Top 10 Mistakes in Data Center Operations: Operating Efficient and Effective Data Centers

White Paper 2

Revision 0

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> Executive summary

How can you avoid making major mistakes when operating and maintaining your data center(s)? The key lies in the methodology behind your operations and maintenance program. All too often, companies put immense amounts of capital and expertise into the design of their facilities. However, when construction is complete, data center operations are an afterthought. This whitepaper explores the top ten mistakes in data center operations.

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Introduction

> ❝ Now is the time for companies to evaluate their data center operations programs. They must able to clearly articulate operational requirements and design an operations program based on the risk profile of the data center. ❞

📖 Link to resource
White Paper 145

Top 9 Mistakes in Data Center Planning

For years, the data center industry has accepted that human operational error, not poor data center design or engineering, is the number one cause of data center downtime[1]. Uptime Institute recognizes this with its *Tier Standards on Operational Sustainability*. As the industry begins to adopt these ratings, regulators, insurers and end users are all going to be increasing their scrutiny of data center operations.

Now is the time for companies to evaluate their data center operations programs. They must be able to clearly articulate operational requirements and design an operations program based on the risk profile of the data center. However, the road to creating an industry-best operations program will not be easy, especially for those companies whose core expertise is not in business critical facilities.

While numerous consultants in the field can help you find your way, very few have data center or mission critical expertise—a vital component if you are looking to achieve operational sustainability. White Paper 145, *Top 9 Mistakes in Data Center Planning*, discusses the nine top mistakes businesses make when building or expanding their data centers. Now we're going to reveal the ten biggest mistakes you can make in the next logical step: data center operations.

The big mistakes

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Big Mistake #1: Not including your operations team in facility design

The first step to the most effective, least costly and highly efficient data center is to use a total cost of ownership (TCO) approach that will balance capital and operational expenditures to your company's needs. Part of this process is determining design criteria and performance characteristics, tailored specifically to your organization.

In our experience, when operations teams are excluded from facility design, modification and repairs often become necessary. For example, we have had to modify a brand new data center where:

1. T he branch circuit design was determined to be inadequate, following a variety of maintenance actions
2. T he generators were designed and installed in such a manner that simple maintenance activities became a challenge
3. Air handling units could not provide required air flow to the data center, due to flaws in the design of the building

These mistakes could have been avoided by including an operations program perspective in the design process. When you include the operator in the design phase, you will "build with the end in mind." That is the essence of TCO.

Big Mistake #2: Relying too much on data center design

Many businesses make the serious error of believing that a high level of redundancy justifies lack of expenditure into a proper operations and maintenance program. Various studies of downtime in mission-critical environments come to the same conclusion: human error is the leading cause. Operations, more than the design, will keep a facility running, manage costs, and protect not only a company's investment but also its reputation. Time and again, we see

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[1] Stephen Elliot, IDC, Senior Analyst Network and Service Management, 2004; Donna Scott, VP and Research Director, "Best Practices for Operational Change Management," Gartner, Inc. 2003
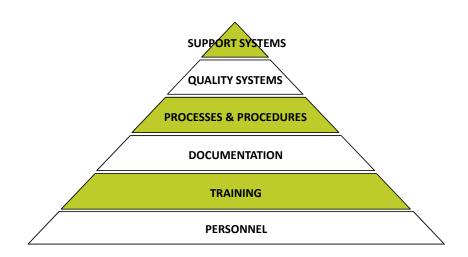
companies make the mistake of spending large sums of money on a robust, redundant design, then neglecting to properly fund their operational budgets.

For instance, many critical facility operations are conducted by companies that specialize in office building maintenance and have no expertise in performing or managing maintenance in critical facilities.

Typical office space facilities operate around the philosophy that systems can be taken offline for maintenance or repair. A short-lived office building system failure might inconvenience the local workforce, but the corporate mission of a company is jeopardized if the data center experiences significant downtime. Both the facility infrastructure and the facility operations team need to be structured with one goal in mind: maximizing uptime. Critical environments have special features and requirements that are not adequately addressed by traditional facility maintenance programs:

- Performance – Operational continuity is a core business requirement
- Availability – 100% uptime without any plant shutdowns
- System Complexity – Redundant systems, failover automation and emergency recovery procedures
- Accountability – Process documentation, change control and auditable records

The key to meeting these requirements is to lay your operational foundation with the right methodology.

