“A Benchmarking Case Study at Children’s Hospital Medical Center, Cincinnati, Ohio:
Its History, Its Current Use, and Its Comparison to Industry Data”

Abstract

This paper covers the Benchmarking efforts at Children’s Hospital Medical Center (CHMC) in Cincinnati, Ohio as it relates to building maintenance and utility plant operation. The evolution of the Benchmarking parameters, how these parameters were agreed upon, and how they are now used as internal reporting mechanism to Senior Management and to the Board of Trustees will also be discussed. More importantly, these data are now used as planning tools to determine budgetary goals and objectives for new ventures and opportunities. Using spreadsheet programs, results are obtained with as little as thirty minutes of time per month. Actual financial and operational data are presented.

A Benchmarking Case Study at Children's Hospital Medical Center, Cincinnati, Ohio: Its History, Its Current Use, and Its Comparison to Industry Data

BY

Thomas E. Kinman, P.E.

Crestview Hills, Kentucky

March 26, 2000

Benchmarking is the practice of being humble enough to admit that someone else is better at something and wise enough to learn how to match and even surpass them at it.

Carla O'Dell, Continuous Journey, April 1994

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Healthcare institutions that can produce the highest quality outcomes, at the lowest effective cost, and can sustain these results over time will become “Best Practice” institutions. Expectations for directors of plant and facilities for these institutions will be no less demanding. As more is expected of healthcare institutions with less financial resources to get the task accomplished, Facility Managers will need ways to help compare and compete. Yet, most healthcare Benchmarking efforts have provided little but anecdotal reasons how each healthcare institution is different from every other. Such discussions are at best interesting, justify the status quo, prove that (unlike people) all buildings and maintenance departments are not created equal, and may help end promising careers.

This document will cover the Benchmarking efforts at Children’s Hospital Medical Center (CHMC) in Cincinnati, Ohio as it relates to building maintenance and utility plant operation. The evolution of the Benchmarking parameters, how these parameters were agreed upon, and how they are now used as internal reporting mechanism to Senior Management and to the Board of Trustees will also be discussed. More importantly, these data are now used as planning tools to determine budgetary goals and objectives for new ventures and opportunities. Using spreadsheet programs, results are obtained with as little as thirty minutes of time per month.

This document contains actual financial and operational data associated with Children’s Hospital Medical Center (CHMC) of Cincinnati, Ohio. It is hoped that those who examine these data and whom perform similar Benchmarking will share their data with their colleagues and with the author.

INTRODUCTION

In these times of cost containment and quality improvement initiatives, it is now more important than ever for facility managers and engineering directors to prove their department's value to their institutions. The many parameters used to determine an engineering and maintenance department's values are numerous however, few are able to accurately and precisely gauge one institution's performance in relation to another. Yet, these parameters are used by some institution's senior management to help make decisions such as whether to continue with current management or perhaps to outsource engineering and maintenance services partially or totally. These comparisons are further compromised when factors that can significantly affect operations and maintenance cost, such as the design of a facility's heating, ventilating, and air-conditioning system, are incorrectly assumed to be equal at facilities which are being compared.

Instead of finding fault with these efforts, engineering and maintenance professionals should embrace these efforts when confronted with Benchmarking activities. A positive attitude will go a long way to help deflect severe criticism if, in fact, Benchmarking results indicate that a facility is not performing quality, cost effective maintenance and plant operations. A willingness to study the issues unfortunately seems to be a departure from the status quo within the healthcare industry.

There are many definitions of Benchmarking and seldom do they define the same concept. Certain productivity benchmarks do not translate well if the total cost of service is the parameter to be studied. For example, one may compare hours worked per square foot as a benchmark. One can make the assumption that this benchmark will produce the best financial result but that is not always true. As will be demonstrated herein, a productivity standard of "hours worked per gross square foot" may, and often does, fail to account for contracted service personnel. This glaring

oversight can lead to an excessive reduction in force if the parameter is assumed to account for contracted service hours when in fact, it does not.

A definition that best fits the intent of the long term goals and objectives of a Benchmarking effort defines it as “the process of identifying, understanding, and adopting outstanding practices and processes from organizations from anywhere in the world to help your organization improve its performance.” [1] The definition needs to be broken apart to understand exactly the intent of Benchmarking.

First, identify and understand the outstanding practices. Size, complexity of buildings and systems, and the “philosophy” brought to the organizational structure of plant operations need to be simply and concisely documented so that such an understanding can occur. Also implied is that these data are accurate. Once accomplished, the management staff can determine whether practices CAN be adopted. This requires a more intimate knowledge of the design and operation of building systems: specifically mechanical, electrical and plumbing, than any Benchmarking effort so far has been able to compare. An understanding of why systems operate the way they do is needed to determine if practices deemed outstanding at one facility can in fact be adopted at another. All too often, what works at one facility is assumed transportable to any other. It will be documented later that this is not an accurate assumption.

The last important piece of the definition is that which says to adopt outstanding practices from outstanding organizations from anywhere in the world. What the definition does not say is that these outstanding practices and processes need to be from the same industry as healthcare. True Benchmarking crosses varying industries. When looking for ways to improve maintenance efficiency of aircraft maintenance, the airlines studied pit crews at the Indianapolis 500 to see how practices could be improved.

There are different kinds of Benchmarking depending on the outcome to be achieved. One source defines three types of Benchmarking: internal, competitive and functional.[2] Internal Benchmarking is only compared within a given organization. Competitive Benchmarking compares similar functions performed in different organizations, while functional Benchmarking compares similar functions at different industries. Benchmarking results for CHMC cover internal and competitive efforts. Monthly Benchmarking results are used to gauge the results of continuous improvement activities. As a result, trends are studied over time while taking into account normal seasonal variation. Operational results for the first quarter of the calendar year have proven to be different from the third quarter results and such variation is normal.

The Benchmarking results at CHMC are also intended to be used for competitive comparisons. A strategic initiative for the institution had been established to reduce the cost per adjusted stay by twenty-five percent over the next five years. A new target has been established as a percentage of gross revenues. The cost data collected for building maintenance and plant operations comparisons will fit nicely into any strategic plan the institution chooses to implement. Costs will already be determined. The new comparative determinant will be the percentage of gross revenues. At this time, no functional Benchmarking efforts are planned across a given range of services but that possibility cannot be discounted in the future. For example, one might benchmark all "hospitality services" such as housekeeping, maintenance, and food services as a percentage of gross revenues.

