"Keratin-Based" Hair Smoothing Products And the Presence of Formaldehyde

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There are other organizations that have recommended exposure limits. Although they do not carry the force of law (as OSHA's limits do), they reflect the considered recommendation of the workplace health community.

The American Conference of Governmental Industrial Hygienists (ACGIH) established a threshold limit value ceiling level (TLV-Ceiling) of 0.3 parts per million (PPM) in 1992. This differs from an 8-hour limit because it limits exposures to 0.3 ppm at any time. In the 2001 "Documentation of Threshold Limit Values," this value was established to minimize irritation, primarily to the eyes and upper respiratory tract. ACGIH also recognizes formaldehyde as a suspected human carcinogen, based on animal studies that resulted in cancers in nasal cavities. In 2000, ACGIH added the "sensitizer," in recognition that the TLV may not protect sensitized individuals. The most recent ACGIH recommendation maintains the previously adopted language.[56] The ACGIH recommendation was exceeded in most of the air monitoring conducted by Oregon OSHA.

The National Institute for Occupational Safety and Health (NIOSH), which is part of the Centers for Disease Control and Prevention, has a recommended exposure level (REL) of 0.016 ppm as an 8-hour time weighted average, as well as a 15-minute short term exposure limit of 0.1 ppm.[57] NIOSH also considers formaldehyde to be a known carcinogen (which likely explains the particularly low recommended exposure levels). The NIOSH recommended limit were exceeded in all the air monitoring conducted by Oregon OSHA (the results reported by the company for stylists also exceeded the NIOSH limit, and the sample for the middle of the salon reached the NIOSH recommended limit for 8-hour exposures).

To provide some perspective, the exposure at 1.88 ppm formaldehyde ranks 6th among the 600 air monitoring samples for formaldehyde Oregon OSHA has collected during the past five years. It is just slightly higher than one particular sample taken during embalming, which measured 1.87 ppm.

Discussion of Air Sampling Scenarios

Case 1: The first salon was in Portland. It was a relatively small salon with roughly six stations. Each station had a chest high divider separating it from neighboring stations. The room had general dilution ventilation that was augmented with two fans. One blew across the client and the other blew toward the stylist. The stylist wore nitrile gloves. The stylist was sampled for airborne formaldehyde exposure during this process.

In this case the stylist took 34 minutes to apply the solution. The exposure was 1.26 ppm formaldehyde for this time period. The stylist took 26 minutes to blow dry the hair and 1.88 ppm formaldehyde was found for this time period. Two samples were taken during the heat treatment. The first sample was for 48 minutes. 1.35 ppm formaldehyde was found for this time period. The second sample was for 6 minutes and 0.369 ppm formaldehyde was found. The time weighed average (TWA) exposure for the 114 minutes to complete the treatment was 1.39 ppm. The 8 hour TWA, with no additional Brazilian Blowout treatments conducted in the salon, was 0.331 ppm. Two samples were taken in the reception area of the salon during this process.

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[56]2010 Threshold Limit Values and Biological Exposure Indices, ISBN 978-1-607260-19-6.
[57]Found at http://www.cdc.gov/niosh/npg/npgd0293.html.

The first sample was for 91 minutes and 0.319 ppm formaldehyde was found. The second sample was for 26 minutes and 0.227 ppm formaldehyde was found.

The stylist's exposure was 44 percent of the eight-hour exposure limit (PEL) and 66 percent of the action level. In this case the stylist's highest short-term exposure was 94 percent of the mandatory short-term limit and more than 6 times the ceiling limit recommended by the ACGIH. One sample in the reception area exceeded the ACGIH recommended ceiling, as did the eight-hour average itself.

Case 2: The second salon was in a medium-sized room with about 8 stylists' stations downstairs. The building had an upstairs as well. There were no dividers between the stylist's stations and there was no general ventilation. A window and a door were left open during the procedure to increase ventilation. The stylist wore nitrile gloves.

This stylist took 13 minutes to apply the solution. The formaldehyde exposure during this time was 0.303 ppm. She took 20 minutes to dry the hair and the formaldehyde exposure was 1.45 ppm. The heat treatment took 12 minutes and the formaldehyde exposure was 0.273 ppm.

