## Scenario 11-C Farm tractor malfunction

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| **Scenario 11-C: Farm tractor malfunction** | |
| **Complexity of the scenario: moderate** | |
| **Possible application of the scenario: Topics 4.1, 5.1, 5.2, 5.6, 6.1 and 6.3** | |
| **Scenario description:** | |
| At 6:30 a.m. on May 3, 2019, a farm tractor experienced a mechanical failure that involved its ammonia tank while on a main road in a low-density residential area, resulting in the release of almost 2000 litres of anhydrous ammonia. The tank, which wasn’t full at the time of the incident, had a capacity of almost 4000 litres. The release created a large, low-lying plume of white gas, which lingered in the area and surrounded nearby homes.  Aerial view of houses along trees in park and straight asphalt roads located in countryside  Yellow Tractor in Asphalt Road  Vehicles encountering the plume stalled (possibly caused by the effects on engines or electronics), and drivers and passengers were overcome by the gas.  A driver, approaching the area, saw the plume and called the emergency services reporting the incident as a car fire and reported an acrid smell and taste. During the call, the caller experiences throat irritation, coughing, difficulty breathing, and choking.  Because DO initially reported the incident as a car fire, some FRs arriving at the scene who were unaware of the chemical release were also overcome by the gas. Other FRs who smelled ammonia and saw the white plume retreated quickly to don a self-contained breathing apparatus before attempting rescues.  13 first responders were transported to the hospital. One first responder was hospitalized, requiring intubation, mechanical ventilation, and ICU care.  Victims were rescued from cars and homes nearest to the release. A shelter-in-place order was issued to residents living within a 1.5-Km radius of the release.  Overall, 83 persons, including first responders, motorists, and neighborhood residents, were evaluated at six local hospitals because of exposure to the gas. Among the 83 persons evaluated for effects of the chemical release, 14 were hospitalized, including eight who were admitted to the ICU, seven of whom required endotracheal intubation and mechanical ventilation; no deaths occurred. In addition, ICU health care providers experienced symptoms of secondary exposure.  No victims had been decontaminated in the field. Many victims were decontaminated at the hospital (clothing removal and soap/water shower). Two hospitals decontaminated victims upon arrival to the ER, and one hospital began to decontaminate admitted victims after some ICU staff members experienced symptoms of secondary exposure in the ICU from off-gassing of anhydrous ammonia from victims’ clothing.  The FB applied a water spray to dilute the plume until the ammonia tank was empty, which took almost 3 hours.  The release was later investigated by the local authorities, fire department, environmental protection agency. Nearby coniferous trees were visibly damaged by the ammonia release and were mapped as a proxy for the location of the anhydrous ammonia plume.  Extra information for the trainees:  - Cool, humid air and calm winds (these conditions prevented the gas plume to be diluted and dispersed);  **-** Among the 18 first responders who entered the plume, nine experienced symptoms of illness within 24 hours of the release;  **-** The four most common symptoms, each reported by five responders, were cough, burning lungs, shortness of breath, and eye irritation;  **-** Overall, 129 FB personnel, 30 Police officers, and numerous DO responded.  **Things to consider:**  Anhydrous ammonia is a clear, colorless, pungent, irritating gas that can cause severe respiratory and ocular damage. Ammonia can be absorbed into the body by inhalation, ingestion, eye contact, and skin contact. Ingestion is an uncommon route of exposure. Absorption by eye contact may be limited by severe corrosive injury and/or by significant spasmodic blinking (blepharospasm), even with mild exposures. Effects occur rapidly following exposure to ammonia. Some respiratory symptoms may be delayed in onset.  Ammonia used commercially is usually named anhydrous ammonia. This term emphasizes the absence of water. Because ammonia boils at -33 °C, the liquid must be stored under pressure or at low temperature. It is normally used in agriculture, refrigeration, food industry, as a disinfectant and in chemical manufacturing.  