Although most global benchmarks are ratios and tend to have a dollar sign in the numerator, the other important piece of data for comparison is quality. A performance measurement is a

---

[1] Carla O'Dell, "Out of the Box Benchmarking", Continuous Journey , April 1994, www.apqc.org/b1/b1stories/story3.htm

[2] Emmanuel Furst and W. David McKinney, "Benchmarking: Performance Measurement, Performance Improvement, and Benchmarking", 1996 Annual Conference Proceedings, American Society for Healthcare Engineering, Page 5

clearly defined quantitative representation of the outcome of a process.[3] Quality of building maintenance and plant operations functions has been elusive and not easily measured. However, there is one quality measure against which most hospitals are measured: the JCAHO accreditation. In the past, the KIPS standards for Plant, Technology, and Safety Management (PTSM) and now the Environment of Care (EC) standards are an attempt at a measure of quality and is a process that most U.S. hospitals are subject. In addition, in recent years, a significant number of U.S. hospital are using comparative customer satisfaction surveys to gauge quality outcomes. It is logical that, in the future, results for the Environment of Care section of the JCAHO review should become the quality benchmark for building maintenance and plant operations assuming that inconsistencies can be resolved. It should be noted however that quality measures for plant operations are difficult to gauge. This is similar to environmental service parameters where the definition of "clean" is so subjective.[4]

As stated earlier, in spite of all the less than complimentary aspects of Benchmarking to date it is very important that facility managers embrace these efforts because Benchmarking seems to be the starting point for many cost reduction programs.[5] It should not be allowed to become the end of the cost reduction program however.

THE HISTORY OF BENCHMARKING AT CHMC

[3] Emmanuel Furst and W. David McKinney, "Benchmarking: Performance Measurement, Performance Improvement, and Benchmarking", 1996 Annual Conference Proceedings, American Society for Healthcare Engineering, Page 2

[4] Pamela L Blythe and Ralph Rice, "Benchmarking: Just the Tool for Environmental Services". Health Facilities Management, September 1996, Page 32

[5] "Cutting Costs in 1996", inside ASHE Volume 3, Number 11, November 1996, Page 1

A. How It Started

In 1992, twelve of the larger Children's Hospitals met and embarked on a Benchmarking effort whereby the member institutions would collect and share data pertinent to operations that were deemed important to the institutions. Twenty departmental benchmarks[6] were established and data collected to compare the various institutions' performance and best practice. Several of the hospital departments were measured against "productivity" benchmarks including engineering. The productivity benchmark chosen for engineering was Hours Worked Per Gross Square Foot. Due to copyright protection, none of these data can be referenced in this paper. The first results were reported in first quarter of 1994 that covered the third quarter of 1993. Upon examination, building maintenance and plant operations at CHMC had a long way to go to catch up to the institution that was deemed "best practice". During the same time period CHMC had just opened a 340,000 GSF inpatient care expansion and increases in service levels for this expansion had been implemented before the additional space was counted in the campus gross square footage.

Also to be noted, first round of data was not assembled by the plant operations departments and much of the data was confusing to the staff trying to analyze the results. A typical response at the time was "who's hospital are we looking at?" Data were submitted by the finance department without having it checked by plant and facilities department personnel.

B. Why it Started

Children's hospitals are a niche player in the U.S. healthcare industry. They generally provide full range of services to the pediatric population. This population is limited in size since the pediatric population is 0 to 18 years of age and represents a fraction of the total population. An adult hospital with a pediatric unit could service the entire population, adult as well as pediatric. The larger children's hospitals tend to be free standing but must be located in larger metropolitan areas to draw from a larger population base. Some children's hospitals are parts of larger adult institution and although have a separate and distinct identity, many building maintenance and plant operations services are provided by the larger adult institution.

Because of the nature of pediatric care, it is assumed that costs for similar types of procedures at adult institutions will be more expensive. For some procedures and services this assumption is accurate. Most newborns in a children's hospital newborn intensive care unit (NICU) have been transported to the nursery due to some complication discovered at birth. These patients are generally very sick and have very long lengths of stay. Newborn nurseries at adult hospital performing labor and delivery functions have relatively healthy newborns. As a result, lengths of stay are shorter and less acute and therefore, less costly.

Likewise, some procedures are more expensive due to the younger patient. Try to convince a three year old to be still during a 45 minute MRI and one can understand why these patients need to be sedated in order to achieve a quality scan. These costs of the sedation and the subsequent recovery are not generally borne in an adult setting.

It is against these factors that the costs for pediatric procedures are considered more expensive than the similar adult procedures. However, in the cost containment environment, these higher costs need to be justified to payers. The children's hospitals which embarked on the

[6] Janet E Porter, "The Benchmarking Effort for Networking Children's Hospitals (BENCHmark)", The Joint Commission Journal on Quality

Benchmarking effort were interested to learn how to perform its work more cost effectively by studying best practices at its peer institutions and thereby justify higher procedural costs where appropriate. Similar to other benchmarking efforts, this was the starting point of a cost reduction program.

C. The Early Results

Initially all the data submitted for this effort was collected by the Finance Department and the departments reviewed none of the data. When the first results were returned for study, many departments wondered where the data came from since it did not accurately reflect the actual conditions in the department. This was true for building maintenance and plant operations. Initially the benchmarking parameter for building maintenance and plant operations was Hours Worked Per Gross Square Foot. Initial reported data was problematic in several ways:

1. Some institutions included structured parking garages in their total gross square feet. Others did not.
2. Clinical or biomedical engineering labor was included with building maintenance and plant operations by some institutions, but not all.
3. Some and not others included grounds maintenance.
4. Labor required to operate central boiler plants was included as building maintenance labor. Those institutions, which purchased steam from a district system, had a labor advantage over the others but the benchmark did not measure utility cost.
5. The most glaring error in the initial reported data was that only hospital employee labor hours were submitted. As a result, those hospitals that had the higher percentage of contracted or "out sourced" labor were initially designated as "best practice".

6. Some hospitals reported net square footage as gross square footage.

On the heals of these initial results came a $10 million expense reduction mandate that needed to be in place at CHMC by July 1, 1995. In order to achieve the cost reduction targets, these same benchmark parameters were compared to “best practice” adult hospitals. Reductions in force targets were set with some adjustments in the numbers. Many of the errors in the data were not corrected and yet were used to define “appropriate” staffing levels. As a result, a benchmarking effort that was suppose to discover best practices at other children’s hospitals, was now used to compare “productivity” at CHMC against “best practice” adult hospitals. These hospitals were unable to be accessed to determine how they had achieved “best practice” in spite of requests to visit these institutions. At this point, the benchmarking effort had lost credibility and was anecdotally blamed for perceived lapses in quality by hospital staff.

THE RETOOLING OF PLANT AND FACILITIES BENCHMARKING

A. Why It Was Changed

In the Fall of 1994 several engineering directors of benchmarking children's hospitals happened to be in Cincinnati attending a conference. It was decided that a general invitation would be extended to all engineering directors of children's hospitals to meet to discuss the Benchmarking effort for engineering. It was also decided that a representative of the consulting firm coordinating the Benchmarking effort would also be invited. As it turned out, those engineering directors who attended the meeting were equally frustrated with the benchmark used to determine productivity, Hours Worked Per Gross Square Foot.

