



## Addressing Unplanned Outages in the Food Processing Sector

By: Robert Wetter and Tom Wasemiller

In recent years, high resistance grounding (HRG) technology has become more prevalent in a variety of process industries. Much of this awareness comes from changes in NFPA70E, which recognizes HRG as an arc flash reduction technology. Likewise, insurance companies also push for upgraded electrical systems in order to reduce equipment damages and process interruptions.

Our introduction to the application of HRG technology predates these more recent events by more than 20 years and stemmed from the desire to avoid uncontrolled, and unplanned outages while improving safety for our employees.

As those of us who work in the food-processing sector can attest, it is critical to finish certain processes completely and without interruption or delay, or the batch is compromised and/or destroyed. Agitators, conveyors, fans, rotary airlocks, blowers etc., all contribute to a continuous product flow within a critical process. When a process is unexpectedly shutdown, radical changes occur resulting in deviances from manufacturing standards and guidelines; the respective changes include but are not limited to, temperature, absorption, tempering, emulsifying,

homogenizing and roasting. Consequently, these undesired changes often result in damaged or destroyed product.

Similarly, if the stall results in solidified product, the equipment can clog, jam and break. As a result, removing the scrap materials and reinstating equipment to its proper state can result in hours of costly downtime. More consequently, when a heat process is involved, such as a trapped oven or roaster, the internal temperatures can quickly rise resulting in a variety of dangerous situations – such as a meltdown, or flash fire.

All of the above-mentioned threats to both product and equipment are actual situations that we have experienced first-hand while working in various food industries. The cost of a shutdown can quickly rise to thousands of dollars, in addition to the secondary losses and damages derived from scrap, re-work, loss of production time, and the inconvenience posed to customers.

In the case of a serious meltdown or fire, the costs are immediately exponentially higher in addition to increased physical risk to personnel. However, accurately quantifying the expense of an unplanned shutdown due to a ground fault is difficult. The cost associated with a ground fault is

largely dependent on a variety of factors: equipment type, severity of the incident, length of shutdown, injuries etc.

For example, let us share our experience dealing with roaster failure due to a sudden shutdown because of a ground fault occurrence. The ground fault occurrence caused the roaster to immediately shutdown, trapping a full product batch inside. Internal temperatures quickly rose causing a meltdown. When a meltdown occurs, unique and valuable equipment is damaged and in certain incidents, destroyed. Due to the unique nature of this equipment, a replacement had to ship from overseas. The total losses for this specific case, including expedited delivery charges, labor with overtime, loss of production, loss of product, etc., surpassed \$100,000.



Therefore, due to the variety of circumstances that can arise resulting from a ground fault occurrence, it is difficult to quantify the monetary value achieved by operating with HRG technology. However, it is safe to estimate that on average, HRG technology can save anywhere from \$1000 - \$5000 per critical process fault.

As a company with hundreds of locations across North America, we operated facilities with a variety of electrical systems; wye, delta, grounded, and many ungrounded. While not universal, the ungrounded electrical system is common in older food processing facilities as there is a strong desire for process continuity even under a single ground fault condition. However, as noted by IEEE and insurance companies such as FM Global, these systems are subject to over-voltages that result in equipment damage and the location of a ground fault is difficult to find. While changing to a solidly grounded system eliminates the issues of over-voltages, equipment damage and fault location, it results in unplanned equipment outages, which is the core problem to be addressed.

The smart business justifications for using HRG technology are:

- HRG allows the process to continue even in the event of ground fault occurrence
- HRG controls and limits the over-voltages, thereby avoiding equipment damage
- HRG provides an alarm to alert personnel who can consider an orderly and sequential shutdown of process equipment if need be
- HRG provides mechanisms for maintenance personnel to quickly locate the fault limiting shutdown time

More sophisticated HRG systems provide indication of which feeder has the fault, thus expediting the fault location process. Likewise, users also have the ability to preset the system in order to determine which critical processes require protection in the event of a second ground fault in order to promote continuity.

Changing the approach to electrical grounding across multiple divisions, in different countries, through a magnitude of personnel, has been anything but straightforward. In our experience, division management and project managers fight to maintain a certain level of autonomy, and the role of corporate engineering is to consult and advise, rather than dictate and direct.

The first step in effort to achieve the desired change and understanding was education. Educate stakeholders on HRG technology and the respective operational benefits. Educating the food industry was complicated due to the skepticism surrounding the lack of food industry installations. This meant there was a lack of overall understanding of HRG technology and an unjust fear of the associated cost. The benefits and cost avoidances quickly and easily outweigh the initial investment. While HRG was relatively unknown in the food industry, it has been used for several years prior in mining and petro-chemical industries.

Likewise, I received some concern from plant personnel who had been conditioned to believe that any electrical fault in the system must be eliminated immediately. The concept of safely leaving an electrical fault on the system until a coordinated shutdown could be arranged was not trusted. The prevailing knowledge among electrical personnel was that any phase to ground fault was bad, likely to result in equipment damage and employee injury.

