

TABLE 4.—VANADIUM COMPOUNDS BEING ADDED TO THE PRIORITY TESTING LIST—Continued

CAS No.	Vanadium compounds
13497-94-4	Silver vanadium oxide (AgVO <sub>3</sub> )
13517-26-5	Sodium vanadium oxide (Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub> ) [Sodium pyrovanadate]
13718-26-8	Vanadate (VO <sub>3</sub> <sup>1-</sup> ), sodium [Sodium metavanadate]
13721-39-6	Sodium vanadium oxide (Na <sub>3</sub> VO <sub>4</sub> ) [Sodium orthovanadate]
13769-43-2	Vanadate (VO <sub>3</sub> <sup>1-</sup> ), potassium [Potassium metavanadate]
13930-88-6	Vanadium, oxo[29H,31H-phthalocyaninato(2-)-.kappa.N29,.kappa.N30,.kappa.N31,.kappa.N32]-, (SP-5-12)-
14059-33-7	Bismuth vanadium oxide (BiVO <sub>4</sub> )
19120-62-8	Vanadium, tris(2-methyl-1-propanolato)oxo-, (T-4)- [Isobutyl orthovanadate]
24646-85-3	Vanadium nitride (VN)
27774-13-6	Vanadium, oxo[sulfato(2-)-.kappa.O]- [Vanadyl sulfate]
30486-37-4	Vanadium hydroxide oxide (V(OH) <sub>2</sub> O)
39455-80-6	Ammonium sodium vanadium oxide
53801-77-7	Bismuth vanadium oxide
65232-89-5	Vanadium hydroxide oxide phosphate
68130-18-7	Vanadium hydroxide oxide phosphate (V <sub>6</sub> (OH) <sub>3</sub> O <sub>3</sub> (PO <sub>4</sub> ) <sub>7</sub> )
68815-09-8	Naphthenic acids, vanadium salts
68990-29-4	Balsams, copaiba, sulfurized, vanadium salts

## 2. Rationale for recommendation.

Long-term inhalation exposure to vanadium pentoxide increased the incidence of lung tumors in male and female mice. As a result, vanadium pentoxide and other vanadium compounds may be potentially carcinogenic to humans. Existing occupational exposure limits for vanadium dusts were primarily developed to protect workers from irritation and acute pulmonary effects and may not be sufficiently protective against an increased risk of lung cancer.

## 3. Information needs. The ITC needs:

i. Recent non-CBI estimates of annual production or importation volume data and trends, and use information, including percentages of production or importation that are associated with different uses.

ii. Estimates of the number of humans and concentrations of vanadium chemicals to which humans may be exposed in each relevant manufacturing or processing scenario.

iii. Health effects data including pharmacokinetics, genotoxicity, subchronic toxicity, reproductive and developmental toxicity, and any human data from occupationally exposed workers.

The ITC seeks this information in order to adequately assess the extent and degree of exposure and potential hazard associated with the various forms of vanadium.

4. *Supporting information.* Vanadium is widely distributed in low amounts as a constituent of mineral ores and crude petroleum deposits. The U.S. consumption of vanadium compounds was reported to be 3,210 metric tons in 2001 (Ref. 14). The majority of vanadium was utilized as an alloying agent in the steel industry or in the production of ferrovanadium and other metal alloys. A smaller portion of vanadium was used as industrial catalysts and in the production of pesticides, dyes, inks, and pigments. More recent applications of vanadium compounds are thought to include manufacture of semiconductors, vanadate glasses, and electro-optical switches. There were over 5,000 potentially exposed workers reported in the National Occupational Exposure Survey conducted between 1980 and 1983. Vanadium exposure has been found in over 300 personal air samples reported in OSHA's Integrated Management Information System since 1995. Worker exposures are known to

occur during manufacture and handling of vanadium containing materials, such as welding operations or during cleaning of oil-fired furnaces and boilers. General population exposure to vanadium most likely occurs through ingestion of food-bearing soil residue and inhaled air in areas with high levels of residual fuel oil consumption (Ref. 15).

For vanadium pentoxide and most vanadium dusts and fumes, NIOSH's Recommended Exposure Limit (REL) is a ceiling value of 0.05 milligram/meter cubed (mg/m<sup>3</sup>). The American Council of Government Industrial Hygienists (ACGIH) threshold limit value (TLV) for vanadium pentoxide is 0.05 mg/m<sup>3</sup> as an 8-hour time weighted average. OSHA's Permissible Exposure Limit (PEL) is a 0.1 mg/m<sup>3</sup> ceiling for vanadium pentoxide fumes and a 0.5 mg/m<sup>3</sup> ceiling for respirable dust. These occupational exposure limits were developed to protect against respiratory tract irritation and acute pulmonary effects and may not be adequate against an increased risk of lung cancer.

In a 2-year inhalation study, NTP found clear evidence of carcinogenic activity of vanadium pentoxide (CAS No. 1314-62-1) in male and female