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A Knowledge Continuity Management Program for the Energy, Infrastructure and Knowledge Systems Center, Sandia National Laboratories

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Version 3.1

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Abstract

A growing recognition exists in companies worldwide that, when employees leave, they take with them valuable knowledge that is difficult and expensive to recreate. The concern is now particularly acute as the large “baby boomer” generation is reaching retirement age. A new field of science, Knowledge Continuity Management (KCM), is designed to capture and catalog the acquired knowledge and wisdom from experience of these employees before they leave. The KCM concept is in the final stages of being adopted by the Energy, Infrastructure, and Knowledge Systems Center and a program is being applied that should produce significant annual cost savings. This report discusses how the Center can use KCM to mitigate knowledge loss from employee departures, including a concise description of a proposed plan tailored to the Center’s specific needs and resources.

ACKNOWLEDGEMENTS

The author acknowledges the valuable contributions of the Knowledge Continuity Management (KCM) team in providing review and suggested changes. A special thanks is extended to Ms. Judy Jewell, the 6000 Human Resources representative, and her predecessor, Ms. Renae Perrine, for important contributions regarding the Center demographic information and for various suggestions involving a description of how personnel should be treated within the KCM program. Bill Stubblefield and Tameka Barrentine of Sandia's Knowledge Systems Design and Engineering Department (6223) provided important suggestions about how to organize and store the captured knowledge and how to apply their expertise in knowledge systems to the KCM implementation. Also, the contributions of a number of people in Sandia's Procurement and Human Resources organizations are recognized for their valuable insights and suggestions. Marianne Hill from Sandia's legal team is recognized for reviewing the KCM program.

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EXECUTIVE SUMMARY

According to the U.S. Bureau of Labor Statistics, more than 25 percent of the working population will be eligible for retirement by 2010, much of it due to the “baby boomers” leaving the work force. As a result, executives worldwide are beginning to realize that their organizations are losing a great deal of knowledge when an employee permanently departs.

Many people think that this lost knowledge is simply inevitable and the associated costs must be paid. That is not true. A new field of science is evolving that addresses this problem. Called Knowledge Continuity Management (KCM), it is designed to harvest knowledge from departing employees, catalog it, and make it available to new employees. The primary goal of KCM is to save money by preserving job knowledge.

Knowledge continuity management is a subset of knowledge management and is a relatively new field of study. Knowledge Management (KM) involves capturing and sharing valuable expertise and experience within an organization. Knowledge Continuity Management (KCM) focuses on ensuring that critical knowledge passes from exiting employees of an organization to their replacements.

Anne Field, a writer for *Harvard Management Communication Letter*, recently wrote:¹

“Without adequate knowledge continuity between employee generations, organizational ‘forgetting’ drains intellectual capital and squanders the knowledge asset,” says Hamilton Beazley, chairman of the Strategic Leadership Group in Arlington, Va., and formerly a professor of organizational sciences at George Washington University. Companies need to have effective methods for transferring employee know-how. That’s where the concept of knowledge continuity management comes into play.”

The KCM concept is in the final stages of being adopted by the Energy, Infrastructure and Knowledge Systems Center (“the Center”) at Sandia and a program is being applied that should produce significant annual cost savings, starting with the first year.

The application began with a careful analysis of the Center’s historical demographic profile, which revealed that total turnover (including separations, retirements, and other job changes) is hovering around 12% per year. Currently, approximately 20% of Center employees are eligible to retire. The cost to the Center of knowledge lost due to departing retirees could be particularly high, because these are often the most knowledgeable employees.

The crux of KCM is a knowledge profile (“K-Pro”), which is created for every critical job, especially “knowledge jobs” (those that involve primarily cerebral activities). Sandia, of course, is replete with knowledge jobs. The K-Pro is simply a questionnaire that a departing employee completes about how a job is performed. Essentially, it is a summary of the primary features of his/her job.

For example, a K-Pro might include information on the employee’s key customers, the teams on which he/she participates, the identification of his/her key supporters/detractors, and key existing

and hibernating issues, etc. The questionnaire can be followed up with a one-on-one interview to clarify any ambiguities. The information is then finalized into the K-Pro and stored for reference. Once complete, the K-Pro can be turned over to a replacement employee. The usefulness of the profile is maximized if the incumbent can work directly with his/her replacement for a short time before final departure.

