BATTERY MONITORING INFORMATION MANAGEMENT- DON'T DROWN IN DATA WHILE FISHING FOR INFORMATION.

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Useful information is crucial to the proper maintenance and management of your back up battery supplies. Information for alarms, reports and trending needs to be accurate and timely. This paper will map out best practices for gathering and organizing all of your battery plant-related information for distribution to internal and external factions. As we all know, the days when a notebook in the drawer or an excel spreadsheet on a single laptop are acceptable are quickly fading. Due to downsizing, outsourcing, budget reductions and ramped up regulatory requirements, best practices are harder to maintain, plant knowledge is walking out the door, and the government and executive suite are turning up the heat by requiring accurate reporting and proactive battery management. Whether you manage five sites, five hundred or five thousand, there are measurements to be taken and information to be gleaned!

BEGIN AT THE BEGINNING

Back up power supplies have a unique status in any network. All other fail safes and redundancy measures are constantly in use: collecting information, blocking network access, working in parallel, etc. Back-Up Power Supplies, however, are only used when they are being tested or used to provide back up power. This circumstance creates the risk of out of site, out of mind. I am not saying that we are all ignoring our back up power sources because we worry about them all the time. Pressure to know varies from organization to organization: Some folks are fine knowing after the fact. When a battery has gone into thermal runaway or exploded, someone walking by may see the acid leaking from the cabinet and say, Hmm, maybe I should tell someone about that…" Others are happy to find out during a preventive maintenance visit that a brand new cell has died 3 months after installation and the rest of the string has been overcharged to balance out the deficit. Most of us, however, need to know before a battery goes down. Furthermore, batteries need to be replaced in a timely basis as soon as and not before their life span is trending down. Trend analysis and alarms are the only way you can track these.

Battery monitoring is crucial to maintaining the proper back up power so that you know that it will be there when you need it. You may want to replace those batteries in a timely fashion, you might like to audit those batteries annually, but you definitely need to track the ongoing performance of those batteries including the battery that starts the generator. This is easier said than done: the range of practices used to monitoring batteries is as broad as the number of past present and future battery personnel in any given organization. Your group and your company need to agree on what you need to know, how it is going to be gathered, how it is going to be filed and how it is going to be analyzed and presented.

RULES OF THE ROAD FOR BATTERY MONITORING

1. HAVE ONE OWNER of the process. They need to have budget, personnel, the ear of upper management, and have compensation tied to this responsibility.

2. NO PEN AND PAPER ENTRIES: Handwriting varies, paper gets lost, and the techs take twice as long because they have to write it and then type when they enter it into a larger database.

3. Require CONSISTENT AND TIMELY MEASUREMENTS. There is enough variability from PM to PM. Please do not compound the issue by having variability with techs and equipment.

4. Have a SINGLE DESTINATION FOR ALL OF THIS INFORMATION to facilitate analysis and reporting.

5. REVIEW THE INFORMATION quarterly and the gathering methods annually.

The project manager for this endeavor is a key position. The PM has to coordinate what is happening now, what needs to happen and how to make it happen. It does not have to be a full time position, but it does have to be 100% ownership. Finger pointing slows things down. Once you have chosen the PM, make sure the position has resources commensurate with the desired scope of the project. Below are the steps that have to be taken to ensure the proper gathering, storage and dissemination of your back up power information.

Where to start? The PM must determine what, if anything, is currently happening in regards to information collection: Audits, readings, inventory, ongoing practices, etc. Once current practices are understood the PM can determine the best way to morph current practices into the desired objectives. Either Casey Stengel or Yogi Berra said, "If you do not know where you are going, any road will get you there." The desired objectives may be framed by government regulations, internal economics, industry standards or all of the above. What ever the drivers are, they need to be clearly defined and supported by budget and personnel. Money is tight so do not put together a plan you cannot afford.

Who are the stakeholders? The PM needs to determine who has skin in the game. Who needs to see this information? Who is going to gather it? Who is going to support the gathering of this information? There are a lot of cooks in the stew and the best way to make sure the PM makes the right choice is to identify and notify anyone who is going to have a stake in this and let them know that a plan is being developed to institutionalize the tracking and reporting of back up battery performance. The work that is done ahead of time is far less onerous than having to get every one on board after the fact. It is your organization so you will know best how to proceed: you can either court consensus or put up with the grief after the fact.