The compromise was to use HRG technology in green field sites where corporate engineering had a higher level of input and on larger brown-field sites for upgrades and



retrofits for the same reasons.

Hazelton Cocoa plant was 1 of 7 high dollar value projects (\$100million+) that our company funded between 2006 and 2009. Fortunately, the project management team responsible for designing and implementing electrical protection and personnel safety were open to support from corporate engineering.

When implementing new technology from any vendor, it is imperative that proper support is provided. Unfortunately, our initial experience was poor, as we did not receive what is now known as critical training. This critical training includes installation guidance, commission and product training as well as trouble shooting tactics. Therefore, the product was not fully accepted or trusted as it did not provide the purported benefits.

When the system indicated a fault situation or initiated a trip signal, electricians were frustrated as they were unable to calibrate or tune the system. Additional frustration stemmed from the inability to quickly locate the fault, which was one of the key expected benefits. As a result, until the situation could be resolved, a portion of the plant was shut down. The lack of technical support from the HRG vendor used in this case rendered the technology useless, thus providing a negative first impression of HRG technology in the food processing industry.

Additionally, there were also minor compatibility issues with existing equipment and the ability to successfully operate in various facilities. Again, this HRG vendor failed to advise us of these potential complications. In order to resolve these issues, grounded transformers had their bonding conductor removed and variable frequency drives modified to ensure compatibility.

Lack of understanding from personnel within ADM was not the only issue when pioneering this technology shift, outside influences were also a problem. The most notable being utility companies that automatically grounded the secondary line coming off their services. This created a situation where the HRG system would constantly alarm and become inoperable. When discussing this issue with utility providers, the common response was that it was a worker safety issue and required union involvement and agreeance.



At this time, we decided a change in our HRG technology supplier was in our best interest, and this is when

we began using I-Gard products. The experience was immediately superior in terms of engineering and product support. Sergio Panetta Vice President of Engineering at I-Gard, accompanied Tom and I on our next plant visit. While the utility refused to change their outdated approach, at least we had an ally with us in the fight.

Shortly thereafter, we installed an I-Gard HRG system in a rural grain location. The local electrical contractor claimed he was well versed in HRG technology and refused support. The moment we energized the system we were plagued with nuisance trips and plant personnel blamed the new equipment. Once again, Sergio intervened and personally offered remote technical support and an in-person troubleshooting visit. The visit was not needed as a series of voltage tests conducted at Sergio's request provided the answer. In this instance, the system was still grounded and once this was corrected, the technology worked as advertised.

From this real-world experience, I-Gard and our corporate Technical Services created a training presentation used by all company personnel as well as all approved contractors when installing and commissioning HRG technology.

Proper training on what HRG technology will provide, correct installation and commissioning of the technology, available expert technical support and validation that the process can operate without damaging equipment or injuring personnel were all vital to win over HRG skeptics.

Implementing new technology or changing the approach that has become accepted practice involves a certain amount of risk and the unknown technology is typically blamed for any installation or operational concerns. Successfully changing to HRG technology, which we knew would provide the expected benefits if implemented correctly, was dependent of realizing the saying, seeing is believing.

It was necessary for the electrical personnel and the operations personnel to keep production equipment running even when the system provided a ground fault alarm with no injuries and no equipment damage. Maintenance personnel could see the HRG system in operation and providing indication of the faulted feeders with a traceable pulse that assisted in locating the fault.

HRG technology avoids the issue of unplanned outages and the associated cost impact. HRG technology eliminates the issue of over-voltages and the associated equipment damage. HRG technology lowers the probability of an arc flash by more than 90%.

For these reasons, decision-making managers need to embrace HRG technology in their project justification discussions when considering upgrades, retrofits or new

builds. However, a successful project isn't just about the product, it is about who you choose to partner with and ensuring they not only have the product you need, but also the commitment to customer service and application expertise.

Altogether, we installed approximately 50 HRG systems all over the world providing plants against unplanned outages, arc flash incidents, personnel injury and costly damage.

### *About the Authors*

#### **Tom Wasemiller**

Tom has 40+ years of experience in electrical safety, much of this time spent working in electrical power distribution throughout several food plants. Tom is also an OSHA certified Electrical Safety Instructor. Prior to retirement, Tom was the Electrical Project Lead at ADM Electrical Technical Services supervising high value projects surpassing \$110million. Tom has led teams of engineers supporting various corporate divisions in new plant construction, retro-fitting and expansion projects while working to reduce arc flash and shock exposure.

#### **Robert Wetter**

Recently retired, Bob has 37 years experience working as a senior automation and electrical engineer for one of the largest food ingredient companies in the world. In recent years, Bob designed a variety of industrial power distribution, automation networks and industrial Cybersecurity systems for projects around the world ranging from 4 megawatts to over 150 megawatts. Through innovative designs, Bob has managed to improve safety by adding features such as High Resistance Grounding while actually reducing the overall electrical system cost.