Although a departing employee is officially qualified for inclusion in the KCM program upon official declaration of termination, the employee's participation is both voluntary and at the discretion of the department manager.

If the employee agrees to participate, the process involves three tasks. The first is completion of a K-Pro by the departing employee with the assistance of the manager. A standardized set of questions has been developed as a starting point (called a Knowledge Questionnaire or "K-Quest"); but the profile must be tailored to the specific job by the manager and the employee. The total time to complete the K-Pro is approximately six hours, including interaction time between the two principals. The manager presents a copy of the K-Pro to the incoming replacement employee and files it in a database for future use.

The remaining two tasks for the departing employee, again at the discretion of the manager, involve drafting a job description and assisting the manager in the selection of a replacement employee. Where possible, the exiting employee works directly with his/her replacement for a period of time. This can be accomplished by either matrixing the departing employee back to the organization (as in the case of a lateral hire) or by hiring the departing employee as a consultant (in the case of a Sandia separation or retirement).

If the departing employee agrees to participate, then a one-time SPOT award will be awarded and the incumbent employee will be obligated to complete the three principal KCM activities outlined above. The size of the SPOT award might best be determined based on length of service in the Center, with awards ranging from \$100 to \$1000.

The positions at Sandia recommended for inclusion in the KCM program include Technical Staff, Technician, Line Manager, and Professional Support Staff. Administrative support positions, often filled with represented employees, usually already have well-documented job descriptions; therefore, this type would probably not be included in the program. However, exceptions to these guidelines could be allowed and any position could be included in the program, at the discretion of the manager and the Center director.

The implementation of the program will be handled by Sandia's Knowledge Systems Design and Engineering Department (KSDE/Org. 6223), with input from the author of this report. KSDE will assist the manager, if required, in developing the K-Quest and follow-up interview with the departing employee and in managing the storage of the K-Pros. This might require approximately 0.1 full time equivalent (FTE) level of effort for perhaps six months. Thereafter, the process might consume 0.05 FTE to 0.1 FTE. *Total costs for the SPOT awards and the coordination are expected to be about \$27,000 per year, which could be covered by Center Support Funds.*

Based on information provided by the *Wall Street Journal* and Nobscot Corporation, a company specializing in organization retention management and metrics, the cost to replace workers is about 33% of the loaded salary in the first year and about half that in the succeeding year. Assuming this information to be accurate — that permanent departures continue at the current pace, and that the KCM program could cut lost knowledge costs in half— the Center could realize net savings of approximately \$850K per year for the foreseeable future. The projected annual return on investment for the KCM program is 3100% (three thousand, one hundred percent).

In addition, personnel in the Knowledge Systems Department believe that this activity could be used as the kernel of a Knowledge Management system in a department.

Verifying the exact savings will be difficult to measure accurately until such a program has been instituted at Sandia for awhile. However, the program's effectiveness can be measured by interviewing managers and new employees who have participated in it. The program plan calls for the coordinator to conduct such interviews, at least in the initial stages. At the same time, suggestions for improving the program can be analyzed and assimilated.

A KCM program at Sandia, which will require approximately six months to fully implement, is described in detail in the document below.

INTRODUCTION

A growing concern within the Center is that, as the employee base ages, retirements will increase, some occurring in clusters. When these departures are coupled with normal personnel separations and other employee departures, the overall impact of lost knowledge and experience could be severe.

This fear is not unfounded. Companies throughout the world are facing an aging workforce of “baby boomers” who are now beginning to retire. According to the U.S. Bureau of Labor Statistics, more than 25 percent of the working population will be retirement-eligible by 2010, resulting in a potential worker shortage of almost 10 million. By 2030, 20 percent of the population will be over age 65.²

Many people believe that the increasing number of retirement-eligible people in professional organizations will result in significant “brain drain,” as knowledge loss is called, when retirements begin to increase in the near term. Some believe that this loss is inevitable and that there is nothing that can be done to mitigate it.

This is not true. A growing field of management science is developing around this subject. It is called Knowledge Continuity Management (KCM) and is a subfield of Knowledge Management. While KCM is not fully developed in practice, the theory appears to be well along. It is based on logical and fundamental constructs that are reasonable and applicable.

In this report, which is divided into three parts, I discuss how we can use KCM to mitigate knowledge loss from employee departures. Part I outlines the problem from the global perspective down to the one in our Center. The organizational costs of lost knowledge resulting from separations and retirements are enumerated. The specific situation in our Center (6200) is discussed in some detail.