What information is needed? The type of information varies depending on the organization, the industry and the Government, each with its own guidelines, standards, and regulations. There are more comprehensive lists out there, but you can choose from the list below and determine what you need to know about the batteries, strings and sites and how often you need to know it. Is it for trend analysis, triggering an alert or alarm state, or to avoid all out battery failure? In the post-Katrina environment and with network reliability as a customer requirement at an all time high, sustainability is a primary concern. In this economic environment, we can't replace batteries because they are old but because they are *about* to fail. Avoid rip and tear. Some of those batteries are still good to go. Others have got to go sooner. Once taken, the information must be loaded into a general report for consistent analysis or the effort put in to gathering the information is wasted. Possible measurements include but are not limited to:

- Voltage
- Temperature
- Ohmic Measurement
- AC Ripple Voltage
- AC Ripple Current
- DC Float Current
- Charger Output Voltage
- Charger Output Current
- Room Ambient Temp
- Individual Cell Voltage
- Pilot Cell Volts, Specific Gravity, Electrolyte Level, Battery Temperature
- Specific Gravity, each individual cell
- Electrolyte Temp, each individual cell
- Electrolyte Level, each individual cell

On-site visits become more valuable once the information is captured for analysis. If the company's needs are met by site visits alone, that is fine. However, if measurements are taken for later analysis, there has to be training to make sure that the same measurements are taken the same way each time.

Determine how many batteries will be monitored: Will it be all the batteries in every site in the company or just the remote locations or just the primary locations or a small subset of the entire battery universe from which a statistical sample will be taken? Remember, something is better than nothing. 20-40% of the sites is a sufficient subset of the entire range of sites (number of batteries, environment, application, model, voltage, etc.) to gauge performance, but do not represent this as any more than an educated guess. It is a starting point and the objective is to keep pushing for the budget to monitor and accumulate information for 100% of your back up power supplies.

Methods of monitoring batteries range from doing nothing to having personnel stand over each battery 24/7 with a voltage meter, a bucket of halogen and a cell phone. In reality the methods break down into four categories: visual inspection, hand held meters, load test and permanent hardware. The PM has to determine what is being done and whether or not it is effective. Going forward, it should be collected in as consistent and legible and accessible a manner as possible. At the very least on a laptop into a spreadsheet into a database and into the hands of someone who is compensated to analyze and report on it.

DATA COLLECTION AND ANALYSIS

Using on site notebooks. This method is not recommended. To go through the expense of a preventive maintenance visit only to put the information in the least accessible medium possible makes the visits irrelevant for any but the most obvious of faults. If there is no trending, there is no analysis. If managers cannot access the information easily, it confounds effective maintenance and replacement of the back up power supply.

Using Laptops and Excel: The PM should **c**reate a secured master workbook on a single server for all desired information. That workbook must hold a summary sheet of all required measurements as well as an individual spreadsheet for each site. Require all Preventive Maintenance techs to store and update the individual worksheet for the sites they visit on a laptop and submit them to the PM, whose job it is then to replace the old information with the new information. Analysis can then be done site by site or on a visit by visit basis. This is a cumbersome for more than 10 sites, but is preferred to a notebook in a drawer.

Software Systems: There are broad monitoring systems (Statmon, DataTrax, NetCool, etc.) which can incorporate battery information. There are specific systems for battery monitoring systems (Continuity by Seldon Systems, Data Power Monitoring Systems, etc.) and there is customized programming you can develop in house or with a contractor. Because software selection is a job unto itself, there is a separate section of the worksheet devoted to the subject and the notion is explored in detail below.

IT and Operations are the primary players in this selection process. While they do not need to agree on everything, both have to be involved with the decision. Operations' strength is the information, IT's strength is the method. If you ignore either you end up with well integrated software that doesn't tell you anything or poorly integrated software that can't tell you anything.

Determining the correct software package also requires a **single point of ownership** for the process, preferably someone from IT. They need to have budget and have compensation tied to this responsibility and report up to the Monitoring Project Manager. They have to do an **audit of all existing software** to find out whether or not one of those systems can already process monitoring information for alarms and trending or can be easily interfaced with an alternative monitoring program.

A new software program is best chosen only after methods of collection, types of measurement, and analytical objectives have been determined. The other key point is that the software must be flexible. The best program is one that can adapt to dynamic measuring techniques, requirements, and analysis. The clearer the requirements, the more likely the right program will be installed. Please note that **vendor accountability** is essential during the design, installation and ongoing performance of the software. The person in charge of buying the software has got to manage expectations so that inevitable delays and possible budget overruns are not a surprise or a project killer. This person has also got to be willing to **embrace triage** so that they are not spending 50% of the budget monitoring the 5% of the system that has antiquated equipment or protocols.

As potential software packages are being considered, a list of questions generated by each of the stakeholders should be used to make sure the chosen software will be best for the entire organization. Some starter questions are included on the attached worksheet.