Another factor contributed to a new look at how to do meaningful benchmarking at CHMC. In January of 1995, it was announced that Children's Medical Center at Dayton, Ohio and Cincinnati Children's Hospital had begun talks to merge the institutions. Although the talks did not produce a merger, it created a need to determine effectiveness of building maintenance and plant operations. It was also a very easy sell to the Plant Engineering staff that if CHMC was going to merge with some institution in the future, it would be to everyone's best interests to be the dominant department in the event that a merger would consolidate staffs. This would be true for all departments in a merging institution including dietary, environmental services, or clinical engineering. This was the single most important factor in getting the attention of the engineering department to embrace again the idea of Benchmarking.

B. What Was Changed

In spite of the fact that the directors considered Hours Worked Per Gross Square Foot meaningless, it was maintained at the insistence of the consultant. Three other benchmarks were

added. Labor Cost Per Gross Square Foot , Non Labor Cost Per Gross Square Foot , and Utility Cost Per Gross Square Foot were the new indicators. For reasons stated earlier, hours worked were initially meant to include contracted service hours. However, none of the institutions attending the meeting had included contracted service hours in the numbers. In order to keep in house and contracted service labor on the same plane, benefits for in house labor were to be included in the labor cost. In addition, vacation and workers compensation time were also included in the labor cost calculation. Non Labor Costs were to include any contracted service labor, parts, supplies, and material.

Utility costs were also a point of contention among the participants. Several institutions (including CHMC) purchased steam from a district heating plant while others generated their own on site. As a result, the on site generators of steam had labor cost associated with central plant operations that were counted as building maintenance. It was decided that the cost of labor associated with the operation of a central plant would be counted in the price of the steam or chilled water and not as a building maintenance item.

Finally, the members felt the need for some kind of quality measure to determine if lowest cost actually provided adequate if not best quality. After long discussion on this issue, the quality benchmark was agreed to be the Joint Commission scores for Plant, Technology and Safety Management (now the Environment of Care) for the last two inspections. In spite of the agreement among the engineering members present, only CHMC shared these scores with the participating institutions. It should be noted that the initiatives to publish JCAHO results (quality) data will assist in developing benchmarking initiatives. Quality indicators have always been the weak link in the chain of benchmarking. If scores were published, hospitals could compare their cost and quality on the same playing field. Currently, most facilities are more than willing to compare their

cost and productivity data but most are reluctant to compare their JCAHO scores. It should be those healthcare institutions with the highest JCAHO scores and the lower operational cost that should be considered “best practice” and emulated by industry.

CHMC BENCHMARK DATA

It is important for any Benchmarking effort to demonstrate how facilities compare in size and complexity. It is an old adage that form follows function and the same may be true for organizational structures of plant maintenance. Therefore, it follows that the organizational structure of a maintenance department will be determined by the functions of the physical plant it maintains. It is also true that the design and use of the mechanical, electrical, and plumbing systems will also play an important role in the size of the maintenance organization and the organizational structure of the maintenance department. Not all hospital physical plants are created equal.

As an example of these concepts, the 1992 ASHRAE Handbook on HVAC Systems and Equipment details all the methods used to heat, cool, and ventilate all buildings. These systems include all-air systems, air-and-water systems, all-water systems, unitary systems, and panel systems.[7] Also included are cost comparisons for packaged heating and cooling units as well as district heating and cooling systems. System types are important for Benchmarking studies since they will have the most influence on system operating costs. ASHRAE states that all-air systems have the greatest potential to minimize operating costs.[8] Also stated by ASHRAE is that central air handling equipment requires less maintenance when compared to other systems.[9] From these examples, HVAC system selection has the potential of being the single most important variable in determining the resources needed to maintain a given physical plant. However, in Benchmarking efforts studied up to this point by the author, none has ever asked for these types of inputs as a basis of comparison.

---

[7] American Society of Heating, Refrigeration, and Air Conditioning Engineers, 1992 ASHRAE Handbook: HVAC Systems and Equipment. 1992, Page 2.5

[8] American Society of Heating, Refrigeration, and Air Conditioning Engineers, 1992 ASHRAE Handbook: HVAC Systems and Equipment. 1992, Page 2.5

In the U.S., older healthcare facilities have under gone several generations of renovations and retrofits and it is difficult to determine a primary system type for many healthcare buildings including those at CHMC. Without going into a long analysis, a best guess is all that is required to set the tone for the primary process to ventilate, heat, and cool an existing building.

A. Physical Plant Data

Table 2 (page 28) is a description of the various physical plants at CHMC. Included for each building operated and maintained by CHMC is:

- The year of completion and amount of gross square feet of each phase of expansion
- The percentage of total campus gross square feet for each phase of expansion
- Most common ventilation system type for each phase of expansion according to ASHRAE definition
- Primary heating utility for each phase
- Primary cooling utility for each phase
- Total conditioned space (including mechanical rooms)
- Average age of the physical plant
- Gross square feet of structured parking
- Average age of structured parking

B. Budgetary Data

The budgetary data included on Tables 2 through 6 (pages 28 through 31) are entered into a spreadsheet program on a monthly basis when departmental budgets are released from the finance department. For plant operations and building maintenance, the monthly data entry process takes

[9] American Society of Heating, Refrigeration, and Air Conditioning Engineers, 1992 ASHRAE Handbook: HVAC Systems and Equipment. 1992,

about ten minutes. Once these data are entered, the entire benchmarking process is automatically completed by embedded spreadsheet calculations. Therefore, the entire amount of time spent on preparing benchmarking data and obtaining results is no greater than 30 minutes a month. Any argument stating that benchmarking is a time consuming process has failed to exploit the use of spreadsheets as a management tool. The spreadsheet setup takes about a week to set up and debug for anyone with moderate knowledge on spreadsheet programs. These sheets provide not only a concise month by month report on budgetary performance, but also data that compares a monthly running average to the budgeted monthly average, and automatically prepares "status quo" budget planning for the following fiscal year based on an assumed inflation estimate.

Included in these data are the following for 1957 Power Plant Cost Center Table 3 and 5 **(**pages 28 and 30):

- Labor costs excluding benefits: (line item100)
- Boiler and chilled water chemical treatment costs (line item 403)
- Maintenance supplies for boilers and chillers (line item 408)
- Purchased service labor for boiler and chillers (line item 570)
- Electric power purchased from the local utility (line item 700)
- Steam purchased from the district heating plant and any incidental fuel oil (line item 711)
- Water and sanitation costs (line item 731)

Building maintenance expenses are contained in two separate budget codes: 1959 Plant Engineering and 1962 Construction Services. The Plant Engineering (Code 1959) department has budgeted 37 full time personnel (full time equivalents or FTE's). These personnel are responsible for all maintenance and repair to all mechanical, electrical, plumbing systems, at all facilities

owned and operated by CHMC. Department management has the option and is budgeted to use contracted service labor at its discretion to maintain acceptable backlog of work. The span of control of the Plant Engineering department is 9 to 1. Salary cost provided by the Finance Department can be increase by 22 percent to account for benefits. This is an important consideration since most U.S. hospitals do not include benefits in their labor costs for in house employees. The invoices for contracted service personnel will include benefit cost of the contracted service personnel.

