Environmental Health
& Engineering, Inc.
117 Fourth Avenue
Needham, MA
02494-2725

TEL 800-825-5343
781-247-4300
FAX 781-247-4305

MEMORANDUM

TO: Reminger Co, LPA

FROM: Environmental Health & Engineering, Inc.

DATE: July 24, 2009

RE: Review of "Implications of Granite Countertop Construction and Uses"

Environmental Health & Engineering, Inc. (EH&E) previously reviewed the 2-page letter from the Conference of Radiation Control Program Directors (CRCPD) titled, "Potential Occupational Exposure, Fabrication of Granite Countertops", dated June 10, 2009, and signed by Dave Bernhardt, CHP (EH&E report dated July 7, 2009). We subsequently received a file from the Marble Institute of America (MIA) on July 20, 2009, which contained an abstract and slides from a poster presentation given by Mr. Bernhardt, Al Gerhart, and Linda Kincaid at the recent Health Physics Society Conference. We reviewed the abstract and slides and made the following observations, in addition to the comments in our original report to the MIA:

1. NO PERSONAL BREATHING ZONE SAMPLES WERE TAKEN

The method used by Linda Kincaid to assess worker exposure was incorrect and is scientifically indefensible. Personal breathing zone air samples are the standard method used in industrial hygiene to assess a worker's exposure. Ms. Kincaid did not follow these standard methods and used area samples taken at a stationary location on a work surface to assess worker exposure to airborne uranium. These stationary air samples were taken in a location directly opposite and in the path of the grinded/sanded debris removed from the granite. The following figure, taken from the author's presentation, clearly demonstrates, even to an untrained eye, that the environment in the breathing zone of the worker is vastly different from the environment where the sample was collected.

The standard sampling method for uranium involves collecting particulate on a filter that is contained in a “cassette”. When samples are taken (personal or area) the orientation of the cassette is very important because if the cassette hole is facing upwards, large particles can enter the cassette and be deposited on the filter. This is well known and is described by the U.S. Occupational Safety and Health Administration (OSHA), in their Technical Manual as, “gross contamination” of the sample. From the picture, the cassettes are facing directly upwards allowing/encouraging this gross contamination with the debris from the grinder. The method used by Ms. Kincaid is not acceptable in the science of industrial hygiene and is of no use for personal exposure estimation.

2. PARTICLE SIZE IS UNKNOWN BUT REQUIRED FOR INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION MODEL

The sampling method used by Ms. Kincaid does not differentiate particle size of the dust in the air. Particle-size (aerodynamic diameter) is a key determinant in estimating radiation exposure with the International Commission on Radiological Protection (ICRP) model used by Mr.

Bernhardt. Use of the model requires knowledge of the activity distribution and how it is related to aerodynamic diameter. Therefore, the sample collection method was incompatible with the inputs needed for the model used to estimated dose.

In the presentation, the words “inhalable” was used to describe the particles that were sampled. “Inhalable particles” is a term used to describe a very specific size range of particles (<100 microns) and requires a specific sampling method that was not used by Ms. Kincaid. Use of the term “inhalable particle” implies a particle size selection sampling method was used when in fact the uranium sampling method demonstrated in the photograph does not do this. The use of this term could also be a result of misunderstanding on the author’s part of what the term “inhalable” means scientifically in the field of exposure assessment.

3. URANIUM AIR CONCENTRATIONS RESULTS ARE IMPLAUSIBLE

At the very least, the authors should have conducted a reality-check on their uranium concentrations to exposure numbers based on existing data. The simple calculation is based on government data and follows here:

1) The hazardous substances databank indicates that uranium occurs in various rocks (including granite and phosphate rocks) exists at concentrations of 0.5 parts per million (ppm) to 5 ppm. This range is consistent with Mangum Uranium Corporation estimates of uranium concentration in granite. (http://www.magnumuranium.com/s/Uranium.asp, accessed July 22, 2009).

2) 1 ppm by weight is 1 milligram per kilogram (mg/kg).

3) Ms. Kincaid reports 0.32 milligrams per cubic meter (mg/m^3) of uranium in one of the samples (the other is 0.24 mg/m^3).