In Part II, the fundamental precepts of KCM are articulated and sources of information are cited.

Part III presents a concise description of a KCM plan that I propose for implementation in 6200. The plan, which will be tailored to the Center’s specific needs and resources, will use many, but not all, of the KCM concepts. A specific implementation procedure is presented along with a budget and timeline.

In Part IV, the costs and benefits, including an estimated return on investment, are presented.

PART I. HOW EMPLOYEE DEPARTURES FOSTER LOST KNOWLEDGE

It is a known fact that when employees leave, they take with them organizational knowledge. In some cases, this knowledge might be important or even essential to the operation of the organization. Assessing the cost of these losses is difficult, but there have been some credible attempts. Knowing the costs of these losses helps to define the business case for KCM in an organization.

What is Knowledge?

Before the value of knowledge losses can be determined, “knowledge” must be defined. Knowledge is in the middle of a continuum between “data” and “wisdom.” *Data* are the fundamental elements of knowledge and are comprised of facts, measurements, etc. The analysis and interpretation of data produce *information*. When information is synthesized into an appropriate framework where decisions are made, *knowledge* emerges. When knowledge of a certain area or field is integrated with other areas of knowledge and then applied to guide activities, *competency* is born. *Wisdom* is competency refined by experience, practice, and maturity, which leads to sound judgment.³

Both competency and wisdom are highly personalized and are difficult to characterize and define. Knowledge is the highest order element on the continuum that can be captured, defined, cataloged, and valued. According to Manasco, knowledge has actual capital value.⁴

Dixon has subdivided knowledge into two categories: tacit and explicit.⁵ Explicit knowledge is an understanding of the official operational procedures of the job and organization along with the limits and freedoms associated with a particular job.

Tacit knowledge is developed from experience and reflects how a person does his/her job. It encompasses an employee’s skill that has been gathered on the job coupled with his/her education and personal experience. Tacit knowledge is the most valuable knowledge that an employee possesses, because it reflects all the secrets of how to do the job most effectively.

Job operation knowledge is an integration of explicit and tacit knowledge.

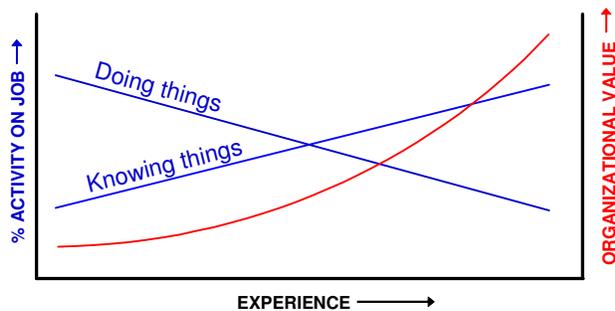
Value of Operational Knowledge

In organizations like Sandia, where the skills of most employees are intellectual rather than physical, operational knowledge is a key corporate asset that should be protected like equipment or classified data. In some cases, knowledge is protected as disclosed intellectual property and in some cases it is patented. However, most knowledge, especially the operational type, is harbored within the individuals who possess it and it must be harvested before they leave to prevent it from being lost. Drucker called workers who primarily work with their minds “knowledge workers,” which certainly describes the typical Sandian.⁶

Operational knowledge is what makes high-performing and experienced employees valuable because they not only use the knowledge to attract funding from sponsors and customers; they also create new knowledge and imbue it in others.

It seems intuitive that, as knowledge workers gain experience, they tend to know more and act less. Part of the reason is that they work efficiently. But another reason might be that more of their activity is a quiet, cerebral type, rather than physical. Contrast the energetic, inexperienced worker, fresh out of school and scurrying about a lab with the more experienced staff member

Figure 1. Purported Value of Knowledge Workers



who is sitting, reading, and contemplating. Although the inexperienced employee might be well educated and full of vigor, it is the experienced staff member who is called in to the meetings where serious decisions are to be made.

In sum, the experienced employees tend to be compensated more for what they know rather than what they do. Less experienced employees, who know less, are compensated more for what they do. Figure 1 represents

this intuitive postulate. The blue lines show the hypothesized percentage of activity for a knowledge worker as a function of experience.