Another common benchmark used for staffing is FTE Per Gross Square Foot.[10] Based on this benchmark CHMC would be at 45,479 Gross Square Foot Per FTE. Ranges of this benchmark for healthcare institutions range from as low as 11,000 Gross Square Feet Per FTE to as high as 112,000.[11] The very high number (112,000 Gross Square Feet Per FTE) worked from a staffing level, according to the cited reference, because most of the work was performed by contracted service personnel and was the highest in terms of cost per square foot.[12]

The Construction Services cost center 1962 is responsible for project execution of all new construction and renovation projects and is responsible for all "cosmetic" maintenance of the facility. "Cosmetic" maintenance at CHMC includes carpentry and painting. Contract service personnel perform carpentry and painting services. General staffing levels for carpenters and painters are two for each craft. The decision to outsource these functions is based the organizational philosophy of the department. This philosophy emphasizes the skills needed to troubleshoot complex and large-scale systems that include the mechanical, electrical, and plumbing trades. Painting and carpentry do not fit this skill mix and are contracted. When this

[10] Donn W. Brown, Physical Plant Staffing for Healthcare Facilities Chicago: American Society for Hospital Engineering, Healthcare Facilities Management Series 1993, Page 6

[11] Donn W. Brown, Physical Plant Staffing for Healthcare Facilities Chicago: American Society for Hospital Engineering, Healthcare Facilities Management Series 1993, Page 6

decision was made, there was a general feeling that this move would increase costs but based on the data acquired from benchmarking, building maintenance costs have, in fact, been reduced over time.

Line items for both the 1959 Plant Engineering Cost Center and the 1962 Construction Services Cost Center are included for review. Most line items for materials are self-explanatory.

C. Plant Operations Data

All data from the 1957 Power Plant, 1959 Plant Engineering, and the 1962 Construction Services Cost Centers feed into the Plant Engineering and Construction Services Benchmark Data report on Tables 2 through 6 and are all part of the same spreadsheet program. This report is the core result of the benchmarking initiative at CHMC and is used to compare data from other institutions (such as the Children's Hospitals initiative) and to monitor budgetary trends in plant operations and building maintenance.

Based on these data CHMC obtained the following results for Building Maintenance during Fiscal Year 2000 Table 4 (page 29):

- Labor costs (excluding benefits) averaged $0.09 per Gross Square Feet (KGSF) per Month or $1.08 per GSF per year.
- Contracted Service expense averages $0.05 per GSF per Month or $0.60 per GSF per year.
- Supply costs averages $0.05 per GSF per Month or $0.60 per GSF per year.
- Total Building Maintenance Expense averages $0.19 per GSF Month or $2.32 per GSF per year.

When these data are compared to Fiscal Years 1993 and 1994, significant improvement in performance had been achieved (Table 6 on page 31). Total Building Maintenance Expense

[12] Donn W. Brown, Physical Plant Staffing for Healthcare Facilities Chicago: American Society for Hospital Engineering, Healthcare Facilities

averaged $3.46 per GSF for Fiscal Year 1993 and $2.65 per GSF for Fiscal 1994 as compared to current operating results for Fiscal 2000 of $2.32 per GSF. These results have not been adjusted for inflation.

Central Utilities produced the following results for Fiscal 1999 (Table 3):

- Utilities expense averaged $3.07 per GSF per year.
- Energy Consumption was 349,791 BTU per GSF per Year.

The energy consumption results did not compare favorably with Fiscal 1998 of 259, 251 BTU per GSF per Year. This was a result of the startup and operation of a new boiler plant on campus. Before Fiscal 1999, steam utilities were purchased from the University of Cincinnati. Therefore, stack losses are incurred increasing consumption number by eighteen percent. However, Utility Cost per GSF has decreased by $0.12 per GSF because of operating the new boiler plant.

The benchmark of Hours Worked per GSF is still included in the report at the request of the Benchmarking consultant but is no longer used for management control. It was found to be poorly measured by the reporting hospitals in two ways. First, it was supposed to include contract service labor hours. Data reported by Finance departs ignore these hours. Second, the parameter of GSF was inconsistently reported.

HOW DATA IS NOW REPORTED

The most significant benefit that these data now provide is the opportunity to benchmark CHMC against CHMC and as a result, these data are posted in the shop areas for review by the staff as soon as they are available. This also reinforces the notion that when and if CHMC merges with another hospital, the plant operations and building maintenance staff plan on being the strongest department in terms of cost effectiveness and skill. There has been a clear benefit to sharing these data down the chain of command.

Likewise, there has been a clear benefit to sharing these data up the chain of command as well. On a monthly basis, these reports are shared with immediate supervision and the interest taken in measurement of cost performance and quality has been rewarded accordingly. These data are shared with the building committee of the board of trustees on a semi annual basis and fit nicely into the financial analyses for various projects or initiatives. For example, certain renovations may be more costly due to specific retrofits to existing HVAC systems. These reports make it easier to justify additional construction expenses. The most significant benefit to these data is the ability to budget for the impact of new construction especially when determining staffing levels for new square footage.[13]

Finally and not to be forgotten, these data are still used for the benchmarking initiatives of children's hospitals. As stated earlier, CHMC did not produce favorable results at the outset of the benchmarking initiative. However, instead of finding fault with the data, an honest effort was put forth to study the results and understand how changes could be made. Once the simple errors and omissions were noted and corrected, CHMC was among the leaders in the Facilities

[13] Pamela L. Blythe and Ralph Rice, "Benchmarking: Just the Tool for Environmental Services". Health Facilities Management, September 1996, Page 32

Benchmarking Initiative among children's hospitals. Now, work is taking place to study the adult best practice hospitals to see where further improvement can be made.

HOW DATA IS COMPARED ACROSS THE INDUSTRY

In recent years, the data available for benchmarking data across the healthcare industry has started to emerge. CHMC has used these data as comparisons to gauge its performance. In 1996, a survey of fifty hospitals in the northeastern U.S. was compiled.[14] The following Table shows the results of these data compared to CHMC.

	Average Beds	Average Beds	Average Beds	Average Beds	Average Beds	Total Beds	CHMC Beds	Average Beds	Average Beds	Average of All	Average Actual
Beds	78	113	160	180	283	313	349	508	720	285	324
Maint Cost	3.10	4.25	4.20	3.03	3.26	2.82	3.41	2.92	2.77	3.05	2.26
Utility Cost	4.03	3.50	3.84	3.48	3.08	3.15	3.36	3.86	4.19	3.79	3.07
Total Cost	7.13	7.75	8.04	6.51	6.34	5.97	6.77	6.78	6.96	6.84	5.33
FTE per 100,000 GSF	6.49	9.29	7.30	5.04	5.18	4.49	4.69	4.19	3.89	4.59	2.20
Total GSF	88000	141000	231000	338000	455000	565000	778000	1413000	2396000	700000	1682679

Table 1: Comparison of Fifty Northeastern U.S. Healthcare Facilities with CHMC

Table 1 shows CHMC's performance against the fifty New England hospitals. The first nine columns are averages of five hospitals with a specific bed number. For example, the first column shows that five hospitals in a specific bed size averaged 78 beds had an average GSF of 88,000. What is remarkable about these data is not only CHMC's results but also that there seems to be an economy of scale with regards to maintenance costs. It appears that the larger the facility in terms of size, the lower the maintenance cost and staffing levels. Of course, for this comparison, quality is assumed the same for all facilities.