Especially interesting in this incident is that secondary exposure of hospital personnel was reported. The amount of gas brought in by the patient(s) is probably minor (most should dissipate before arrival at the hospital) therefore the symptoms of hospital personnel are expected to be very minor. It is reported occasionally also in literature, such as after chlorine gas exposure and multiple casualties.  Most hospitals reported receiving insufficient information about the chemical, type of exposure, and the number and triage category of inbound victims. These hospitals therefore received inadequate decontamination recommendations, leading to secondary exposures of hospital personnel. Clear communication during a chemical release is essential to reduce exposures and harm. The timing of this event in the early morning when traffic was sparse and its location in a less populated area minimized morbidity among residents and motorists, and the actions of the FRs likely saved lives. However, multiple communication challenges during each part of the response hindered effective action to prevent exposures. Responders who initially arrived on scene were unaware it was a hazmat incident. Although some first responders did don the recommended personal protective equipment after smelling ammonia, half of those who entered the plume experienced symptoms, including one responder who required mechanical ventilation.  The communication issues between the FRs arriving at the scene and the EMS experienced in this situation are an important aspect of this scenario and should be thoroughly discussed with the trainees.  Sources:  Based on the Anhydrous Ammonia Chemical Release — Lake County, Illinois, April 2019.  Rispens JR, Jones SA, Clemmons NS, et al. Anhydrous Ammonia Chemical Release — Lake County, Illinois, April 2019. MMWR Morb Mortal Wkly Rep 2020;69:109–113.  DOI: <http://dx.doi.org/10.15585/mmwr.mm6904a4>  <https://www.cdc.gov/niosh/ershdb/emergencyresponsecard_29750013.html>  <https://anhydrous-ammonia.biz/anhydrous-ammonia-specifications/>  - Ronald De Groot, Gerard A. Van Zoelen, Marianne E. C. Leenders, Antoinette J. H. P. Van Riel, Irma De Vries & Dylan W. De Lange (2021), *Is secondary chemical exposure of hospital personnel of clinical importance?,* Clinical Toxicology, 59:4, 269-278, DOI: 10.1080/15563650.2020.1860216 | |
| **Application: First alarm (Topic 4.1)**  **Target audience: DO, FB, (M)P, AS** | **Learning objective:** To recognize signs of a potential CBRN release and (initiate first) respond(ers).  **Aim:** The dispatch officer interacts with the caller to identify the likelihood of a possible CBRN release and to know which information should be shared with the chain of command. Use of METHANE and Four W’s protocols. |
| Example: |  |
| **Application: Arrival on scene (Topic 5.1)**  **Target audience: FB, (M)P, AS** | **Learning objective:** To recognize how to carry out an on-site risk assessment, zoning of the area, and isolation and registration of victims.  **Aim:** The first responders arrive on scene, perform a risk assessment, talk with the caller, perform a reconnaissance of the incident scene and discuss actions. They apply METHANE, establish zoning, isolate people and pet animals, initiate evacuation, register persons. |
| **Example:** |  |
| **Application: Forensic awareness (topic 5.2)**  **Target audience: FB, (M)P, AS, EMS, GP** | **Learning objective:** To recognize how to carry out your work without forensic disruption of the scene.  **Aim**: The responders discuss the possible forensic value of the materials found on the scene and preserve the evidence. |
| **Example:** |  |
| **Application: medical treatment and triage (topic 5.6)**  **Target audience: FB, (M)P, AS, EMS, GP** | **Learning objective:** To recognize how to apply appropriate medical care towards patients involved in a CBRN incident.  **Aim:** The responders assess the medical conditions of the victims, perform triage on the victims and recommend possible treatment. |
| **Example:** |  |
| **Application: Alarm Protocol (topic 6.1)**  **Target audience: DO** | **Learning objective:** To differentiate a possible CBRN incident (from normal incident) and to carry out appropriate procedures & protocols.  **Aim:** The dispatch officer interacts with the caller and relays necessary information to the responders moving towards the scene. |
| **Example:** |  |
| **Application: Task Specific – Triage of victims (topic 6.3)**  **Target audience:** **AS, EMS, GP** | **Learning objective:** To familiarize with and carry out triage and provide medical care in relation to CBRN scenarios**.**  **Aim:** The responders assess the medical conditions of the victims and perform medical triage on the victims based on provided symptoms. |
| **Example:** |  |