

Preliminary Findings of the U.S. Chemical Safety Board  
from its Investigation of the West Fertilizer Explosion and Fire

The CSB has made the following observations and preliminary findings to date, which are subject to further revision and development as the investigation unfolds:

- 1) The explosion at West Fertilizer resulted from an intense fire in a wooden warehouse building that led to the detonation of approximately 30 tons of AN stored inside in wooden bins. Not only were the warehouse and bins combustible, but the building also contained significant amounts of combustible seeds, which likely contributed to the intensity of the fire. According to available seismic data, the explosion was a very powerful event.
- 2) Whether additional factors such as material characteristics, shock, or contamination contributed to the incident remains to be determined. Company employees described a PVC plastic pipe that was located directly above the AN bin that detonated, and likely would have been melted by the fire. Additionally, large amounts of potentially flammable anhydrous ammonia were stored along the southern edge of the warehouse building.
- 3) The building lacked a sprinkler system or other systems to automatically detect or suppress fire, especially when the building was unoccupied after hours. By the time firefighters were able to reach the site, the fire was intense and out of control. Just 20 minutes after the first notification to the West Volunteer Fire Department, the detonation occurred.
- 4) Both National Fire Protection Association (NFPA) and the International Code Council (ICC), private organizations that develop fire codes that are widely applied across the U.S., have written code provisions for the safety of ammonium nitrate. Many of these safety provisions are quite old<sup>1</sup> and appear to be confusing or contradictory, even to code experts, and are in need of a comprehensive review in light of the West disaster and other recent accidents. For example the ICC's International Fire Code directs users to a defunct code for ammonium nitrate (NFPA 490, last issued in 2002) rather than the current code, known as NFPA 400.
- 5) The existing fire codes do contain some useful provisions; for example the codes do require a fire resistant barrier between AN and any stored flammable or combustible materials and have provisions to avoid AN confinement and promote ventilation during fire conditions. However, even the most current NFPA 400 standard *allows* AN to be stored in wooden buildings and in wooden bins, and does not mandate automatic sprinkler systems unless more than 2500 tons of AN is being stored – vastly more than the approximately 30 tons that was sufficient to devastate much of the town of West. In addition, the standard contains a “grandfathering” provision that allows existing buildings that were constructed prior to code adoption – and fail to meet all of its provisions – to continue in use.

---

<sup>1</sup> NFPA 400 refers users to a 1953 publication by the U.S. Bureau of Mines for information on the explosive properties of AN.

- 6) Texas has not adopted a statewide fire code, and state law actually prohibits most smaller rural counties from adopting a fire code. McLennan County, where the West facility was located, had not adopted a fire code, although it technically had the authority to do so because of its proximity to the more populous Bell County. The West Fertilizer facility was thus not required to follow any NFPA or ICC recommendations for the storage of AN.
- 7) Although some U.S. distributors have constructed fire-resistant concrete structures for storing AN, fertilizer industry officials have reported to the CSB that wooden buildings are still the norm for the distribution of AN fertilizer across the U.S.
- 8) Industry has developed other forms of ammonium nitrate that are reported to reduce or eliminate the risk of accidental detonation. For example, compounding the ammonium nitrate with calcium carbonate (limestone) “practically eliminates any risk of explosion in its storage, transportation, and handling,” while preserving the AN’s nutritive value.<sup>2</sup> Calcium ammonium nitrate fertilizers have been widely used in Europe. Ammonium sulfate nitrate also has been found to be non-explosive provided the percentage of AN is held below about 37%.<sup>3</sup>
- 9) The federal OSHA standard for “Explosives and Blasting Agents” (29 CFR 1910.109) does have requirements for ammonium nitrate fertilizer; its provisions are similar to the NFPA codes. Unlike the NFPA codes – which West was not legally required to follow under any fire code – the OSHA standard would have applied. Like NFPA, however, the OSHA standard does not prohibit wooden bins or wooden construction, and does not require sprinklers unless more than 2500 tons of AN is present. However, OSHA public records indicate that OSHA last inspected the facility in 1985, and no citations were issued under the “Explosives and Blasting Agents” standard.
- 10) OSHA’s Process Safety Management standard (29 CFR 1910.119) or PSM was adopted in 1992 and is designed to prevent catastrophic workplace incidents involving highly hazardous chemicals. PSM requires companies to have a variety of management elements to prevent catastrophic incidents, such as conducting hazard analyses and developing emergency plans. Ammonium nitrate is not, however, one of the listed chemicals that triggers PSM coverage. The PSM standard also contains an exemption for retail facilities.
- 11) The EPA’s Risk Management Program rule (40 CFR Part 68) or RMP was adopted in 1996 and is designed to prevent catastrophic offsite and environmental damage from extremely hazardous substances. As the name suggests, the rule requires covered facilities to develop a Risk Management Plan, implement various safety programs, and analyze offsite consequences from potential accidents. Once again, however, ammonium nitrate is not one of the listed chemicals that triggers RMP coverage. West Fertilizer was RMP-covered due to its stored ammonia, and the company’s offsite consequence analysis considered only the possibility of an ammonia leak, not an explosion of ammonium nitrate.

