or exposure control device when larger quantities of formaldehyde solutions are rapidly introduced into the embalming room environment, such as through accidental spills. There was little or no effect in reduction of formaldehyde exposure when a simulated embalming was conducted by irrigation of the table with an embalming solution even though the embalming room was predosed with ozone for 30 minutes prior to the test.

## GRAPH 1



## GRAPH 2



Ozone is very effective in controlling the unpleasant odors associated with embalming and embalming rooms. The air was fresh and pleasant at all times and no formaldehyde smells were detected. Ozone would be very effective in reducing foul odors associated with advanced decomposition cases and other delayed embalming situations. However, do not be lulled into a false sense of security due to the lack of formaldehyde smells as formaldehyde can be present and in relatively high concentrations and not be detected by the embalmer when ozone is used.

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The ozone generator used during this study was surprisingly effective at total ozone output. With a maximum setting on the controls, ozone output was in excess of 700mg/hr. In fact, at any setting above medium the output would exceed the recommended exposure limits (TLV) for humans. During all tests, the setting was always on high so as to maximize the effect of ozone. At this high output both embalmers experienced respiratory distress after approximately one hour of exposure. The embalmer's symptoms included a dry throat, inflammation and difficulty in breathing. The symptoms disappeared approximately 3-4 hours after exposure ended. Ozone concentrations measured in the air at these settings were .7ppm, which is far above the threshold limit values for exposure. Obviously, care should be taken in the use of ozone generators in embalming rooms as some machines can output an excessive amount of ozone at their higher settings.

**SUMMARY:** Ventilation is the most important factor in reducing formaldehyde vapor exposure in embalming rooms. Adequate ventilation coupled with proper technique of vapor control (adequate table irrigation, lid on embalming machine, no open fluid bottles and careful injection of all fluids) results in the greatest reduction of formaldehyde fumes. The use of glutaraldehyde based fluids with reduced amounts of formaldehyde or low odor type fluids have been shown to reduce total formaldehyde exposure during embalming operations.

The use of ozone generators in controlling noxious odors in embalming rooms is recommended. Ozone would, no doubt, be effective in other areas of the funeral home such as smoking lounges and offices as an air freshener and purifier. Ozone as a primary means of formaldehyde exposure control in embalming rooms does not appear effective. Supplementing ventilation and other effective means of formaldehyde vapor control with the use of an ozone generator would be acceptable.

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