The stylist's average exposure during the treatment was 0.805 ppm and the 8 hour average was 0.075 ppm. An area sample was taken at an adjacent station and the formaldehyde was 0.2 ppm. In this case stylist's exposure was only 10 percent of the eight-hour exposure limit and 15 percent of the action level. Even with multiple treatments, she would have been unlikely to exceed either the PEL or the action level. However, the highest short-term exposure reached 73 percent of the mandatory short-term limit and was almost five times the ACGIH-recommended ceiling. The adjacent station reached 67 percent of the ACGIH-recommended ceiling.

Case 3: The third salon was in a very large room with a high ceiling and general dilution ventilation. A window was left open to increase ventilation. The client had shoulder length hair. The stylist wore nitrile gloves.

The stylist took 23 minutes to apply the solution. The formaldehyde exposure was 0.206 ppm. She took 13 minutes to blow dry the hair and the exposure was 0.472 ppm. She took 25 minutes to heat treat the hair. The formaldehyde exposure was 0.181 ppm. She did a second blow dry for 15 minutes and the exposure was 0.084 ppm. A 188-minute sample was taken upstairs. It had a concentration of 0.048 ppm formaldehyde. A sample taken for 24 minutes after the treatment was 0.045 ppm formaldehyde. A 15-minute sample taken after that had formaldehyde less than the limit of quantification.

The stylist's average exposure during the treatment was 0.219 and the 8 hour average was 0.035 ppm, 7 percent of the action level and less than 5 percent of the 8-hour permissible exposure limit. Even with multiple treatments, she would have been unlikely to exceed the PEL or the action level. Her highest short-term exposure was 24 percent of the mandatory short-term exposure level and 50 percent higher than the ACGIH-recommended ceiling.

Case 4: A fourth salon had 8 stylists in a large room with some partitions between stations. There were several adjacent rooms and the front and back doors were left open for ventilation. The stylist wore latex gloves (latex gloves are not recommended for use with formaldehyde). The client had shoulder-length hair.

The samples in this case were not identified by task. The first sample took 19 minutes and the formaldehyde exposure was 0.442 ppm. The second sample was for 47 minutes and the exposure was 0.34 ppm. The stylist's average exposure during the procedure was 0.369 ppm and her eight-hour average was 0.051 ppm. Two samples were taken on an adjacent stylist. Her first sample was for 16 minutes and formaldehyde was less than the limit of quantification. The second sample was for 57 minute and the exposure was 0.121 ppm. A person away from the treatment process was also sampled. Her exposures were 0.045 ppm formaldehyde for the first 41 minutes and 0.112 ppm for the next 57 minutes.

Once again, the stylist's exposures were 10 percent of the action level and less than seven percent of the 8-hour limit, making it unlikely that even multiple treatments would result in exposures above either the action level or the PEL. The stylist's highest short-term exposure was 22 percent of mandatory short-term limit 50 percent greater than the ACGIH-recommended ceiling.

Case 5: The fifth salon was in an unusually large room with ceilings higher than 20 feet. The room had general ventilation. The stylist wore nitrile gloves.

The samples were not separated by task. The first sample took 17 minutes and the formaldehyde exposure was 0.108 ppm. The second sample was for 15 minutes and the exposure was 0.074 ppm. The stylist's average exposure during the treatment was 0.092 ppm and the 8 hour average was 0.006 ppm. This stylist was well under the action level, as well as the mandatory eight-hour and short term limits. In contrast to the other procedures sampled, her exposure was also below the ACGIH-recommended level, coming in at 36 percent of the recommended ceiling.

Case 6: The sixth salon was in a room with two large ceiling fans on ceiling of different heights. There were six stations and the stylist sampled was in the area with the highest ceilings. The doors were left open during the treatment process. The stylist had a fan that blew across the clinent and wore nitrile gloves.