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To ensure that these critical requirements are met, fully qualify the people who will be performing your data center operations from the start. Picking the wrong people or engaging them too late in the design process is a missed opportunity to achieve operational excellence.

Big Mistake #3: Failure to correctly address the staffing requirement

Many companies estimate their data center staffing needs based upon typical building management criteria. In a data center environment, underestimating your staffing needs is a risk that leads to a shortage of coverage in case of emergency. Staffing needs should be based on your risk profile and budget. Create a schedule that deploys the workforce in an optimal configuration for emergency response, equipment maintenance and vendor management.

Likewise, hiring and retaining the right personnel is essential. Recruiting talented individuals with specific technical expertise is extremely challenging. Prospective team members need to be carefully screened, not only with traditional background checking but also to qualify their technical, administrative and communications capabilities. All of these skills are crucial in critical facility operations. However, simply identifying qualified personnel is only the first step.

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Big Mistake #4: Failure to train and develop your talent

Once you find qualified people to hire, it's important to provide them with proper support, training, and career development opportunities. Creating a positive environment significantly improves employee retention rates. High turnover in a mission-critical space leads to loss of knowledge, which is a significant risk in most operations programs.

Properly trained personnel understand how the plant works, how to safely operate and maintain it, and what to do when things do not function as expected. When a facility is built, training is commonly provided by the vendors and contractors involved with site construction, which limits the scope to specific components rather than covering an entire plant's operation.

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By default, tradesmen and technicians usually end up training a few of the employees at the most basic level. In a typical on-the-job training (OJT) environment, the newly "trained" employees then teach other personnel. In this scenario, it's easy for poor methodologies and improper procedures to become standardized in the work environment.

What is needed is a program that effectively provides and verifies proper training in a format that increases the level of expertise for all individuals.

- Level 1: Qualification for basic supervised operations
- Level 2: Qualification for routine operations and maintenance
- Level 3: Qualification for advanced operations and maintenance
- Level 4: Subject matter expertise

Implementing a Training Plan
The most common reason for inefficient training programs is the time and expense of program development. What most managers do not realize, though, is that the cost and effort expended on typical training program development are more than offset by increased uptime, lower maintenance cost, and decreased employee turnover.

Ongoing training programs must be viewed as an investment in the overall business.

Big Mistake #5: Failing to consistently drill and test skills

Soldiers, Firemen, and EMTs repeat drills over and over until the right responses become "second nature," even in the most extreme conditions. The same should apply to data center technicians, who operate in an environment where every second counts in an emergency. An emergency situation is the last place to be unprepared to react— for both safety and financial reasons.

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In an emergency situation, you have the responsibility to make sure your staff is prepared to react as efficiently as well-trained emergency workers. Your technicians' lives may depend on it. The key is repetition: consistently setting aside time to conduct drills. These drills

should be performed with all team members so that everyone knows exactly what to expect in a live situation.

But training isn't just a matter of drilling. It requires a complete curriculum. The necessary steps for creating an effective critical environment training curriculum are:

- Create drills for emergency procedures
- Develop theory of operation for major equipment/systems
- Create training modules for operating and maintenance procedures
- Develop exams for various training levels.

Quantifying the results of the drills and tests is necessary to encourage continuous improvement.

Big Mistake #6: Failure to overlay your operations program with documented processes and procedures

> Vendor turnover documentation is a vital component of the operation, but just as important are detailed procedures that the critical environments team will need to perform.

Every action in a mission-critical environment must be documented. And the documentation must provide value by measuring an expected result, creating a foundation for corrective actions, or promoting proactive, continuous improvement.

Vendor turnover documentation is a vital component of the operation, but just as important are detailed procedures that the critical environments team will need to perform. These include facility walkthroughs, routine operations, preventative maintenance, corrective maintenance, and emergency response. In addition, accurate as-built drawings are vital to safe and reliable facility operations. Information such as equipment lists, maintenance scopes of work, and maintenance schedules seem simple but often turn up missing, inaccurate or inadequate when needed.