The comparison to CHMC on both maintenance and utility cost can be argued that the cost of living is higher in the Northeastern U.S. than in the Midwest. This is true. However, staffing levels are not prone to such regional variations.

Another area that has much more improved data on benchmarking is in terms of energy consumption.[15] The following comparisons are made:

- BTU/SF consumption for facilities without cogeneration is 262,545 with cogeneration are 564,319.[16]
- The cost per square foot is $0.40 lower for a facility with cogeneration than without.[17]
- BTU/SF for facilities with electric cooling is 257,783 and for gas cooling is 280,446.[18]
- The cost per square foot for gas-cooled facilities is $0.22 less than electric cooled facilities.[19]
- BTU/SF for facilities without an energy management system is 272,120 and with an energy management system is 283, 577.[20]
- The cost per square foot for facilities with an energy management system is $0.32 less than those without an energy management system. [21]

---

[14] Loranger, Robert A., " What we learned from a 50-Hospital Collaborative Facilities Survey." 1997 Annual Conference Proceedings in San Antonio, Texas July 1997, American Society for Healthcare Engineering, Page 869

[15] Butkus, Alexander S., "Match Game: Finding out how your energy use stacks up against other facilities". Health Facilities Management, May 1998, Page 44

[16] Butkus, Alexander S., "Match Game: Finding out how your energy use stacks up against other facilities". Health Facilities Management, May 1998, Page 44

[17] Butkus, Alexander S., "Match Game: Finding out how your energy use stacks up against other facilities". Health Facilities Management, May 1998, Page 44

[18] Butkus, Alexander S., "Match Game: Finding out how your energy use stacks up against other facilities". Health Facilities Management, May 1998, Page 44

[19] Butkus, Alexander S., "Match Game: Finding out how your energy use stacks up against other facilities". Health Facilities Management, May 1998, Page 44

[20] Butkus, Alexander S., "Match Game: Finding out how your energy use stacks up against other facilities". Health Facilities Management, May 1998, Page 44

[21] Butkus, Alexander S., "Match Game: Finding out how your energy use stacks up against other facilities". Health Facilities Management, May 1998, Page 44

CONCLUSIONS

"A benchmark defines the current situation."[22]

In spite of the pitfalls, lessons learned from this benchmarking initiative are numerous. Janet Porter, CEO at Columbus Children's Hospital commenting on this benchmarking initiative stated that the key factor in distinguishing BENCHmark members is the willingness of leadership to share information with stakeholders.[23] The experience at CHMC in plant operations benchmarking paralleled this comment. Initial data was forwarded to the benchmarking coordinator without review of the Facilities department for accuracy and appropriateness. It was not until facilities staff seized the initiative to provide data that the results were improved.

When confronted with this effort, departmental management must make the effort and spend the time to get it right and then to really learn from the experience. "Time is increasingly limited, yet we must improve our operations in order to maintain our professional and personal competitiveness.[24]" The bottom line is that in today's environment, cost counts and careers will be on the line if these benchmarking initiatives are taken lightly.

Finally, in this era of reengineering and cross training, the functions that used to distinguish departments are beginning to blur. In a recent publication on patient focused care, the idea of hotel services for hospitals was introduced. Hotel services were defined as work needed to feed patients and keep their rooms fresh and clean. It also includes the upkeep and maintenance of facilities and equipment.[25] In the study on patient focused care, J Phillip Lathrop stated that 8 cents

---

[22] Pamela L. Blythe and Ralph Rice, "Benchmarking: Just the Tool for Environmental Services". Health Facilities Management, September 1996, Page 32

[23] Janet E. Porter, "The Benchmarking Effort for Networking Children's Hospitals (BENCHmark)", The Joint Commission Journal on Quality Improvement Volume 21, Number 8, August 1995, Page 403

[24] Emmanuel Furst and W. David McKinney, "Benchmarking: Performance Measurement, Performance Improvement, and Benchmarking", 1996 Annual Conference Proceedings, American Society for Healthcare Engineering, Page 1

[25] J. Phillip Lathrop, Restructuring Health Care: The Patient Focused Paradigm. Jossey-Bass Publishers, 1993, Page 62

of every dollar today is spent on these hotel services.[26] In the future, he contends that cost containment will require that every dollar spent today will have to be cut to 80 cents in the future.[27] At the same time cost for healthcare overall are being cut by 20 percent, the spending on the hotel services will actually rise to 11 cents of the 80 cents or rise from 8 percent of total cost today to 14 percent in the future.[28] If Mr. Lathrop is correct, Hotel Services (which includes building maintenance and plant operations) at the hospital of the future is a growth industry. In addition, the adept Director will have to learn how to benchmark cross function services. The best advice is to learn how to benchmark now, while it is still easy.

[26] J. Phillip Lathrop, Restructuring Health Care: The Patient Focused Paradigm. Jossey-Bass Publishers, 1993, Page 62
[27] J. Phillip Lathrop, Restructuring Health Care: The Patient Focused Paradigm. Jossey-Bass Publishers, 1993, Page 91
[28] J. Phillip Lathrop, Restructuring Health Care: The Patient Focused Paradigm. Jossey-Bass Publishers, 1993, Page 91