The red line shows the hypothesized relative value of the knowledge worker to the organization as he or she gains experience and knowledge. I purport that the line is non-linear. As knowledge is gained in one area, it is integrated with knowledge gained in other areas and applied to a wide variety of problems; thus its cumulative effect over time is more than a simple linear summation. Instead, it has Gestalt characteristics.*

Adam Smith, over 250 years ago, opined profoundly on the general notion of the value of experienced people. He said, “An old man, provided his age is not so far advanced as to give suspicion of dotage, is every where more respected than a young man of equal rank, fortune, and abilities.” He added that “age is a plane and palpable quality which admits of no dispute.”⁷

It is the accumulated knowledge of the experienced employee that is valuable to an employer; and it is the fruit to be harvested before the person departs the organization.

According to Nobscot Corporation, a company specializing in organization retention management and metrics, the cost of replacing knowledge workers is about 33% of their burdened salary per year for the first year and declining amounts in subsequent years.⁸ Recently, the *Wall Street Journal* reported that J.C. Penney Corporation had concluded that “each employee who left Penney cost the company about a third of that employee’s wage. All told, for 2005, those departures added up to \$400M...”⁹

* Definition derived from Gestalt psychology, in which a configuration or pattern of elements is so unified as a whole that it cannot be described merely as a sum of its parts.

Much of the costs for replacing existing employees is in bringing the replacement employee up to near the level of competency, productivity, and knowledge of his/her predecessor. In a large, modern U.S. corporation this cost might range up to \$100K for the first year and perhaps half to a quarter of that amount for the following year. This might at first blush seem extraordinarily high; but after even a brief consideration of how much collective effort is required to break in a new employee, these estimates seem quite reasonable.

A more direct measure of the value of operational knowledge is to compute the present value of a revenue stream that a knowledge worker produces. In some cases this can be directly measured (e.g., an individual who is successfully building new programs). In other cases, it might be indirectly measured (e.g., an individual whose technical expertise is demanded by a sponsor who routinely pays for the talent).

The Situation in the Center

This KCM project is being undertaken to address a perceived problem (or potential one) in the Center. The concern is that a significant percentage of employees are retirement-eligible. As these people grow and mature, they are more valuable; but they are also more inclined to retire. It is a phenomenon of the proverbial “baby boomer” generation, the various social and economic effects of which have rippled through the society and economy over the past six decades.

If these retirements occur in a cluster, which could be spurred by national economic trends or by laboratory conditions, the sudden loss of knowledge could be significant. Normal attrition, those people who separate from the Center for other reasons (i.e., lateral to a new job, leave Sandia, die, etc.), could only exacerbate the situation.

Just how serious is the potential problem in the Center? Table 1 shows some statistical information. These data were provided by 6000's Human Resources (HR) Consultant, who has access to organization historical data from Human Resources.

Before I launch into interpretations, let me explain what is in the table. The data represent all employees. We were not able to separate the data into job types, but HR's best guess is that about 66% are nonrepresented, professional employees.

The description of the data in most of the columns is clear, based on the headings. However, some contain subtleties or computations that require some explanation.

The column labeled *Total on Roll* represents the Center's actual population, except for 2007, which is estimated to be equal to the 2006 level.

The *Retirement-Eligible* columns (one the number of employees, the other the percentage of the total number of employees) reflects the number of employees in the center who are, or will be, eligible for retirement at the end of the associated FY noted in the first column. For FY06 and FY07, the estimates are based on the assumption that the population is stable. However, based on the average number of retirements in previous years, these numbers might be inflated, because as some of these people retire the total number of retirement eligible people is reduced.

Table 1. Center Demographic Information

FY	Total on Roll	Retirement Eligible	Retirement Eligible	Estimated Eligible	Estimated Eligible	Actual Retired	Actual Retired	Sandia Separated	Internal Transfer	Total Departed	% Total Departed
2001	217	No data	No data	N/A	N/A	2	1%	1	21	24	11%
2002	129	No data	No data	N/A	N/A	6	5%	1	10	17	13%
2003	126	No data	No data	N/A	N/A	7	6%	2	9	18	14%
2004	118	No data	No data	N/A	N/A	8	7%	2	10	20	17%
2005	193	38	20%	N/A	N/A	5	3%	0	14	19	10%
2006	190	40	21%	32	17%	N/A	N/A	N/A	N/A	N/A	N/A
2007	190	43	23%	35	19%	N/A	N/A	N/A	N/A	N/A	N/A
Annual Average	166					6		1	13	20	12%

I account for this in the columns labeled *Estimated Eligible* (again, one the number of employees and the other the percentage of the total number of employees). These data are estimates of how many would be eligible after an average number of retirees actually left.

