

**MICHIGAN DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENT**

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**INTEROFFICE COMMUNICATION**

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TO: Barium Sulfate File (CAS # 7727-43-7)  
FROM: Gary Butterfield  
SUBJECT: Screening Level for Barium Sulfate  
DATE: January 22, 2010

The naturally occurring barium ore, barite, is mainly composed of barium sulfate. Barium sulfate is a water insoluble form of barium. Many of the water soluble salts of barium are covered under the AQD ITSL for barium CAS # 7440-39-3. The difference in water solubility is the main reason why the barium ITSL should not be applied to barium sulfate. It is relatively difficult for barium sulfate to enter the body due to the insolubility. Barium sulfate is generally considered to be non-toxic. It is commonly used as a contrast agent in x-ray examinations of the GI tract, respiratory and urinary systems because of its high radio-opacity. The wide use of barium sulfate for these x-ray medical procedures has proved evidence that barium sulfate is non-toxic, in addition to being poorly absorbed into the body. Occupational exposure to high dust levels leads to pneumoconiosis (baritosis) and varying levels of x-ray opaque chest films. Several studies found that without further exposure, the respiratory tract does tend to clear itself over time of barium sulfate deposits via macrophage and the mucociliary elevator clearance.

The following references or databases were searched to identify data to determine the screening level: U.S. Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS), National Institute for Occupational Safety and Health (NIOSH) Registry for Toxic Effects of Chemical Substances (RTECS), American Conference of Governmental and Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), Michigan Department of Environmental Quality (DEQ) library, International Agency for Research on Cancer (IARC) Monographs, Chemical Abstract Service (CAS) Online (1968 - Dec 2009), National Library of Medicine (NLM) - Toxline, and National Toxicology Program (NTP) Status Report.

The CAS and NLM on-line literature searches were conducted on Dec. 9, 2009. There are no good quality long-term inhalation toxicity studies upon which the ITSL can be based.

In the barium sulfate review documents by ACGIH, ATSDR and WHO, there can be identified the main effect caused by inhalation of barium sulfate dust, pneumoconiosis. Many of the reports of pneumoconiosis occurring are without quantified dust exposure amounts, making those reports/studies of little value for calculating a screening level. However, the noncollagenous pneumoconiosis caused by barium sulfate is described as having minimal stromal reaction consisting mainly of reticulin fibers, the alveolar architecture remains intact, and the lesions are potentially reversible. Authors have described

the increased lung x-ray opacity and pneumoconiosis, from barium sulfate exposure, to be relatively benign, and may last for many years with no increased change in lung symptoms, or abnormal signs. There are some reports that the lung x-ray opacity does decrease over time, as the barium sulfate is removed from the lungs by macrophage and mucociliary elevator clearance action.

Due to a lack of adequate toxicity data in order to calculate an RfC type ITSL, the NIOSH REL appears to be the best available information as the basis for setting the ITSL. The NIOSH documentation for the REL was not able to be located. However, that documentation can be expected to closely follow the ACGIH TLV documentation reasoning. There is an REL for respirable barium sulfate, as opposed to using the ACGIH TLV, which is for total dust. The respirable dust based screening level, as opposed to total dust, should be protective against health effects from dust, which is inhalable, which is most appropriate for the AQD screening level. The ITSL can be calculated following R232(1)(c), using the REL for respirable dust of  $5 \text{ mg/m}^3$ , which can be calculated as follows.

$$\text{ITSL} = (5 \text{ mg/m}^3) \times 1/100 = 50 \text{ } \mu\text{g/m}^3 \text{ with 8 hour average time}$$

#### References:

ACGIH. 2001. Documentation of the Threshold Limit Values and Biological Exposure Index. Barium sulfate.

ATSDR. 2007. Toxicological profile for barium — update.

NIOSH. 2005. NIOSH Pocket guide to chemical hazards. NIOSH publication 2005-149.

WHO. 1990. International Program on Chemical Safety (IPCS) Environmental health criteria # 107 barium.

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