Reporting all of this information is vital for your company to implement changes.

Big Mistake #7: Failure to implement appropriate processes and procedures

Change Control processes must be used in the critical environment to ensure that all system changes are assessed and approved prior to their implementation. This can only be accomplished with a formal set of procedures and processes that follow generally accepted guidelines for change and configuration management.

Procedures

> Strong Change Control processes set the foundation for quality systems.

Virtually all work that takes place in the data center should have a written procedure. The most commonly used types of procedures are:

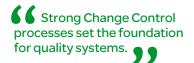*Standard Operating Procedure (SOP)*
    A SOP can be functional or administrative. It details a fixed operating procedure and can be referenced whenever needed.

Method of Procedure (MOP)
    A MOP is a detailed, step-by-step procedure used when working on or around any piece of equipment that has the ability to directly or indirectly impact the critical load. A library of MOPs should be compiled for scheduled maintenance operations, corrective maintenance, and installation activities.

Emergency Operating Procedure (EOP)

> An EOP is a response procedure for a potential or previously experienced failure mode. It covers how to get to a safe condition, restore redundancy, and isolate the trouble.

Vendor Management

> When vendors are engaged, unnecessary risk is introduced unless a comprehensive vendor management program is in place. All vendor activities must be supervised and standardized in SOP, MOP and EOP policies and procedures. Again, human error is the number one reason for outages. Without proper documentation and a vendor supervision program, the risk of outage compounds exponentially.

Emergency Response

> Emergency response and reaction protocols are essential to minimizing system downtime. Unpredictable events will occur no matter how careful the preparation. A well designed escalation process can prevent or mitigate damage, while detailed incident reporting, failure analysis, and a lessons-learned program will help prevent future occurrences.

All of these procedures set the foundation for quality systems.

Big Mistake #8: Failure to develop and implement Quality Systems

Many companies err in thinking that process, once proven, is infallible. Continuous improvement is the only way to ensure your data center operations are efficient, reliable, and cost effective. A program for quality systems consists of two principles:

- **Quality Assurance (QA):** processes to ensure that errors are not introduced into the system
- **Quality Control (QC):** measures taken at various stages of the process to proactively identify problems that could potentially lead to system failure

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The level of excellence required to achieve zero downtime is not easily attainable. No process or procedure is perfect, particularly in its early stages. To provide a mechanism for fine tuning the program, it is crucial to have a plan for continuous process improvement. For instance, all site documents should have a feedback section to document any variances required to perform or improve the procedure. Such changes are then incorporated into a new version of the procedure and reviewed by quality assurance.

QUALITY IMPROVEMENT → QUALITY ASSURANCE → QUALITY CONTROL →

Once your company's processes are engineered in an optimal manner, you can focus on the power of automation to attain superior results. Without process automation, it is nearly impossible to capture key data elements to build a repository that can create trending and decision modeling.

Big Mistake #9: Failure to use software management tools

It is easy to cut costs by forgoing software management tools. However, the amount of documentation required to run a successful operations program is enormous and must be retrievable on a moment's notice. A spreadsheet might work for a little while, but poor document management puts all your efforts at risk. **Table 1** shows a sample report of several types of data center activities over a three month timeframe in a 50,000 square foot facility; every activity requires a significant amount of coordination and detailed documentation.

> A well-implemented Computerized Maintenance Management System (CMMS) helps in the scheduling, assignment and tracking of all the facility maintenance activities.

Table 1

Typical site activities performed over a quarter

Activity	Quantity
Preventative Maintenance	767
Corrective Maintenance	486
Emergency Response	3
Operational Improvement	4
Complex Training	12
Emergency Preparedness Drills	2
Quality Assurance	566
Quality Control Audits	15

A well-implemented Computerized Maintenance Management System (CMMS) helps in the scheduling, assignment and tracking of all the facility maintenance activities. The record of these activities can be used to generate vital statistics about facility health, program effectiveness, and resource utilization. When a CMMS is combined with a quality systems approach, you will be able to implement more advanced practices, such as predictive maintenance and failure modeling. These will further reduce costs and risks in the data center.

