

Lysergic Acid Diethylamide

Introduction Few drugs have had an impact on our culture, politics, and scientific community like lysergic acid diethylamide (LSD). First synthesized in 1938 by Albert Hofman of Sandoz Corporation, the drug had humble beginnings. At the time, Dr. Hofman was investigating therapeutic applications of lysergic acid compounds derived from the ergot fungus. He was working in the Sandoz pharmaceutical laboratory when he accidentally ingested a very small dose of LSD-25, the 25th molecule in the series. The drug's effects were powerful. He described terrifying visual and sensory hallucinations, and with further study, the psychotropic properties of compound were characterized. As the world's first synthetic hallucinogen, the drug's potential was profound. Touted initially as a wonder drug with uses in psychiatry and medicine, its reputation has evolved over the years. Through scientific study and experience, the hazards of LSD have been carefully documented. Lysergic acid diethylamide is a dangerous compound classified by the Federal Controlled Substances Act as Schedule I, having "a high potential for abuse and no currently accepted medical use in the United States." Even so LSD's popularity remains strong, challenging the Navy to maintain a viable deterrence to its use.

Pharmacology and Use of LSD The LSD precursor, lysergic acid, is a naturally occurring alkaloid found in the ergot fungus, *claviceps purpurea*, which grows on rye, barley, and wheat. LSD is an indole derivative synthesized from lysergic acid and diethylamine. The synthesized LSD is a clear or white, odorless, water-soluble compound. Produced initially as a crystal, the drug can be crushed and mixed with binding agents to form tablets or gelatin. More commonly, LSD is available as LSD soaked paper known as "blotter". Street names for LSD include acid, blotter, microdot, window-pane, purple haze, and orange sunshine to name a few. Blotter acid often comes with colorful artwork such as cartoon characters, geometric designs, or astrological symbols. Entire genres of literature, art, and music have grown from the drug's use. The infamous San Francisco drug scene has its roots in LSD experimentation during the 1960's.

LSD is the most potent mood and perception-altering drug known. It is 4500 to 9000 times as potent as the naturally occurring hallucinogen, mescaline. LSD acts as a stimulant and hallucinogen taken in dosages of 25 to 250 micrograms. LSD may be self-administered orally, nasally, or by injection; the oral route is most common. The drug's effects start approximately 30 to 90 minutes after ingestion and may last up to 12 hours. Physiological effects include increased blood pressure and heart

rate, dizziness, dry mouth, sweating, nausea, numbness, and tremors. The mechanisms for its activity are not fully understood, but the drug appears to act on specific serotonin receptors known as 5-HT₂ effecting two brain regions: the cerebral cortex which is responsible for mood, cognition, and perception and the locus ceruleus which receives a widespread convergence of sensory information.

Psychological Effects of LSD The psychological effects of LSD are intense, responsible for the drug's popularity and mystique. The LSD experience is often referred to as a "trip" where unpleasant experiences are described as "bad trips." These effects are unpredictable and vary greatly with dosage. There is also significant variation between individuals depending on their mood, personality, and expectations. A "bad trip" may be characterized by nightmarish feelings of anxiety, despair, and suicidal ideation. The sensory effects can also be very confusing. Users sometimes experience an effect known as synesthesia where an individual can "feel" color and "see" sound. Long-term effects include psychosis and hallucinogen persisting perception disorder (HPPD). LSD-induced psychosis may cause mania and major depression. Persistent visual disturbances and hallucinations may last for years. Users with HPPD sometimes referred to as "flashbacks" describe visual distortions such as color flashes, halos, and false motion. These disorders can be caused by a single LSD experience and are not limited to individuals with a history of psychological disorder.

Analysis of LSD The analysis of urine specimens for LSD has been challenging. Rapid metabolism and low urinary concentration have limited the ability of analytical methods to detect the presence of LSD in urine. However, new technology and an alternate metabolite promise to significantly improve deterrence through drug urinalysis. The new metabolite, 2-oxo-3-hydroxy LSD (O-H-LSD), is 20-40 times more prevalent in urine than LSD, and a new testing method is nearing final approval. By monitoring for O-H-LSD the detection window could increase to several days vice 12 to 24 hours for LSD itself.

Conclusions Given the acute physiological and psychological effects of LSD, maintaining an effective deterrence is paramount to the Navy. Although LSD use is tempered by the long duration of effect, adverse hallucinations, and long reorientation time, individuals under its influence cannot function properly. The dramatic visual and auditory hallucinations could jeopardize the safety of military members and severely decrease mission readiness.