APPENDIX

CHMC PHYSICAL PLANT ANALYSIS — UNDER CONSTRUCTION — TO BE DEMOLISHED

BUILDING	GSF	% OF TOTAL GSF	YEAR OPENED	HVAC SYSTEM TYPE	HEATING UTILITY	COOLING UTILITY	MAINTENANCE EXPENSE	UTILITY EXPENSE
CHILDREN'S HOSPITAL	197,500	8.61%	1926	UNITARY	STEAM	CH WATER	> AVERAGE	AVERAGE
	10,000	0.44%	1949	ALL AIR	STEAM	CH WATER	> AVERAGE	AVERAGE
	90,900	3.96%	1968	ALL AIR	STEAM	CH WATER	> AVERAGE	AVERAGE
	20,000	0.87%	1980	ALL AIR	STEAM	CH WATER	> AVERAGE	AVERAGE
	1,500	0.07%	1986	ALL AIR	STEAM	CH WATER	> AVERAGE	AVERAGE
TOTAL	319,900							
HOSPITAL TOWER	346,135	15.09%	1993	ALL AIR	STEAM	CH WATER	AVERAGE	AVERAGE
PHASE 3	464,573	20.25%	2002	ALL AIR	STEAM	CH WATER	AVERAGE	AVERAGE
TCHRF	89,000	3.88%	1929	ALL AIR	STEAM	CH WATER	> AVERAGE	AVERAGE
	80,000	3.49%	1968	ALL AIR	STEAM	CH WATER	AVERAGE	AVERAGE
	120,100	5.23%	1991	ALL AIR	STEAM	CH WATER	AVERAGE	AVERAGE
	119,400	5.20%	1998	ALL AIR	STEAM	CH WATER	AVERAGE	AVERAGE
	112,000	4.88%	2000	ALL AIR	STEAM	CH WATER	AVERAGE	AVERAGE
TOTAL	520,500							
OUTPATIENT SERVICES	112,400	4.90%	1983	SPLIT	ELEC	ELEC	AVERAGE	> AVERAGE
	77,600	3.38%	1988	SPLIT	ELEC	ELEC	AVERAGE	> AVERAGE
TOTAL	190,000							
PAVILION	125,500	5.47%	1971	SPLIT	ELEC	ELEC	> AVERAGE	> AVERAGE
	1,700	0.07%	1987	SPLIT	ELEC	ELEC	> AVERAGE	> AVERAGE
TOTAL	127,200							
EDUCATION CENTER	132,500	5.77%	2000	ALL AIR	STEAM	CH WATER	AVERAGE	AVERAGE
DAYCARE @ CHMC	11,700	0.51%	1988	ALL AIR	ELEC	ELEC	AVERAGE	> AVERAGE
DAYCARE @ VERNON PL.	20,000	0.87%	2000	ALL AIR	ELEC	ELEC	AVERAGE	> AVERAGE
TOTAL	31,700							
OUTPATIENT MASON	22,700	0.99%	1987	ALL AIR	GAS	ELEC	AVERAGE	> AVERAGE
	12,913	0.56%	1996	ALL AIR	GAS	ELEC	AVERAGE	> AVERAGE
	21,913	0.96%	1997	ALL AIR	GAS	ELEC	AVERAGE	> AVERAGE
TOTAL	57,526							
VERNON PLACE	104,500	4.55%	ACQ 1999	ALL AIR	GAS	ELEC	AVERAGE	> AVERAGE
TOTAL OCCUPIED GSF	**2,294,534**	**100.00%**						
AVERAGE AGE OF PLANT	**1984**							

NOTES:
1. STEAM BOILERS FIRED FROM GAS OR FUEL OIL
2. CH WATER PRODUCED FROM ELECTRIC CENTRIFUGAL, ABSORPTION, AND THERMAL STORAGE
3. ON SITE ELECTRICAL GENERATION CAPACITY OF 14,000KW

PARKING STRUCTURES			
SOUTH GARAGE	265,250	20.39%	1998
NORTH GARAGE	372,000	28.60%	1991
VISITOR PARKING A	278,000	21.37%	1993
VISITOR PARKING B	100,280	7.71%	1999
VISITOR PARKING C	285,300	21.93%	2000
TOTAL	1,300,830	100.00%	
AVERAGE AGE			1995

Table 2: CHMC Physical Plant Data

57 CENTRAL UTILITIES	FY 2000	JUL	AUG	SEP	OCT	NOV	DEC
SALARIES	$146,741	$12,331	$12,109	$12,054	$11,548	$12,228	$11,714
BENEFITS							
CHEMICALS	$50,000	$4,114	$961	$3,630	$3,300	$3,300	$3,300
MAINTENANCE SUPPLIES	$50,000	$1,851	$5,584	$2,141	$7,753	$8,429	($3)
PURCH SRVCS	$80,000	$10,433	$20,634	$11,662	$3,423	$3,029	$8,428
ELECTRIC	$3,176,740	$315,534	$314,570	$279,436	$254,812	$217,696	$248,676
STEAM/FUEL/OIL	$826,878	$81,810	$56,188	$55,472	$56,190	$102,237	$71,142
WATER & SANITATION	$454,584	$48,094	$37,615	$40,578	$34,097	$41,893	$40,561
7 TOTAL	$4,784,943	$474,167	$447,661	$404,973	$371,123	$388,812	$383,818
TOTAL UTILITIES	$4,458,202	$445,438	$408,373	$375,486	$345,099	$361,826	$360,379
TOTAL PURCH SRVC	$80,000	$10,433	$20,634	$11,662	$3,423	$3,029	$8,428
TOTAL SUPPLIES	$100,000	$5,965	$6,545	$5,771	$11,053	$11,729	$3,297
ITIES COST / GSF / YEAR	$2.84	$0.33	$0.31	$0.28	$0.26	$0.27	$0.27
FUEL COST FY2000	**$572,903**	$79,142	$72,270	$65,528	$65,286	$93,720	$89,368
OIL CONSUMPTION	0	7,500	0	0	0	15,011	0
OIL COST / GAL		$0.567	$0.549	$0.625	$0.665	$0.6570	$0.7215
OIL COST / MMBTU		$4.046	$3.918	$4.461	$4.750	$4.693	$5.154
OIL ENERGY (MMBTU)		1,050	0	0	0	2,102	0
GAS COST / MCF	$3.41	$3.055	$3.439	$3.751	$3.400	$4.026	$3.157
GAS CONSUMPTION (MMBTU)	242,321	24,512	21,013	17,468	19,203	20,827	28,308
UNIT ELEC COST / KWH	$0.0455	$0.0392	$0.0398	$0.0415	$0.0428	$0.0413	$0.0437
ELEC CONSUMPTION (KWH)	71,010,869	7,478,773	7,236,095	5,966,651	5,590,256	6,046,287	5,317,482
BILLING DEMAND							
COST OF ELECTRIC	**$1,784,081**	$293,095	$288,199	$247,624	$239,538	$249,469	$232,186
WATER COST / CCF	$0.85	$0.93	$0.92	$0.94	$0.94	$0.95	$0.94
WATER VOLUME (CCF)	151,980	25,228	26,967	17,465	19,488	19,156	14,440
SANITATION COST (CCF)	$1.25	$1.33	$1.28	$1.34	$1.30	$1.37	$1.34
SANITATION VOLUME (CCF)	117,812	18,857	15,374	12,658	15,929	16,323	12,771
WATER & SANITATION COST	**$236,429**	$48,542	$44,488	$33,379	$39,026	40,407	30,587
TOTAL ENERGY (BTU/GSF/YR)	287,999						
TARGET: BTU / GSF / MONTH	**24,000**	**30,356**	**27,161**	**22,480**	**22,748**	**25,886**	**27,606**

