

US EPA ARCHIVE DOCUMENT

## TUNGSTEN

### A. Commodity Summary

More than 20 tungsten-bearing minerals are known, but the principle domestic ores used to produce ammonium paratungstate (APT) powder and tungsten metal powder are wolframite, ferberite, and scheelite. Tungsten occurs in association with minerals of copper, tin, bismuth, or molybdenum and can be recovered either as the primary product or as a coproduct or byproduct.<sup>1</sup>

Tungsten ores and concentrates are converted into the following intermediate products: APT, tungstic acid, sodium tungstate, tungsten metal powder, ferrotungsten, and tungsten carbide powder. Most of the APT is reduced to tungsten metal powder, which then may be processed into tungsten carbide powder or ferrotungsten.<sup>2</sup> End uses of tungsten include metalworking, mining, and construction machinery and equipment, 74%; electrical and electronic machinery and equipment and transportation, 10%; lamps and lighting, 9%; chemicals, 4%; and other, 3%. The total estimated value of primary tungsten material consumed in 1994 was \$180 million.<sup>3</sup>

Eleven facilities in the United States produce either APT or tungsten metal. Three of the eleven facilities produce APT, a precursor to tungsten, as an end product. Four additional facilities are captive plants that produce APT, then tungsten. All seven of these plants appear to engage in beneficiation operations in the production of APT. They conduct a variety of operations, including milling (e.g., crushing, grinding, washing), physical separation (e.g., gravity concentration, magnetic or electrostatic separation, froth flotation), roasting as a pretreatment for leaching operations, concentration using liquid separation (e.g., soda autoclaving, solvent extraction, ion exchange), and calcining (i.e., heating to drive off water or carbon dioxide).

In addition, two plants produce tungsten powder and cemented tungsten carbide using proprietary processes. A Kennametal plant, located in Fallon, Nevada employs a unique process that produces tungsten carbide directly from ore. A Curtis Tungsten plant located in Upland, California was recently reopened and produces tungsten concentrate from ore. Little is known about the operations of these two facilities.

The two remaining facilities obtain APT (a "saleable" mineral product) and produce tungsten carbide or powder. Tungsten is produced from APT by reduction using hydrogen, followed by a second reduction step using aluminum, potassium, and silicon. The metal is then washed with hydrochloric acid, and cast into ingots. These two facilities do not perform beneficiation activities, and there is some question as to whether their operations could even be considered "mineral processing" operations, because they start with a saleable mineral product (see 54 FR 36592).

For the nine plants that conduct beneficiation and processing operations, names, locations, products, operations, and waste streams generated are presented in Exhibit 1. Two tungsten mines are in operation, Curtis Tungsten in Upland, California and U.S. Tungsten in Bishop, California. These are also listed in Exhibit 1.

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<sup>1</sup> Phillip T. Stafford, "Tungsten," from Mineral Facts and Problems, U.S. Bureau of Mines, 1985, pp. 881-891.

<sup>2</sup> Ibid.

<sup>3</sup> Gerald Smith, "Tungsten," from Mineral Commodity Summaries, January 1995, pp. 182-183.

**EXHIBIT 1**

**SUMMARY OF TUNGSTEN FACILITIES**

Facility Name	Location	Products
Buffalo Tungsten	Depew, NY	APT, Tungsten (carbide)
Curtis Tungsten, Incorporated	Upland, CA	Tungsten (concentrate)
General Electric	Euclid, OH	APT, Tungsten (carbide)
OSRAM Sylvania, Inc.	Towanda, PA	APT, Tungsten (carbide)
Kennametal	Fallon, NV LaTrobe, PA	Tungsten (carbide)
Teledyne Firth Sterling	La Vergne, TN	APT
Teledyne Advance Materials	Huntsville, AL	APT, Tungsten (carbide)
U.S. Tungsten	Bishop, CA	APT