---

<sup>2</sup> Calcium ammonium nitrate (CAN) must still be protected from contamination with other chemicals that can re-sensitize it to detonation. See Popovici Ipochim, N.N.; Icechim, M.M.; “Other Ammonium Nitrate Fertilizers;” In Keleti, C. (ed.); *Nitric Acid and Fertilizer Nitrates*; New York: Marcel Dekker Inc., 1985.

<sup>3</sup> *Ibid.*

- 12) OSHA considered adding ammonium nitrate along with other highly reactive chemicals to its list of PSM-covered substances in the late 1990's. However, this proposal was shelved in 2001. In developing the RMP regulation, the EPA did not explicitly include explosives or reactive chemicals in the list of covered chemicals. In 2002, the CSB issued a study on reactive hazards, identifying 167 prior reactive incidents (including a 1994 explosion at an ammonium nitrate manufacturer). The Board recommended that both OSHA and EPA expand their standards to include reactive chemicals and hazards. However, neither agency has yet acted upon the recommendations.
- 13) No federal, state, or local standards have been identified that restrict the siting of ammonium nitrate storage facilities in the vicinity of homes, schools, businesses, and health care facilities. In West, Texas, there were hundreds of such buildings within a mile radius, which were exposed to serious or life-threatening hazards when the explosion occurred on April 17.
- 14) West volunteer firefighters were not made aware of the explosion hazard from the AN stored at West Fertilizer, and were caught in harm's way when the blast occurred. NFPA recommends that firefighters evacuate from AN fires of "massive and uncontrollable proportions." Federal DOT guidance contained in the Emergency Response Guidebook, which is widely used by firefighters, suggests fighting even large ammonium nitrate fertilizer fires by "flood[ing] the area with water from a distance." However, the response guidance appears to be vague since terms such as "massive," "uncontrollable," "large," and "distance" are not clearly defined. All of these provisions should be reviewed and harmonized in light of the West disaster to ensure that firefighters are adequately protected and are not put into danger protecting property alone.
- 15) While U.S. standards for ammonium nitrate have apparently remained static for decades, other countries have more rigorous standards covering both storage and siting of nearby buildings. For example, the U.K.'s Health and Safety Executive states in guidance dating to 1996 that "ammonium nitrate should normally be stored in single storey, dedicated, well-ventilated buildings that are constructed from materials that will not burn, such as concrete, bricks or steel."<sup>4</sup> The U.K. guidance calls for storage bays "constructed of a material that does not burn, preferably concrete."
- 16) CF Industries, a principal manufacturer of AN that was one of the suppliers to West, also recommends more rigorous safeguards in its Material Safety Data Sheet (MSDS) for the chemical. In the section entitled "Handling and Storage," CF recommends that "Storage construction should be of non-combustible materials and preferably equipped with an automatic sprinkler system."<sup>5</sup> Although companies are required to issue MSDS's, the recipients of this information like West Fertilizer are not obligated to follow the recommended safety precautions. West lacked these safeguards.
- 17) The Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) has regulations for ammonium nitrate used as an explosive but these do not apply to ammonium nitrate used as fertilizer. The U.S. Department of Homeland Security has reporting

---

<sup>4</sup> U.K. Health and Safety Executive; "Storing and Handling Ammonium Nitrate;" Available from <http://www.hse.gov.uk/pubns/indg230.pdf>

<sup>5</sup> <http://www.cfindustries.com/pdf/Ammonium-Nitrate-Amtrate-MSDS.pdf>

requirements for companies that have a threshold amount of fertilizer grade ammonium nitrate. However, the authority of DHS is to require security measures to protect against theft, diversion, or other intentional acts; DHS does not regulate the safety of ammonium nitrate to prevent conditions leading to accidental detonation.

- 18) The Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) contains an exemption from hazardous chemical reporting for “fertilizer held for sale by a retailer to the ultimate customer.” The EPA has interpreted this provision as not applying to firms, like West, that make custom blends of bulk fertilizer for customers’ use. In 2012, West Fertilizer filed an EPCRA Tier II report with the McLennan County Local Emergency Planning Committee (LEPC). West reported the presence of up to 270 tons of ammonium nitrate, as well as anhydrous ammonia, at the site. The company did not provide the LEPC or the West Fire Department with an ammonium nitrate MSDS indicating the material’s hazards, nor does EPCRA automatically require that information to be provided. There is no indication that West’s filing with local authorities resulted in an effort to plan for an ammonium nitrate emergency.