4) Therefore, using the highest uranium concentration reported by the hazardous substance databank (5 mg uranium/1 kg granite, from Step 1, we can calculate the amount of granite rock that would have to present in air if 0.34 mg/m^3 of uranium was found in the air:

0.32 mg uranium/m^3 * (1 kg granite/5 mg uranium) = 0.064 kg granite/m^3 (1,000 grams/kg) = 64 grams Granite/ m^3

5) 64 grams of granite/m^3 is not a plausible exposure scenario. National Institute for Occupational Safety and Health (NIOSH) has an immediately dangerous to life and health (IDLH) value of 3 grams/m^3 for total dust so the exposure would be almost 23 times the IDLH value. This concentration of dust in the air resulted from using the highest concentration of uranium provided by HSDB that provides the lowest estimate of granite dust in the air. Using the lower value from HSDB (0.5 ppm) for uranium concentration in granite the concentration of granite dust would be ten times higher, 640 grams of granite dust/m^3, or over a pound of granite dust per cubic meter of air. Both numbers are extraordinarily high and without precedent.

The result of this simple reality check tells us that the samples were not valid and not representative of personal exposure. Another possibility is that there were interferences in the analysis of uranium that caused the uranium concentration to be reported higher than it actually was. But these results obtained by Ms. Kincaid should have been a red flag that something was wrong and the reason should have been pursued before using the data any further.

4. NON-REPRESENTATIVE SAMPLING OF GRANITE TYPE

As we conclude in the two papers recently accepted for peer-reviewed publication, granite slabs exhibit high within-slab variability, a feature which is more prominent on slabs on the higher end of the distribution for radon and radiation emissions. In this report by Bernhardt et al., the authors disregard this variability and, instead, use the values from isolated surface measurements and apply those values to the entire stone. For example, in the abstract, the authors state, “Uranium and thorium concentrations range from those similar to normal soil to over 15 Bq/g of uranium.” They do not address the issue of the size of the surface area represented by the high end or the low end of the range. It is clear from our peer reviewed papers that the high end of the cited range would be a small percentage of the overall stone activity and a very small portion of the surface area of the stone. Mr. Bernhardt and Ms. Kincaid use the highest value and apply it to the entire stone.

5. NON-STANDARD WORK CONDITIONS

The authors present information from one stone shop under unrealistic OSHA non-standard fabrication procedures. However, on one of the author's website (www.solidsurfacealliance.org), he states that samples were taken in 8 shops. The authors provide no indication of which samples were selected for use in the article. The author's do not present this information for review.

6. BIASED GRANITE SAMPLE SELECTION PROCEDURE

The author's present information on selected granite stones in Table 1, yet the slides state that information was not included on 'stones with concentrations similar to natural soil'. Therefore, the 'Summary' as presented by the authors is misleading because they intentionally omitted information on stones at the lower end of the distribution for radon and radiation emissions; these stones make up the vast majority of stones sold and fabricated in the United States, based on market-share data.

The authors state that the data presented in a 60-page report issued by EH&E were not included in the summary due to 'difficulties' in interpretation. However, in their summary table (Table 1), they include results for two stones from the EH&E report but only stones from the upper end of the distribution for radon and radiation emissions. And, again, these stones make up a small percentage of stones on the market.

SUMMARY

In summary, this group of authors continues to use scientifically indefensible methods to draw conclusions regarding exposures to workers and the public. The scientific errors all lead to gross over estimates. No identified scientific errors committed by these authors were found that would lead to an underestimate of exposure

Specifically, the over-estimates are due to:

1) No personal breathing zone samples were taken.

2) Stationary area samples taken directly across from the cutting tool on a work surface was used to estimate worker exposure.

3) No particle size data was collected that is a required input of the ICRP model used to estimate worker radiation exposure.

4) Non-representative sampling conditions for collecting air samples of any type, i.e., the exposure scenario the authors artificially constructed, assumed workers worked in dry conditions and with only one type of stone that was at the upperbound of the distribution for radionuclide activity.

5) Non-standard work conditions.

6) Biased sample selection.

If you have any questions regarding this memorandum, please do not hesitate to contact us at 1-800-TALK EHE (1-800-825-5343).