



FOCUS ARTICLE

Oops, We Did it Again: Reducing Human Error-Induced Truck Unloading Events

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Human error is a leading contributing factor to reactive chemistry and loss of containment events. These cases often involve unloading trucks to storage tanks or processing equipment. Driving and connecting hoses, as well as initiating and ending chemical transfers, requires worker actions that must be completed correctly in an ever-changing work environment.

For decades, efforts have been made to reduce human error and unlock the mystery of why good employees make poor decisions that create high-consequence events. Ongoing neuroscience research has identified that critical organizational elements, including work environments, operating procedures, and work schedules, are often not aligned with how our brains work. Using this insight, methods to implement human factor controls to reduce risk can be applied from the boardroom to the shop floor to improve the reliability of operations.

The Catastrophic Consequences of Human Error

On October 21, 2016, the 11,000 residents of Atchison, Kansas, were ordered to shelter-in-place while a chlorine cloud vented from a bleach tank owned by MGP Ingredients (MGPI). That morning, a truck operator from Harcos Chemicals mistakenly offloaded 4,000 gallons of sulfuric acid to the wrong tank. The two chemicals reacted to form a toxic gas cloud that resulted in a command to shelter-in-place within ten miles of the release, ultimately resulting in over 120 people seeking medical attention.¹ Three years later, a Federal Grand Jury indicted MGPI, stating that “MGPI did not design and maintain

a safe facility consistent with current industry standards, generally accepted good engineering practices, and recommendations cited in the chemical material safety data sheets that would have prevented or minimized the consequences of accidental releases of extremely hazardous substances.”² Later that year, MGPI pled guilty to violating the EPA’s Clean Air Act and agreed to pay a one million dollar fine.³

For decades, safety professionals have used the Hierarchy of Controls philosophy to “engineer out the human” to create a safer workplace. However, there are circumstances where human interaction cannot be eliminated entirely; people are needed to operate tank trucks, connect to the pipeline, and unload the contents without incident.



U.S. Department of Transportation data show nearly 9,500 incidents associated with cargo tank motor vehicles between 2010 and 2020, and nearly 2,200 of these incidents were caused by human error. Examples of errors that can be made during truck unloading operations are shown in the illustration. This list is not exhaustive, but it offers common ways that an unloading operation might go wrong. Depending on the material involved, some errors do not create safety concerns, but others can result in severe accident scenarios such as fire, explosion, toxic vapor release, over-pressure event, or a catastrophic spill.

Brain-Centered Hazards

DEKRA has identified seven categories of human error based on neuroscience research, The Seven Brain Centered Hazards™. These areas account for how the different aspects of the brain interact with one another, as well as expectation bias. These hazards also consider how the brain responds to stress and divided focus. This list of hazards can be used to explain and mitigate common problems related to reliable human performance and sound decision-making, such as truck unloading events.

- > **Fast Brain Functioning:** People complete important tasks without conscious thought and rely on habits that may not align with the situation.
- > **Visual Recognition:** People miss important information due to the brain’s visual system, where they see what they want to see, not what is there.
- > **Divided Attention:** Attempting to multi-task leads to missed information and error.
- > **Memory:** Memory is flawed, and people often operate on information that feels correct in the moment. Information may not be encoded to memory through training because of poor training design.
- > **Social Think:** Two brains are usually better than one, but humans’ innate need to go along with a group gets in the way when they need to challenge behavior or decisions.
- > **Fatigue:** People’s conscious attention cannot function without sufficient high-quality sleep. For example, asking a truck driver to properly unload a hazardous chemical at the end of a long drive can lead to unintentional error driven by fatigue.
- > **Stress & Urgency:** People pressure themselves to complete tasks and note signs of urgency from others. This creates a stress response, which hinders the brain from focusing on the task.

Error Reduction Strategies

By considering the Seven Brain Centered Hazards™ when developing operational plans, processes, and training, organizations can improve human performance and reduce critical errors. DEKRA recommends that organizations consider the following factors to develop stronger processes.

