Arsine Incidents

Of all the incidents, the 1974 Asiafreighter is the one with the most acute exposures. This is summarized in a separate document.

I have been making arsine since 1982 and have involved with incidents with it. These are some known arsine incidents that are significant, it is not a complete list since some are covered under NDA's or many companies have held them confidential.

1. **Arsine Manufacturer, US, 1973**
   The technician wore SCBA and long gloves to free up a 50 gallon arsine reactor stirring rod. His arm swelled up a few hours later. He was taken to the local hospital, but doctors did not know how to treat so they sent him home. The next day he was rushed to the local Poison Control hospital where he was admitted to intensive care and given whole blood transfusions.
   Lessons Learned:
   The regulations now require any facility handling a highly toxic material like arsine to train the local medical facility on treatment. Arsine is unique, not many doctors are familiar with the symptoms of exposure or treatment.
1. **Arsine Manufacturer, US, 1973**
   The shipping/receiving supervisor received a dozen empty cylinders of diborane, phosphine and arsine mixtures from a customer in box truck. They were not secured properly and wound up on the floor of the truck rolling around. He smelled a garlic odor when he opened the back door. One valve was half open. All dust caps were on handtight. He noticed dark red urine a few hours later and went to the hospital where he was treated for arsine poisoning.[1]
   Lessons Learned
   As with the Asiafreighter incident the cylinders rolling around caused the valves to open. Since the dust caps were not properly secured it leaked into the truck. Companies now receiving these types of shipments use a handheld leak detector to sample the truck before entering it.
2. **Research Laboratory, US, June 14, 1982[2]**
   A 15% AsH_3/H_2 lecture bottle was disconnected from the tool and found by the student with the valve open. He was dead when they found him.
3. **Compound Semiconductor Manufacturer, US, June 11, 1984[3]**
   Deliberate exposure to AsH_3/H_2 mixture. He died.
4. **Chemical Waste Disposal Company, US, Nov 10, 1987**,
   Workers venting 6 pure arsine cylinders into a 5 gallon bucket of $KMnO_4$ which vented into a NaOH scrubber. They noted that the bottoms of some of the cylinders were frosted. Periodically the Hydride alarms at a Liquid Carbonic facility ½ mile away would alarm. They removed their SCBA and Level B chemical suits thinking the cylinders were empty. They poured a neutralizing solution into the cylinders that immediately vaporized the arsine. One worker died 6 days later and the second had to be treated for acute arsine poisoning.
   Lessons Learned
   Proper training of workers is critical in these types of hazardous activities.

5. **Arsine Manufacturer, US, July 2001**[4]
   Arsine collector had condensed liquid air in the cylinder. The air reacted with the arsine and the rapid deflagration pushed the valve out of the cylinder, released 65 lbs of arsine.
   Almost 100 employees and neighbors were immediately tested for arsine exposure. None had any level of arsine in their blood or symptoms of exposure.
   Lessons Learned
   Air can easily be liquefied in a cylinder immersed in liquid nitrogen. Proper training and Lockout Tagout procedures were not followed.
6. **Semiconductor Manufacturer, Taiwan, Jan. 27, 2005**
   Contractor cut the wrong supply line releasing 0.5% AsH_3/H_2 both taken to hospital. Severity of exposure unknown.
   Lessons Learned
   Lock out Tag out and line tracing is critical for safety.
7. **Arsine Manufacturer, US, Oct 18, 2005**
   Laboratory chemist analyzing pure arsine for purity. Both arsine detectors in the room alarmed at >150 ppb. 9 hours later he noticed that his urine was red. Treated for arsine poisoning.
8. **Compound Semiconductor Manufacturer, US, April 14, 2019**
   While doing maintenance on a MOCVD system the AsH_3/H_2 in the system was released and ignited. The flashover burned 3 workers. This likely burned all the AsH_3 preventing exposure.

References:

1. Fowler, Bruce A. and Joseph B. Weissberg – Arsine Poisoning. The New England Journal of Medicine, 291(22):1171-1174, 1974
2. Andrew Blake, “Arsine Gas Blamed in Death”, Boston Globe, June 23, 1982
3. Robert A. Jordan, “Firm Cleared in Engineer’s Death From Toxic Gas, Boston Globe, December 6, 1984
4. Channel 6 Tulsa, OK “Toxic Release at the Port of Catoosa Sends 95 Workers to Hospital”, July 12, 2001

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