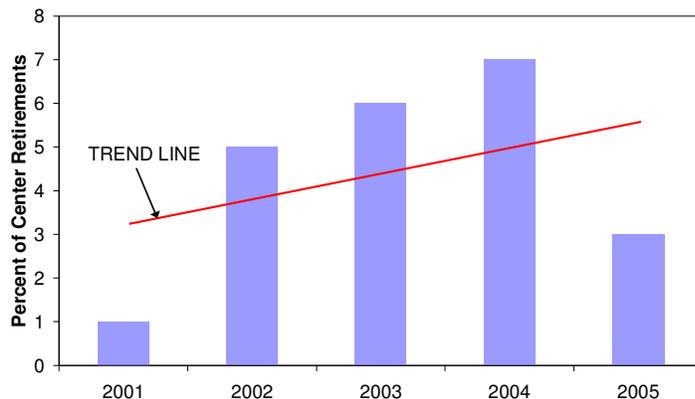
I computed these estimates by taking the average percentage of retirements in years 2001 through 2005 (from *Actual Retired*). Then, for 2006 and 2007, I multiplied that average percentage by the total on roll in the center and then subtracted that product from the average number of retirement-eligible in each of the years 2006 and 2007. The results suggest that about 18% of the center will still be retirement-eligible in 2006 and 2007, even after an average number have retired.

Separations are divided into two columns; *Sandia Separated* shows the number of people in the Center who left Sandia and *Internal Transfer* reflects the people who separated from the Center to take another job at Sandia.

Annual Average data are presented in the bottom row for some of the columns. The values are rounded to the nearest whole number because most of the data represent people, and fractions of people do not exist.

I examined some trends that might be lurking in the data, especially regarding retirees. I plotted the data from a trend line with a slope around 0.6, which suggest that the percentage of retirements might grow by about 0.6 percentage points per year (see Figure 2).

Figure 2. Retirees as a Percentage of Center Population



However, the data are quite limited and the trend is not overwhelming, with the fifth year falling far off the pace of the previous four.

Moreover, it is likely that the percentage of retirements will soon stabilize and eventually start falling as the “boomers” retire and are replaced by less-experienced workers.

For the next five to six years, it is probably reasonable to plan for a steady exodus of retirees at a rate of approximately 5% of the center’s population, followed by a slow decline in subsequent years. After about a dozen years, the last of the “boomers” will be set for their exit and the retirement trend will be in full recession, leading to eventual stabilization at relatively low levels.

I drew two significant conclusions from the data in the table: First, the 18% of the Center that is, or will be, retirement-eligible reflects a large amount of knowledge that could be potentially lost on short notice. Second, the normal annual turnover of around 20 people or 12% of the Center routinely represents a large amount of knowledge that is potentially lost.

I examined the potential costs for knowledge losses and what the future impact might be if a retirement trend similar to the one discussed above were actually to occur. Since I did not have specific salary band data for the people who actually departed from the center, I used the guidance provided by Nobscot Corporation.[†]

Table 2 shows a hypothetical case that demonstrates how the costs of knowledge worker departures can propagate through the years. The data might be typical for a modern, large U.S. technology company.

The columns represent departures. The rows represent the years, 12 in all.

In this example, I assumed that the knowledge workers would initially depart in groups of six (five retirees and one separation), recurring for a period of five years. Then, a group of five would depart, with recurrence at four years. A group of four would depart for the next two years, followed by the last year in the model, in which three would depart.

Table 2. Example of Cost Propagation for Replacing Departed Knowledge Workers (\$1000)