- > **Simplify:** Eliminate choices and the number of points where people can make mistakes. For example, change hose fittings that allow certain materials through specific lines or physically relocate lines, in addition to simplifying the process, where possible.
- > **Embed Safe Habits:** Use human performance reliability concepts by leveraging an expert who knows how the brain works to improve training and operating procedures so that critical messages and steps are embedded in employees' brains and become daily habits.
- > **Align Leadership and Connect in the Field:** Leverage how the brain generates social bonds by getting leaders in the field to provide coaching and correction to promote safe habits and stop shortcuts. Spending time in the field allows leaders to discuss intrinsic hazards of the operation and reinforces a positive culture.
- > **Empower People:** Teach workers about brain-centered hazards and how they can improve their work and personal lives. This includes teaching how to reduce fatigue and stress factors, as well as the value of focus. Teach employees simple ways to trigger situational awareness so that habits do not result in mistakes when conditions change.
- > **Lead with Data:** Update the facility's incident program so that people ask questions related to brain-centered hazards in order to identify and address common causes. For example, ask brain-centered questions as a part of the investigation or assign someone to look for trends in relevant data.
- > **Form Partnerships:** The truck driver, the unloader, and the process area receiving the material must understand their role, the hazards of their work, and necessary steps to keep themselves and communities safe. Reach across organizational boundaries and create avenues for best practices and incident reports to be shared.
- > **Utilize Outside Expertise:** When the potential consequence of an error is high, do not rely on simple checklists to identify and mitigate risk caused by human factors. Behavioral science and human performance specialists create a work environment that naturally improves decision-making and performance.

Conclusion

Every person is unique, but research shows that we can accurately predict human action. Pragmatic steps can be taken to improve performance and reduce errors by leveraging what we know about recent advances in neuroscience. By understanding brain-centered hazards, organizations can improve procedures and training, as well as how workers and management relate to one another.

As the partner for safety at home, at work and on the road, DEKRA is one of the largest safety organizations in the world. We combine process safety management expertise with our cutting-edge organizational safety practice to help our clients protect their people, property, and communities. We are the trusted advisor for process safety excellence and welcome the opportunity to assist you with your process safety consulting and training needs.

References

1. MGPI Processing, Inc. Toxic Chemical Release Final Report released on 01/03/2018, Chemical Safety Board. [https://www.csb.gov/mgpi-processing-inc-toxic-chemical-release-/,](https://www.csb.gov/mgpi-processing-inc-toxic-chemical-release-/) last accessed on 2/18/2020.
2. Feds indict MGP Ingredients for releasing chlorine gas cloud over Atchison, by James Dornbrook, March 6, 2019; Kansas City Business Journal. <https://www.bizjournals.com/kansascity/news/2019/03/06/feds-indict-mgp-ingredients-chlorine-gas-cloud.html>, last accessed on 2/18/2020.
3. MGP pleads guilty, faces \$1M fine for releasing chlorine gas over Atchison, by James Dornbrook, Nov 19, 2019. <https://www.bizjournals.com/kansascity/news/2019/11/19/mgp-guilty-plea-clean-air-act-fine.html>, last accessed on 2/18/2020.

DEKRA Process Safety

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Process Safety Management (PSM) Programs

- > Design and creation of relevant PSM programs
- > Support the implementation, monitoring, and sustainability of PSM programs
- > Audit existing PSM programs, comparing with best practices around the world
- > Correct and improve deficient programs

Process Safety Information/Data (Laboratory Testing)

- > Flammability/combustibility properties of dusts, gases, vapors, mists, and hybrid atmospheres
- > Chemical reaction hazards and chemical process optimization (reaction and adiabatic calorimetry RC1, ARC, VSP, Dewar)
- > Thermal instability (DSC, DTA, and powder specific tests)
- > Energetic materials, explosives, propellants, pyrotechnics to DOT, UN, etc. protocols
- > Regulatory testing: REACH, UN, CLP, ADR, OSHA, DOT
- > Electrostatic testing for powders, liquids, process equipment, liners, shoes, FIBCs

Specialist Consulting (Technical/Engineering)

- > Dust, gas, and vapor flash fire and explosion hazards
- > Electrostatic hazards, problems, and applications
- > Reactive chemical, self-heating, and thermal instability hazards
- > Hazardous area classification
- > Mechanical equipment ignition risk assessment
- > Transport & classification of dangerous goods

We have offices throughout North America, Europe, and Asia.

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