

#### 4. PRODUCTION, IMPORT, USE, AND DISPOSAL

##### 4.1 PRODUCTION

1,2-Diphenylhydrazine is produced in the stepwise reduction of nitrobenzene by the action of iron or zinc powder in caustic solution (e.g., caustic soda, alcoholic alkaline) first to azoxybenzene, then azobenzene, and finally 1,2-diphenylhydrazine (Sandridge and Staley 1978). A batch process is used in which a caustic soda solution is added to a heated vessel charged with nitrobenzene and iron borings. Additions of iron in caustic soda solution are made to continue the reaction. When the reaction is complete, separation of the 1,2-diphenylhydrazine from the iron sludge is accomplished by solvent extraction or by alternative methods, such as stopping the reaction at the azobenzene step and performing the final reduction in a zinc-alcoholic alkali solution followed by filtration and washing of the sodium zincate mass.

No recent information was located regarding production volumes of 1,2-diphenylhydrazine. The U.S. International Trade Commission last reported production of 1,2-diphenylhydrazine for the 1978 production year (USITC 1979). In that year, Bofors Lakeway, Muskegon, MI, reportedly produced and isolated 1,2-diphenylhydrazine, but no volumes were published. The USITC will not publish production volumes of chemicals for which there are less than three manufacturers. No producers have been reported by the USITC since 1978, indicating either that less than 5000 pounds were produced or that the product was never isolated, but was used directly in the next reaction step.

##### 4.2 IMPORT

No information concerning the importation or exportation of 1,2-diphenylhydrazine in the United States was located in the literature.

##### 4.3 USE

One of the major uses of 1,2-diphenylhydrazine is as a starting material in the production of benzidine; however, it is no longer produced in the United States. 1,2-Diphenylhydrazine rearranges to benzidine upon treatment with strong acid; benzidine is used by the dye industry for the production of benzidine-based dyes including many of the Direct dyes (e.g., Direct Red 28, Direct Black 4, Direct Blue 2) (Ferber 1978; Lurie 1964). Fabricolor, the last producer of benzidine based dyes, discontinued production in 1988 (Personal communication, Alvarez 1989).

1,2-Diphenylhydrazine is used for the production of the drugs phenylbutazone (trade name Butazolidin, an anti-inflammatory agent) and sulfinpyrazone (trade name Anturane, a uricosuric agent for the treatment of gouty arthritis) (Barnhart 1988; Hughes 1981; Kornis 1982). These drugs are made by the condensation of 1,2-diphenylhydrazine with malonic acid derivatives to form pyrazolidinedione structures. It is not clear from the literature if the 1,2-diphenylhydrazine used in the condensation reaction is

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produced by the manufacturers that use it or if it is purchased by them as an isolated product.

##### 4.4 DISPOSAL

Very little information was located in the literature concerning the disposal of 1,2-diphenylhydrazine. Dietrich et al. (1985) reported that wet air oxidation (heating wastewater under pressure with the addition of an oxygen-containing gas such as air) would remove 99.88% of the 1,2-diphenylhydrazine in the water (initial concentration, 5000 mg/L). Wet air oxidation can effectively treat aqueous waste streams that are too dilute to incinerate, yet too toxic to treat using biological processes. Results of treatment by wet air oxidation are in keeping with the observation that 1,2-diphenylhydrazine oxidizes on standing to azobenzene (Riggin and Howard 1979). Information regarding the amount of 1,2-diphenylhydrazine disposed of in the United States was not located in the literature.