Laboratory Management considerations when working with Nano-Engineered Materials

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Purpose of the research

Nanotechnology is said to be an innovative and novel way to address the world's future needs. However, there is limited knowledge on the behaviour of nano-engineered (NEM) materials even though their use is widespread.

The context of this study is Quality Management (QM). This study was undertaken to seek the extent to which QM practices were adopted during the research and development and manufacture of NEM. It is purely exploratory and draws on the literature from research and technical guidelines in the field on risk management.

Due to the limited literature related to QM in this field this paper aimed to establish suitable quality management steps that could be adopted by a laboratory to monitor, measure and control its activities when working with nano-engineered materials. It attempts to show both the quality management (in terms of systems) and the quality technical (laboratory practise) activities that should be undertaken to achieve this.

Delgado (2010) reported that in 2006 the following nano-materials were already being used in consumer goods: carbon (34%), silver (30%), silica (17%), titanium oxide (9%), zinc oxide (9%) and cerium oxide (1%).

The behaviour of NEMs during its lifecycle and post lifecycle and its effects are of particular importance due to the fact that these potential effects are largely unknown (SABS: 12885, 2008). Of concern is that presently, monitoring, measurement and control and assurance are based on research and development (R & D) knowledge and supplier data sheets.

In most instances NEMs are managed in accordance with the behaviour of their bulk counterparts but little is known about whether their behaviour is similar (Thomas et. al; 2006). Delgado (2010) cites Poland et.al that carbon nanotubes exposed to rats' abdominal cavity resembled the pathogenicity of that of asbestos. To prevent the negative views as was the case from the emergence of past novel products and in an attempt to learn from the poor perceptions of the public to genetically modified (GM) foods and to prevent similar repercussions from the use of asbestos, NEM manufacturers, scientists and users should understand the material to pre-emit their possible undesirable effects. Therefore, an understanding of the effects of NEM to fauna and flora are equally important (Delgado, 2010).

Already studies have suggested that exposure to nanoparticles in laboratory tests and in products in the market have had adverse effects on animals and consumers respectively (Delgado, 2010; Sass et.al; 2006). Examples cited were as follows: lung inflammation, granulomas, brain cell damage, pre-cancerous lesions, consumer intoxication with bathroom products, death and pulmonary disease from exposure to NEM paint, to name a few.

Quality management and engineering has the ability to monitor, measure, control and assure the use of NEM. This can be supported by Tolmachev (2012) who proposes the importance of understanding product quality in gaining an understanding of its behaviour to provide control accordingly. Thomas et.al (2006) suggested the establishment of suitable data collection, detection, monitoring, control and remediation structures specifically for NEM. Vladimir et. al (2009) proposed that the OECD – GLP provides a suitable structure to manage the safety of chemicals and data analysis to encourage global uniformity in practice.

Keywords: Nano-Engineered Materials, Quality Management, Monitoring and Measurement Nano-engineered Materials, Laboratory Testing, Risk Management