



Health and Safety Considerations for the Successful Commercialization of Graphene and related Products

Gregory Nichols, MPH, CPH
GP Nichols & Company

The relative newness of graphene and the excitement around its discovery and potential applications have created an environment in which researchers and manufacturers are racing to be first to new discoveries and products. However, during this process, as is the case with any newly developed industry or technology, health and safety aspects are often not considered, and if they are, it is typically as an after-thought. The right balance of regulation and oversight must be found in order to prevent unnecessary illness, injuries, and pollution yet also allow for innovation and economic growth. Even though that regulation may not be present now, it will come in time. Graphene is no exception, and the graphene community has a choice to be part of that conversation now and help develop reasonable recommendations and practices that will help strike that balance. Ignoring the situation now only pushes the decision-making process further out of the hands of industry and academia.

Major U.S. regulatory and research agencies (i.e., EPA, FDA, NIOSH, and CPSC) have funded studies to assess the health and safety of engineered nanomaterials. Throughout that process, the consensus has been that some nanomaterials may cause health effects in certain doses under certain situations, but the situation was not as bad as some may have thought it was going to be. However, health research has been prioritized to focus on what was considered the most detrimental materials (carbon nanotubes, and nanoscale titanium dioxide). Other materials were slowly added, including Ag and Au NPs, and others are still being assessed.

Nanomaterial regulation has been slow, but it is beginning. In 2006, Berkeley, California, enacted the first nanotechnology-specific ordinance in the U.S. NIOSH has already developed recommended exposure limits for TiO₂ (2011), CNTs (2013), and Ag NPs (2015). Just last year (2017), the EPA's revised Toxic Substances Control Act reporting and record keeping requirements went into effect for nanoscale materials.

Some organizations have opted to follow the precautionary principle (exposures are considered dangerous until proven safe) while some tended to continue to ignore *in vitro* and animal data. Most likely, a middle-path is needed, one that promotes cautious optimism – continue with research and development and commercialization but be deliberate in understanding the implications of those processes and products.

Graphene is one of those materials that is just beginning to be evaluated. While it may appear to be counterintuitive, assessing the health and safety of graphene is good for industry. If studies are negative, then solutions can be developed to make it less toxic, and it is better to know now than during litigation. If studies are generally favorable, then it gives a boost to the community. In addition, assessing health and safety allows industry to control the message better and be an integral part of the process.