Breathing zone samples were placed on the stylist during the process. The samples were changed every 15 minutes. Samples were also placed on a chair between stylist stations, behind the stylist, in the reception area, and near the trash receptacle. The highest 15-minute exposure for the stylist was 0.176 ppm while blow drying and ironing the hair. Her average exposure during the procedure was 0.059 ppm and the 8-hour average was 0.006 ppm. The area sample on the chair had a peak exposure of 0.295 ppm, an average during the 45-minute treatment period of 0.144 ppm, and an 8 hour average of 0.014 ppm. The area behind the stylist had a peak exposure of 0.206 ppm with a an average during the treatment of 0.116 ppm and an 8 hour average of 0.011 ppm. All the samples in the reception area were less than the limit of quantification of 0.2 ug per sample. The area at the trash receptacle had a peak exposure of 0.227 ppm with an average during the treatment of 0125 ppm and an 8 hour average of 0.012 ppm.

The stylist's exposure was well below the Oregon OSHA PEL of 0.75 ppm and about 9 percent of the short-term limit, making it unlikely that either limit would be exceeded even if multiple treatments had been conducted during a single day. It was about 60 percent of the ACGIH-recommended level. The areas around the stylist had higher concentrations of formaldehyde during the course of the treatment than those to which the stylist was exposed.

Case 7: The seventh salon had four stations with a false ceiling. No doors or window were left open and the stylist did not use any fans during the treatment. She did not wear gloves. Breathing zone samples were placed on the stylist during the process, which took 94 minutes. The samples were changed every 15 minutes. Samples were also placed to the right of the stylist, near the stylist's sink and to the left of the stylist. The stylist's peak exposure was 0.471 ppm, while applying the solution. Her average exposure during the procedure was 0.255 ppm and the 8 hour average was 0.050 ppm. The results did not exceed the 8-hour limit and it is unlikely that multiple treatments would have done so. The stylist's highest short-term exposure was about 24 percent of the mandatory short-term limit, although both her highest and second highest 15-minute exposures exceeded the ACGIH recommended ceiling of 0.3 ppm..

The area to the right of the stylist had a peak concentration of 0.157 ppm, with an average of 0.066 ppm and a 8-hour average of 0.013 ppm. The area near the sink had a peak concentration of 0.183 ppm. The area to the left of the stylist had a peak concentration of 0.160 ppm, an average of 0.062 ppm and an 8 hour average of 0.12 ppm.

Discussion of Oregon OSHA Results Compared to Brazilian Blowout's Reported Results

The company released air monitoring results on October 15, 2010, taken from two stylists performing two treatments each in a single salon. The only results reported were for the eight-hour average exposure, which came to 0.064 ppm for one stylist and 0.073 ppm for the other. The middle of the salon also was tested, providing an eight-hour average of 0.016.[58]

In general, these results – although less detailed – are not inconsistent with Oregon OSHA's air monitoring results, which included both results that were higher and results that were lower than those reported by the company.

This exposure level is below both the action limit and the permissible exposure level.[59] Given Oregon OSHA's own results, however, both CROET and Oregon OSHA would be interested in the short-term exposure levels included in the company's sampling. It seems likely that the product used was relatively small and that ventilation, in keeping with the company's recommendations, was good. Assuming that the procedures took no more than two hours each (likely to be an overestimate), the average exposure during the procedure would be roughly half that reported for the eight-hour average.

If the procedures averaged no more than 75 minutes each (not an unreasonable assumption, given the time frames reported during the Oregon OSHA sampling), then the two stylists probably averaged more than 0.2 ppm during the procedure itself.

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[58] Found at http://www.brazilianblowout.com/pdf/october15.pdf.

[59] As the standard notes, formaldehyde can cause signs and symptoms at much lower levels than the specified exposure limits, which is why the standard triggers a number of requirements at an 8-hour time-weighted average of 0.1 ppm. The action level and permissible exposure limits (PELs) can perhaps better be described as "danger" levels – they are regulatory levels of significant, and exceeding the PEL is a serious violation of the standard. While staying below the action level may mean that an employer is in compliance (assuming the air monitoring, medical surveillance, personal protective equipment, and hazard communication requirements of the standard also are met), it does not mean that formaldehyde levels are "safe."