Table 3: Central Utilities Data: Budget Performance July 1999 to December 1999

1959 PLANT ENGINEERING	FY 2000	JUL	AUG	SEP	OCT	NOV	DEC
100: SALARIES	$1,580,890	$127,683	$117,690	$105,681	$110,886	$112,163	$117,074
BENEFITS	*$0*						
405: PLUMBING	$121,000	$4,904	$10,157	$14,624	$5,949	$5,119	$10,452
406: ELECTRICAL	$141,000	$6,349	$16,643	$18,557	$12,088	$13,727	$11,008
408: MAINTENANCE	$128,000	$4,365	$9,661	$13,746	$8,866	$10,844	$15,660
409: STERILIZER	$299,150	$22,597	$7,830	$16,777	$6,678	$18,697	$5,619
411: MATRESS	$10,000	$3,501	$1,697	$2,556	$1,690	$431	$1,365
415: UNIFORMS	$19,000	$913	$1,907	$1,355	$1,647	$819	$1,737
450: OFFICE SUPPLIES	$5,000	($1,227)	$766	$1,487	$483	$358	$857
451: STOREROOM	$500	$65	$14	$34	$16	$23	$8
472: PRINTSHOP	$300	$0	$18	$205	$48	$26	$0
495: GROUNDS	$18,540	$0	$789	($51)	$861	$1,849	$743
513: TEMP SALARIES	$10,000	$0	$0	$0	$0	$0	$0
552: CELL PHONE		$75	$35	$76	$59	$63	$71
570: MAINT PURCH SRVC	$558,000	$34,691	$29,535	$34,488	$46,204	$24,744	$27,905
572: GROUNDS PURCH SRVC	$210,000	$19,546	$23,158	$23,292	$20,211	$33,239	$32,432
581: PAGER MAINTENANCE	$0	$153	$155	$0	$15,660	($15,481)	$99
695: HVAC	$74,000	$3,634	$3,862	$5,396	$3,764	$2,926	$4,018
713: GASOLINE	$6,000	$0	$614	$776	$400	$672	$560
740: PHONE	$1,800	$95	$132	$300	$145	$82	$0
940: CONF & TRAVEL	$10,000	$5,156	$1,637	($3)	$10	$109	$145
990: MISC EXPENSE	$3,000	$509	$242	$187	$510	$419	$990
1959 TOTAL	$3,196,180	$233,009	$226,542	$239,483	$236,175	$210,829	$230,743

1962 CONSTRUCTION SERVICES							
100: SALARIES	$245,680	$20,801	$19,241	$20,143	$21,022	$20,226	$20,897
BENEFITS	*$0*						
402: PAINTING	$15,389	$1,547	$2,324	$1,258	$1,795	$319	$1,687
407: CARPENTRY	$90,000	$4,533	$6,419	$7,874	$6,214	$2,561	$6,292
420: PHOTO SUPPLIES	$9,000	$0	$8	$630	$0	$1,122	$0
450: OFFICE	$5,000	$0	$48	$76	$291	$0	$3
492: WINDOW SHADES	$2,000	$0	$0	$280	$200	$0	$0
500: PURCH SRVC - DESIGN	$30,000	$279	$0	$3,813	$368	($98)	$8,020
552: CELLULAR PHONE	$0	$11	$19	$0	$0	$0	$0
570: PURCH SRVC - MAINT	$285,000	$31,140	$14,695	$15,189	$22,633	$32,595	$23,841
581: PAGER MAINTENANCE	$0	$18	$18	$0	$18	$28	$18
586: VINYL REPAIR	$7,000	$0	$1,794	$0	$300	$2,680	$1,769
682: EQUIPMENT REPAIR	$0	$0	$0	$0	$0	$0	$0
740: PHONE	$800	$0	$0	$0	$0	$0	$0
940: CONF & TRAVEL	$7,200	$974	$1,263	$129	$50	$231	$894
950: DUES & SUBSCRIPTIONS	$500	$0	$90	$0	$115	$0	$120
990: MISC EXPENSE	$2,000	$17	$134	$526	$93	$17	$17
1962 TOTAL	$699,569	$59,320	$46,053	$49,918	$53,099	$59,681	$63,558
MAINTENANCE COST / GSF / YR	$2.32						
TARGET: COST / GSF / MONTH	**$0.19**	**$0.17**	**$0.16**	**$0.17**	**$0.17**	**$0.16**	**$0.17**
LABOR COST / GSF / MONTH	$0.09	$0.09	$0.08	$0.07	$0.08	$0.08	$0.08
CONTR SERV COST / GSF / MONTH	$0.05	$0.05	$0.04	$0.05	$0.05	$0.06	$0.06
SUPPLY COST / GSF / MONTH	$0.05	$0.03	$0.04	$0.05	$0.04	$0.03	$0.04
HOURS WORKED		5,894	5,883	5,737	6,037	5,659	5,508
HOURS WORKED / KGSF		3.50	3.50	3.41	3.59	3.36	3.27

Table 4: Plant Engineering and Construction Services Data: Budget Performance July 1999 to December 1999

: POWER PLANT	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999
SALARIES						$61,370	$128,330
CHEMICALS	$9,396	$11,925	$14,330	$14,160	$14,655	$17,222	$40,291
MAINT SUPPLIES	$28,406	$19,948	$13,786	$23,009	$17,186	$24,570	$55,689
PURCH SERVICES - ASBESTO	$8,963	$6,823	$31	$15	$14	($309)	
PURCH SERVICES	$38,046	$44,364	$30,572	$46,766	$48,466	$51,448	$79,242
ELECTRIC	$2,005,664	$2,404,385	$2,481,377	$2,941,219	$2,497,096	$2,923,089	$2,931,411
STEAM / FUEL OIL / GAS	$616,276	$1,289,972	$1,168,607	$1,586,343	$1,230,406	$1,272,453	$829,144
WATER & SANITATION	$211,881	$260,234	$232,564	$337,636	$307,420	$335,226	$448,939
TOTAL	$2,918,632	$4,037,651	$3,941,267	$4,949,148	$4,115,243	$4,685,069	$4,513,046
COST PER GSF	**$2.99**	**$3.07**	**$2.97**	**$3.74**	**$3.11**	**$3.19**	**$3.07**
ELECTRIC (KWHR)	**48,127,400**	**57,766,554**	**57,089,040**	**57,379,272**	**57,825,948**	**63,635,851**	**71,674,035**
STEAM (MLBS)	**104,302**	**159,452**	**163,748**	**186,312**	**150,384**	**149,645**	**0**
OIL (GALLONS)	**6,178**	**11,040**	**4,666**	**19,080**	**18,128**	**6,315**	**45,906**
GAS (MCF)	**0**	**0**	**0**	**0**	**0**	**13,693**	**263,549**
RGY USE (BTU / GSF / YR)	**276,315**	**272,339**	**271,108**	**290,409**	**264,341**	**259,251**	**349,791**
CENT OF GROSS REVENUE			**1.34%**	**1.57%**	**1.16%**	**1.22%**	**1.06%**

Table 5: Central Utilities Data: Historical Budget Performance Fiscal Years 1993 through 1999

