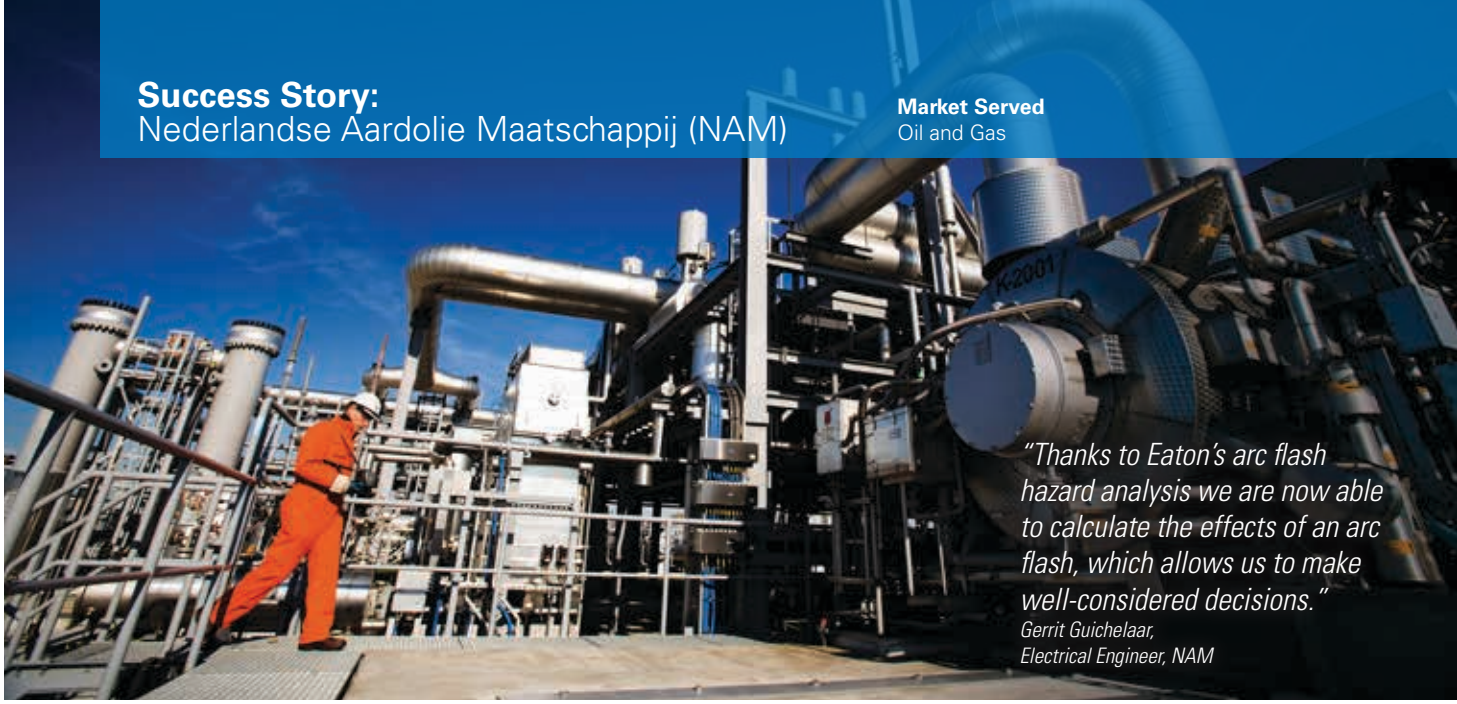
Success Story:
Nederlandse Aardolie Maatschappij (NAM)

Market Served
Oil and Gas



"Thanks to Eaton's arc flash hazard analysis we are now able to calculate the effects of an arc flash, which allows us to make well-considered decisions."
Gerrit Guichelaar,
Electrical Engineer, NAM

Work safely…

Location
Assen (Netherlands)

Segment
Oil and Gas

The issue
Despite modern equipment and proper working practices there is always a risk of arc flashes when working on switchboards.

The solution
Eaton offers an arc flash hazard analysis to identify the risks.

The results
Thanks to this analysis, the threats could be identified and the appropriate measures for protecting employees could be taken.