If you are incorporating one set of software for analysis or forwarding alarms and another for monitoring, please make sure the two software systems are capable of being integrated in a cost effective manner. This cannot be stressed enough. Furthermore, if your monitoring devices do not come with a software package, it is absolutely necessary for those devices to be able to speak to your chosen software. There are numerous protocols associated with power supply monitoring: SNMP, ModBus, Ethernet, DMP3, TCP/IP, HTTP. You have to be absolutely sure that the information chain (battery > monitoring device > proprietary software > monitoring software) is thoroughly integrated. That compatibility should be a requirement of final payment approval for every factor of the information chain. The IT person should corral all of the software vendors to ensure that compatibility and culpability is guaranteed. Vendor involvement might be encouraged by pointing out that it will be their headache to fix if it is not designed and installed properly.

Finally, leverage incidents of exposure: A diplomatic explanation of how monitoring would have avoided an accident goes farther than "I told you so". It is up to you to keep your network up and your budget down. Managing the information you get from monitoring will help you do just that.

SAMPLE

MONITORING PROJECT WORKSHEET

GENERAL INFORMATION

CONTACT PERSON		TITLE	DATE
STREET ADDRESS			OFFICE
CITY	STATE	ZIP CODE	OFFICE TELEPHONE NO. ( ) -
MAILING ADDRESS (IF DIFFERENT FROM OFFICE)			MOBILE NO. ( ) -
CITY	STATE	ZIP CODE	FAX NO. ( ) -

SCALE OF OPERATION

NUMBER OF SITES COMPANY WIDE	NUMBER OF STRINGS COMPANY WIDE
NUMBER OF CELLS COMPANY WIDE	NUMBER OF GENERATORS

MONITORING METHOD AND FREQUENCY (CURRENT AND PROPOSED)

CURRENT ☐ HAND HELD EQUIPMENT ☐ PERMANENT EQUIPMENT

PROPOSED ☐ HAND HELD EQUIPMENT ☐ PERMANENT EQUIPMENT

☐ CURRENT MONITORING FREQUENCY
☐ ANNUAL ☐ QUARTERLY ☐ MONTHLY

☐ PROPOSED MONITORING FREQUENCY
☐ ANNUAL ☐ QUARTERLY ☐ MONTHLY

☐ CURRENT MONITORING PERCENTAGE
☐ 0-35% ☐ 36-70% ☐ 70-100%

☐ PROPOSED MONITORING FREQUENCY
☐ 0-35% ☐ 36-70% ☐ 70-100%

(table continued on next page)

PROPOSED INFORMATION					
YES	**NO**	**MEASUREMENT**	**YES**	**NO**	**MEASUREMENT**
		TEMPERATURE			CHARGER OUTPUT CURRENT
		VOLTAGE			ROOM AMBIENT TEMPERATURE
		OHMIC MEASUREMENT			INDIVIDUAL CELL VOLTAGE
		AC RIPPLE VOLTAGE			PILOT CELL VOLTS
		AC RIPPLE CURRENT			SPECIFIC GRAVITY, EACH CELL
		DC FLOAT CURRENT			ELECTROLYTE TEMP, EACH CELL
		CHARGER OUTPUT VOLTAGE			ELECTROLYTE LEVEL, EACH CELL
PROPOSED METHOD FOR INFORMATION COLLECTION					
		PAPER REPORT			BATTERY MONITORING SOFTWARE
		SPREADSHEET			ANALYTICAL SOFTWARE
		COMPANY MONITORING SOFTWARE			REPORTING SOFTWARE

Starter questions for qualifying a Monitoring Software System	
Who else uses this software to monitor and analyze batteries?	
What other software packages have they integrated into their software package?	
What protocol will the software require? (SNMP. Modbus, DMP-3, Scada, etc.)?	
Is there a recommended program or reporting structure by regulatory agencies?	
What is the server configuration (does it require PC's at every site, regional sites, the NOC)?	
What does one license cost and is it per site, string or cell?	
Is it a thin client with continuous seating?	
What are the recurring costs associated with the license (Upgrade and Support)?	
Do they have dedicated support and is it 24/7?	
If there is a server involved, are there parts readily available for hot swapping?	
What scale is the software capable of: Enterprise, regional, or Local?	
Are Ethernet connections and IP addresses required at each site?	
What report templates are available (technical, executive, regulatory, etc.)?	
What hardware is required?	
What is the required skill sets of primary support and usage personnel?	
What Access/security provisions exist?	
What is the environment in which the software will be deployed?	