1959: PLANT ENGINEERING	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999
100: SALARIES	**$1,732,589**	**$1,606,397**	**$1,444,252**	**$1,272,706**	**$1,222,231**	**$1,303,897**	**$1,381,361**
402: PAINT SUPPLIES	$11,016	$12,816					
405: PIPING SUPPLIES	$65,460	$76,821	$94,310	$62,247	$80,291	$121,381	$74,538
406: ELECTRICAL SUPPLIES	$114,117	$129,760	$114,070	$160,760	$168,792	$165,963	$109,281
407: CARPENTRY SUPPLIES	$96,902	$109,635			$554	$1,515	
408: MAINTENANCE SUPPLIES	$135,576	$191,666	$116,982	$174,351	$132,497	$196,276	$150,012
409: STERILIZER SUPPLIES	$80,201	$74,538	$69,260	$101,944	$94,230	$87,685	$100,506
411: MATRESS SUPPLIES	$5,776	$4,245	$12,374	$12,199	$7,801	$23,376	$11,598
415: UNIFORMS	$20,047	$22,062	$12,772	$11,791	$12,332	$19,161	$15,183
450: OFFICE SUPPLIES	$12,136	$15,664	$1,571	$8,367	$6,423	$7,827	$9,220
451: STOREROOM	$3,209	$1,808	$422	$423	$344	$474	$402
472: PRINTSHOP	$876	$393	$467	$211	$223	$485	$454
474: COPYING	$1,200						
492: WINDOW SHADES	$179		$2,371				
495: GROUNDS SUPPLIES	$14,028	$12,730	$16,988	$15,670	$2,876	$9,623	$11,767
500: PURCH SERVICE: ASBESTOS	$18,669	$12,634	$1,559	$225	$762	$1,094	$1,263
513: TEMP SALARIES		$17,227		$2,899	$1,733	$344	$3,317
552: CELL PHONES							$645
570: PURCH SERVICE	$673,710	$806,534	$406,968	$460,551	$543,515	$594,026	$514,103
572: PURCH SERVICE - GROUNDS	$90,696	$95,187	$135,395	$105,086	$106,820	$245,447	$283,616
581: PAGER MAINTENANCE							$2,585
682: EQUIPMENT REPAIR						$16,360	
695: HVAC SUPPLIES	$73,525	$59,584	$63,975	$93,921	$62,933	$80,916	$45,929
713: GASOLINE	$5,023	$5,507	$4,520	$2,458	$3,993	$5,487	$5,336
740: PHONE	$53	$653	$264	$223	$140	$1,965	$2,405
940: CONF & TRAVEL	$9,555	$10,560	$5,052	$11,224	$4,848	$11,470	$6,988
990: MISC EXPENSE	$10,594	$7,241	$8,250	$7,555	$3,740	$4,885	$7,256
TOTAL	$3,175,137	$3,273,662	$2,511,822	$2,504,811	$2,457,078	$2,899,657	$2,737,765
1962: CONSTRUCTION SERVICES							
100: SALARIES	**$165,568**	**$187,606**	**$222,287**	**$187,588**	**$197,462**	**$225,736**	**$237,579**
402: PAINTING SUPPLIES			$10,879	$10,647	$11,635	$13,171	$12,548
407: CARPENTRY SUPPLIES			$89,804	$78,802	$77,842	$66,774	$64,561
450: OFFICE SUPPLIES	$1,768	$1,564	$2,013	$2,801	$5,331	$2,377	$1,969
451: STOREROOM	$117	$75	$74	$79	$58	$85	$16
472: PRINTSHOP	$110	$59	$64	$217	$10	$1,021	$40
492: WINDOW SHADES				$370	$556	$1,615	$4,355
500: PURCH SERVICES	$16,613	$9,965	$56,126	$49,286	$11,156	$55,335	$6,194
513: TEMP SALARIES		$7,174		$1,043			
552: CELL PHONE							$403
570: PURCH SERVICE			$292,336	$278,653	$313,093	$232,472	$243,553
581: PAGER MAINTENANCE							$201
586: VINYL REPAIR			$9,869	$9,095	$7,682	$21,960	$10,671
682: EQUIPMENT REPAIR	$156					$373	
740: PHONE	$1,764	$1,931	$1,751	$632	$573	$1,096	$442
940: CONFERENCE & TRAVEL	$4,865	$755	$5,015	$6,153	$3,311	$4,742	$6,572
950: DUES & SUBSCRIPTIONS	$672	$506	$552	$255	$245	$720	$495
990: MISC EXPENSE	$3,833	$1,200	$2,882	$1,233	$1,709	$7,568	$946
TOTAL	$195,466	$210,835	$693,652	$626,854	$630,663	$635,045	$590,545
TOTAL 1959 AND 1962	$3,370,603	$3,484,497	$3,205,474	$3,131,665	$3,087,741	$3,534,702	$3,328,310
MAINT COST PER GSF	**$3.46**	**$2.65**	**$2.42**	**$2.36**	**$2.33**	**$2.40**	**$2.26**
PERCENT OF GROSS REVENUE			**1.09%**	**0.99%**	**0.87%**	**0.92%**	**0.79%**

Table 6: Plant Engineering and Construction Services Data: Historical Budget Performance Fiscal Years 1993 through 1999

BIBLIOGRAPHY

American Society of Heating, Refrigeration, and Air Conditioning Engineers, 1992 ASHRAE Handbook: HVAC Systems and Equipment . 1992

American Society of Heating, Refrigeration, and Air Conditioning Engineers, 1995 ASHRAE Handbook: HVAC Applications . 1995

Blythe, Pamela L. and Ralph Rice, "Benchmarking: Just the Tool for Environmental Services". Health Facilities Management , September 1996

Brown, Donn W., Physical Plant Staffing for Healthcare Facilities Chicago: American Society for Hospital Engineering, Healthcare Facilities Management Series 1993

"Cutting Costs in 1996", inside ASHE Volume 3, Number 11, November 1996

Feltus, Anne, "Exploding the Myths of Benchmarking", Continuous Journey, April 1994, www.apqc.org/b1/b1stories/story2.htm

Furst, Emmanuel and W. David McKinney, "Benchmarking: Performance Measurement, Performance Improvement, and Benchmarking", 1996 Annual Conference Proceedings in Orlando, Florida June 1997, American Society for Healthcare Engineering

Hammer, Michael and James Champy, Reengineering the Corporation. HarperBusiness, 1994

Lathrop, J. Phillip, Restructuring Health Care: The Patient Focused Paradigm. Jossey-Bass Publishers, 1993

Microsoft Corporation, User's Guide Microsoft EXCEL, Version 5.0, 1994

O'Dell, Carla, "Out of the Box Benchmarking", Continuous Journey, April 1994, www.apqc.org/b1/b1stories/story3.htm

Porter, Janet E., "The Benchmarking Effort for Networking Children's Hospitals (BENCHmark)", The Joint Commission Journal on Quality Improvement, Volume 21, Number 8, August 1995

Loranger, Robert A., " What We learned From a 50-Hospital Collaborative Facilities Survey." 1997 Annual Conference Proceedings in San Antonio, Texas July 1997, American Society for Healthcare Engineering

Butkus, Alexander S., "Match Game: Finding out how your energy use stacks up against other facilities". Health Facilities Management, May 1998