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Background

For many people "arc flash hazard analysis" sounds like a rather American concept. In Europe scant attention is usually paid to explicit arc flash harzards, since for the most part, people have faith in the intrinsic safety of electrical installations. Despite this tendency, the Dutch gas producer Nederlandse Aardolie Maatschappij recently asked Eaton to perform an arc flash hazard analysis.

NAM is the largest gas producer in the Netherlands, producing some 67 billion m^3 of gas each year. Over three quarters of this gas comes from the Groningen gas field, and the remainder from a variety of smaller fields on land and in the North Sea. NAM is responsible for around 75% of the total gas production in the Netherlands. The company also continues to extract oil, and in 2011 the oilfield at Schoonebeek was brought back into use.

At NAM, safety is of paramount importance, just as it is throughout the gas and oil industry. This is evident, for example, in the fact that staff are not allowed to work on live electrical installations under any circumstances. "Safety is more important than availability", says Rien Luchtenberg, Electrical Team Leader, Shell. The question of why NAM had an arc flash hazard analysis carried out is an easy one to answer for Luchtenberg: "Because the calculation methods became available". As he further explains, "At a company where the safety of staff, contractors and the environment is so important, the use of new technological developments and insights to improve safety and working methods is self-evident". The risks that accompany the maintenance of electrical installations can be limited by using modern equipment and proper work instructions. However, this does not always rule out the possibility of a personal accident completely. Work such as disconnecting the installation, removing fuses on the power supply side of a switch, or locating failures is always potentially risky — even in the case of switchgear that has been tested on the basis of the latest IEC standards. It is not without reason that this type of hazard is cited explicitly in the new NEN 3140 standard.

The challenges

An arc flash is the result of an electric current that is passed through air when the insulation or isolation between electrified conductors is no longer sufficient to withstand the applied voltage. The majority of arc flashes arise during or immediately following work on an electrical installation. An arc flash is usually the result of human error, such as (for example) dropping tools onto live parts of the installation. The current involved in an arc flash releases huge amounts of energy, as a result of which the copper and steel in the installation melt and evaporate. This causes the volume of these materials to increase exponentially. The result is a fiery explosion that has the capacity to produce extremely serious and fatal injuries. Professional analysis is required in order to properly protect staff from this risk.

Before work on any electrical installation at NAM can be carried out, be it by contractors or its own staff, an authorization must first be obtained, irrespective of whether it is about changing a bulb in the operating area or

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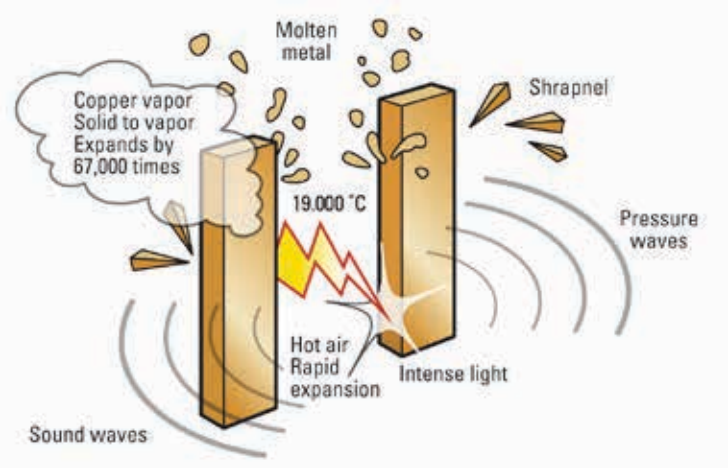

carrying out maintenance on a circuit breaker. The permit will only be issued once a Work Risk Assesment, which entails an assessment of both the the hazards and the potential effects has been performed. The risk of an arc flash is estimated based on static data as well as experience.

Predicting the effects of an arc flash used to be a tricky task — after all, the arc current in an arc flash behaves very differently from the short-circuit current based on which the system has been calculated. An arc flash hazard analysis involves calculating the energy released in an arc flash, and the method for performing arc flash calculations has been set out and published in IEEE Standard 1584-2002. This standard takes a vast number of design factors into consideration and is based on many years of research and empirical testing of the arc flash phenomenon.