The second management software tool is a document management system (DMS). A DMS is used to provide electronic storage and retrieval of important facility documentation, such as methods of procedures, emergency response procedures, one line drawings, safety policy, maintenance schedules, facility reports, etc. It is absolutely critical to have an archive of information that can be continuously leveraged and used as a platform for change management. Any site that is subject to external evaluations and audits must have a documentation management system as part of its comprehensive Quality Systems approach.

Complete data center management takes uncompromised commitment from an organization.

Big Mistake #10: Thinking you can build a best in breed program as quickly as a data center

Many do not understand what it takes to build a best in breed program. Most severely underestimate the amount of time it takes to build one starting from scratch. Do you have the

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time and resources? Do you have the internal expertise, especially if data centers aren't your core business?

Most businesses do not. They also don't have years of data and experience to base a program on, much less the budget. However, if your company does have resources and expertise, then be prepared to make a significant investment in the following areas:

- **Personnel:** The heartbeat of the program lies in technicians, quality assurance specialists, training specialists, and subject matter expertise in mechanical, electrical and controls systems.

- **Training:** It is imperative that you invest in your personnel to keep them operating at peak efficiency.

- **Software Management Systems:** The operations program relies upon a properly implemented and maintained CMMS and DMS that can, over time, provide a valuable database of information for your predictive modeling procedures.

- **Procedure Development and Quality System:** The operations program must document procedures for all critical activity, while the Quality System ensures consistent performance.

- **Process Integration:** The operations program must continuously leverage the strengths of all these components to achieve results and establish best practices.

If you have the resources and expertise to invest, make sure you have the time as well. If you are faced with recurring outages or other problem areas, or if your company is planning to build a new data center within the next 12 months, do not depend on your operational platform to be developed in time. It takes years to build a best in breed program. Here's what it involves:

Key Attributes of a Best in Breed Operations Program
I. Personnel management
   a. Evaluating team size /skill set requirements
   b. Recruiting
   c. Technical qualification
   d. Background screening
   e. Hiring and placement
   f. Retention
   g. Career progression
II. Training program
   a. Certification/Recertification
   b. Task/Certification Alignment
   c. Emergency Response Drills
III. Documentation
   a. As-built Drawings
   b. Asset Database
   c. Preventative Maintenance Scope of Work
   d. Maintenance Schedule
   e. Critical Facility Work Rules
   f. Safety Program
   g. Facility Reports
   h. Walkthrough checklist
IV. Processes and Procedures
   a. Change Control Process
   b. Standard Operating Procedures
   c. Methods of Procedures
   d. Emergency Procedures
   e. Vendor Management Program

V. Emergency Response
- a. Escalation Process
- b. Incident Reporting and Analysis
- c. Lessons Learned Program

VI. Quality System
- a. Quality Assurance
- b. Quality Control
- c. Quality Improvement

VII. CMMS
- a. Work Order Management
- b. Preventative Maintenance Scheduling
- c. Corrective Maintenance Scheduling
- d. Statistical Reporting

VIII. DMS
- a. Electronic Document Storage and Retrieval
- b. Document Review and Approval Workflow
- c. Document Archiving

IX. Regulatory Conformance

Conclusion

Now more than ever, companies must realize the importance of a sustainable operations program. To achieve operational sustainability, organizations must act quickly to assess their current programs and begin building an operational methodology that avoids common mistakes. A complete program integrates people, processes, and systems in a manner that promotes quality assurance and continuous improvement.

Companies ill equipped to quickly design a program of this magnitude should seek the assistance of mission-critical subject matter experts. The alternative invites unnecessary delay, risk, and expense. By implementing a best in breed program, you will protect your capital investment and ensure stronger returns years after year.

✎ About the author

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Mr. Woolley has been involved in the critical facilities management field for over 25 years. Bob served as Vice President of Data Center Operations for Navisite, as well as Vice President of Engineering for COLO.COM. He was also a Regional Manager for the Securities Industry Automation Corporation (SIAC) telecommunications division and operated his own critical facilities consulting practice. Mr. Woolley has extensive experience in building technical service programs and developing operations programs for mission critical operations in both the telecommunications and data center environments. He may be reached at rwoolley@leetechnologies.com.

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