Case No.43

Explosion inside a tank during wastewater system repair work

[Circumstances of Incident]

An explosion occurred inside a tank during repair work on wastewater treatment facilities located within the premises of an oil refinery.

The wastewater treatment facilities are comprised of oil/water separation equipment, dissolved gas removal equipment, activated carbon adsorption equipment and other equipment in order to remove environmental pollutants from the wastewater discharged from each process of the plant. The wastewater tank is provided for holding operations in order to keep the treatment volume constant.

During normal operations, the upper 60 percent of this wastewater tank contains gas while wastewater after oil separation and accumulated sludge make up the remaining portion. Most of the gas is hydrogen sulfide, although some nitrogen, ammonia, hexane, etc., are also included.

The purpose of repair work was to clean the 250m³ wastewater tank and coat the interior walls of the tank.

On the day of the accident, preparatory work for the repair work began at 9:00 in the morning. In order to first confirm the situation of the remaining wastewater within the tank, the cover of the manhole was raised 15cm by a chain block, and the sludge situation was checked. When the cover of the manhole was put back in place, flames and white smoke erupted from the manhole with a muffled thud. As a result, five workers suffered from burns.

[Causes]

The following can be considered as the causes of this accident.

1. Inflammable gas remained inside the tank.
   a. Inflammable gas such as hydrogen sulfide contained in the wastewater remained in the tank because of insufficient replacement.
   b. Inflammable gas contained in the sludge was released into the tank with the elapse of time.
c. A very small amount of oil contained in the wastewater remained on the surface of sludge.
d. The gas/air mixture within the tank was in the explosive limit.

2. Iron sulfide that was generated from the hydrogen sulfide contained in the wastewater made contact with the air that entered within the tank when the cover was opened and became a source of ignition through exidation and exothermic reaction.

3. Work procedures for non-standard operation were not properly prepared.

[Caused by] Inflammable gas
[Type of accident] Explosion
[Number of victims] Five injured (requiring an absence from work)