

**CHAPTER 7.7**  
**ULTRAVIOLET OXIDATION**

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## CHAPTER 7.7 ULTRAVIOLET OXIDATION

7.7-1. GENERAL. Ultraviolet (UV) oxidation is a destructive process that oxidizes organic chemicals and explosives in water by the addition of ozone or hydrogen peroxide in the presence of UV light. If complete destruction is achieved, the final products are carbon dioxide, water, and salts. Ozone is a gas that is generated on site and bubbled into the waste water stream either immediately upstream of or inside the enclosed reactor vessel containing the UV lights. Hydrogen peroxide is purchased as a liquid solution of 35 or 50 percent hydrogen peroxide mixed in water. This solution is pumped into the waste water stream. If hydrogen peroxide is used as the oxidant, it is fed into the waste stream before it enters the enclosed reactor which houses the UV lights. A wide variety of organic and explosive contaminants can be treated with UV oxidation, including petroleum hydrocarbons, solvents, pesticides, and explosives such as TNT, RDX and HMX. UV light, ozone and hydrogen peroxide are hazardous, therefore, vendor information should be reviewed for safe handling and operating procedures.

### 7.7-2. PRODUCTS.

- a. Hydrogen Peroxide ( $H_2O_2$ ). Storage tank and pump (if  $H_2O_2$  is used).
- b. Ozone ( $O_3$ ) Generator. Unit that generates gaseous ozone from atmospheric air.
- c. UV Reactor. Unit containing UV light(s) in which the organic materials are destroyed.

### 7.7-3. EXECUTION.

- a. Interface. Ensure that the controls and interface required between the UV oxidation system and other plant components are clearly identified, and adhered to, per the contract specifications.
- b. Cooling Loops. When an ozone generator is supplied as part of the process equipment, make sure that cooling loops are not run through electrical circuitry, where condensate from the tubing can lead to electrical shorts.
- c. Off-Gas Control. If ozone is used as part of the treatment package, off-gas control to destroy residual ozone is normally provided. The off-gas control typically consists of a heated catalyst bed. It is imperative that no condensate or water be allowed to contact the catalyst bed since moisture destroys the integrity of the catalyst. Ensure connecting piping slopes away from the unit.
- d. Cooling Water. If ozone is produced on site, water will be required to cool the ozone generator. Verify that the contractor has a permit for the discharge of the ozone generator cooling water (if required).
- e. Hydrogen Peroxide. Hydrogen peroxide storage is typically handled like other process chemicals. Spill containment is normally provided on the process floor.

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f. Air Handling. When air handling is a system requirement, ensure that the valving/dampening is provided according to specifications.

7.7-4. OPERATIONS AND MAINTENANCE. The UV oxidation system will require periodic replacement of ultraviolet bulbs, however, fouling of the quartz sheaths that house the bulbs may also become a problem. Excessive fouling may require that the system be taken off line in order to remove the encrusted material.