

## Lowering Your Environmental Entropy



**Y**ou might recall from some of your engineering courses the concept of 'entropy' in determining overall plant efficiency and performance. Much of your plant improvement activities are actually geared to lowering the entropy of your plant's processes to improve its efficiency. But you might be surprised to

learn that entropy applies to your plant information as well. Claude Shannon, known as the Father of Information Theory, worked out information entropy equations at Bell Labs in the late 1940s. The entropy of data is related to its uncertainty. The higher your data uncertainty is, the higher its entropy. High entropy in your plant process results in a high heat rate and lower plant productivity. High information entropy means you know little about what is actually going on at your plant.

As environmental engineers, we depend on the quality of information because much of it derives from things that are not directly seen, but are measured. Lots of data has to be collected from diverse points, aggregated, used in complex calculations and summarized. There are many ways that uncertainty can creep into your results and get amplified along the way.

### High information entropy = non-compliance

So, how can you improve the quality of your environmental information and lower its entropy? Let's take Title V Compliance as an example. You may be getting by with an assortment of spreadsheets and checklists to meet compliance requirements. But there are numerous sources of uncertainty. How do you know that your spreadsheets accurately reflect the requirements as written? How do you know that your checklist is complete? Can you be sure that the spreadsheets and checklists have not been inadvertently changed? If you have a change in your plant equipment or process, how can you assure that those changes get accurately reflected in your spreadsheets and checklists in a timely manner? If there's a change in permit requirements, how can you be certain that the changes are accurately promulgated through your system of spreadsheets and checklists? What about the human factor? How does one manage the set of tasks and collect the data without human errors and gaps? All of this is a prescription for high information entropy that could ultimately translate into non-compliance.

### Efficient data management

What can you do to improve your compliance? Lower your

environmental information entropy. Let me first say that you can stay with your current compliance system and lower the entropy if you apply enough sustained energy and effort. However, the human cost of maintaining, checking, verifying, re-checking, etc. is probably going to be extraordinary. An alternative may be to consider what a modern environmental information management system (EMIS) has to offer.

### What is under the hood?

A state-of-the-art EMIS should be able to consolidate and store all of your plant's environmental data in one place. Modern relational database technology provides an excellent medium for doing so. The cost of relational databases has gone down dramatically in recent years as their reliability and usability has improved. But what are the qualities you should look for in an EMIS?

- An EMIS should have a **relational database** built-in, unseen under the hood.
- An EMIS should be intimately **connected with existing plant databases**, so that data doesn't have to be redundantly entered. Where information must be manually entered, simple data forms that are accessible from anywhere are mandatory.
- A built-in **task management system** should also be provided to help you organize and manage your compliance activities. Wherever possible, humans should be taken out of the loop.
- Make sure the EMIS is **configurable to the particular needs of your plant**. If you are doing a multi-plant installation, choose a system that can accommodate the individual needs of each of the facilities involved.
- Look for the EMIS that can be **coordinated with your plant's production activities** so that decisions can be made and actions taken on behalf of environmental concerns that are fully in congruent with your plant's production goals.

So what can you take-away from this? Entropy rules apply to your EMIS as well as your plant. A good system can dramatically improve the utility of your environmental information by reducing data uncertainty; lowering your information entropy and improving your eco-efficiency. It's something to shoot for.

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