The major benefit of an arc flash hazard analysis is that decisions in an exceedingly important area – the personal safety of maintenance staff — are now being made on the basis of facts rather than estimates. The results of an arc flash hazard analysis are used to detect potentially hazardous situations and subsequently to minimize the danger. The arc flash hazard analysis also provides the appropriate criteria for selecting the most suitable personal protective equipment (PPE) for the working environment in question.

The solution

Following a brief inspection by the experts from Shell, it was clear to NAM that an arc flash hazard analysis produces genuinely new insights that help reduce the risks affecting electrical installations. The search then commenced for a partner who would be able to swiftly assess NAM's 140 sites. Eaton was selected on the grounds of its demonstrated expertise, and because Eaton's extends far beyond making calculations and drawing up a report.

An important point for NAM was that Eaton would also provide advice on how to include arc flash safety in the safety plan. To achieve this, the analysis should not only take IEEE 1584-2002 into consideration, but also the relevant European standards (EN 50110; IEC 61482; IEC 61641 (low voltage) / IEC 62271-200 (medium voltage); IEC 60909)

In the first instance, NAM was looking for a substantial report containing a thorough analysis and recommendations. The objectives were to prevent hazardous situations and to categorize unavoidable hazards.

Eaton charted the arc flash energy levels and recommended improvements accordingly. Sometimes it emerged that only a minor modification would be required to solve the issue — for example, in some cases energy levels can be reduced without making any investment simply by adjusting the settings of protective devices. Naturally this should not be to the prejudice of selectivity. Growing awareness of arc flash risks can prompt modifications — technically, it may even affect the replacement schedule. Usually, however, it is precisely the minor adjustments that improve safety. The ultimate assessment as to whether a risk is acceptable, and whether the risk itself or the potential effects should be mitigated, remains a decision for NAM's electrical experts. Reliable information is essential to make this decision. The crucial question for NAM's experts is always: will we be able to justify our decision after the fact if something does go wrong? The inspection also brought to light arc flash risks that cannot be reduced to an acceptable level by means of modifying the electrical installation. The best possible response to these risks was therefore to opt for the use PPE. Well-chosen PPE protects people from burns and eye injuries.

Wearing PPE is not always practical, as it can get excessively hot inside the equipment due to the lack of ventilation options. While this may not be very comfortable, the use of PPE is imperative for quick tasks such as securing a system. For more protracted work and for arc flash hazards the most serious category, PPE is not a real option. In such cases, the entire electrical installation and overhead power supply have to be switched off.

The result

Although the risk analysis is not yet fully complete, Rien Luchtenberg and Gerrit Guichelaar both agree that the arc flash analysis has delivered concrete benefits for NAM.

First and foremost, it appears that awareness of arc flash hazards has increased. When it comes to protecting the people in the vicinity of ongoing work on electrical installations, for instance, measures based on facts are easier to explain than measures based on intuition. Arc flash calculations also occasionally show that intuition can be misleading.

As is the case with many maintenance and safety issues, calculating the exact costs and benefits of an arc flash risk analysis is not always easy. "The fact that we are doing it shows that we deem it important", says Luchtenberg. "At NAM we always try to work as safely as possible, but if there is a method that allows us to better assess the risks, we want to use it. The chances of an arc flash are slim, but the consequences could be dire. Thanks to the hazard analysis we are now able to calculate the effects with precision. In itself, performing a hazard analysis does not offer any guarantee that fewer accidents will occur, but it does provide the right pointers for making well-considered decisions".

Up to now, the arc flash hazard analysis has not brought to light any situation in which safe working on electrical installations results in a heightened arc flash risk. In a number of cases it has even been possible to reduce the potential danger of an arc flash in a straightforward manner without investing in equipment or further studies, and it is anticipated that more carefully selected PPE will increasingly be used.

The arc flash hazard analysis performed has also had consequences for NAM's new projects. Arc flash calculations are now being made in advance, alongside load calculations and system studies, for extensions as well as for new construction work. NAM can thus rest assured that in case of an error, the energy released by an arc flash will be reduced to an acceptable level in new installations.

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