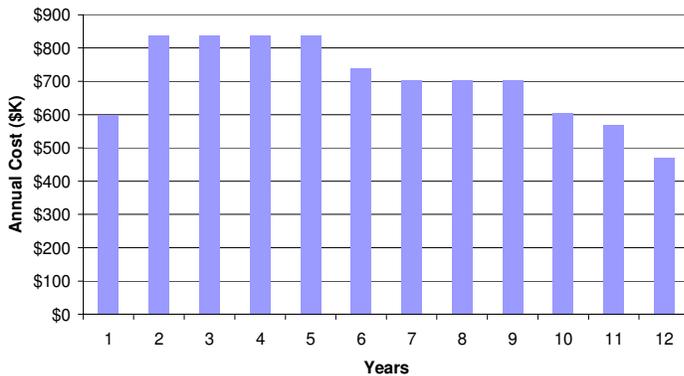
YEAR	Depart	Sub Totl	Total													
1	\$100	\$100	\$100	\$100	\$100	\$100									\$600	\$600
C/O 1	\$34	\$34	\$34	\$34	\$34	\$34									\$204	\$838
2	\$34	\$100	\$100	\$100	\$100	\$100	\$100								\$634	\$838
C/O 2		\$34	\$34	\$34	\$34	\$34	\$34								\$204	\$838
3		\$34	\$100	\$100	\$100	\$100	\$100	\$100							\$634	\$838
C/O 3			\$34	\$34	\$34	\$34	\$34	\$34							\$204	\$838
4			\$34	\$100	\$100	\$100	\$100	\$100	\$100						\$634	\$838
C/O 4				\$34	\$34	\$34	\$34	\$34	\$34						\$204	\$838
5				\$34	\$100	\$100	\$100	\$100	\$100	\$100					\$634	\$838
C/O 5					\$34	\$34	\$34	\$34	\$34	\$34					\$204	\$738
6					\$34	\$100	\$100	\$100	\$100	\$100					\$534	\$704
C/O 6						\$34	\$34	\$34	\$34	\$34					\$170	\$704
7						\$34	\$100	\$100	\$100	\$100	\$100				\$534	\$704
C/O 7							\$34	\$34	\$34	\$34	\$34				\$170	\$704
8							\$34	\$100	\$100	\$100	\$100	\$100			\$534	\$704
C/O 8								\$34	\$34	\$34	\$34	\$34			\$170	\$704
9								\$34	\$100	\$100	\$100	\$100	\$100		\$534	\$604
C/O 9									\$34	\$34	\$34	\$34	\$34		\$170	\$604
10									\$34	\$100	\$100	\$100	\$100		\$434	\$570
C/O 10										\$34	\$34	\$34	\$34		\$136	\$570
11										\$34	\$100	\$100	\$100	\$100	\$434	\$470
C/O 11											\$34	\$34	\$34	\$34	\$136	\$470
12											\$34	\$100	\$100	\$100	\$334	\$470

[†] Assumptions: For each departed employee assume first year replacement costs of \$100K, second year \$34K.

This sequence is reasonable under the assumption that separating employees would exit at a fixed rate, but that the number of retirements would slowly begin to reduce as the “boomers” exit the organization.

In the first row of the table, the year’s cost is noted along with the carryover from the previous year. For example, “C/O 1” is the amount of additional expense for the replacement workers in year one. Thus, for every group of departures, there are two rows of costs, the carryover from previous year (blue) and the costs for the current year (yellow).

Figure 3. Cost Propagation for Departed Employees



The two columns on far right are the summation of costs for each year. The subtotal represents the costs for the current year and the carryover costs from the previous year. The last column, the total annual costs, is presented in graphical form in Figure 3. As evidenced, the projected annual replacement costs are substantial, over \$800K/year with propagation into future years. Note also that this example shows the costs beginning to decline in Year 8; and that will be true if departures

decline, as in this example. Obviously, a more extended departure sequence would force the replacement costs out much further.

Some cautions are advised in drawing conclusions out of the data. First, this is an example only and is intended to show how knowledge worker replacement costs propagate. It is not necessarily intended to project the costs for employee replacements in Center 6200; but it could be an indicator. The number of departures assumed in the example is smaller than those we have observed historically in the Center.

I believe it is apparent that the potential costs for replacing workers in the Center are sufficiently high to warrant a proportionally sized Knowledge Management program.

PART II. THE THEORY OF KNOWLEDGE CONTINUITY MANAGEMENT

Knowledge Continuity Management (KCM) is a subset of Knowledge Management (KM) and is a relatively new field of study. KM concerns capturing and sharing valuable expertise and experience to workers performing similar jobs in a company. KCM focuses on ensuring that critical knowledge passes from exiting employees to their replacements.

Anne Field, a writer for *Harvard Management Communication Letter*, recently wrote:¹⁰

“Without adequate knowledge continuity between employee generations, organizational ‘forgetting’ drains intellectual capital and squanders the knowledge asset,’ says Hamilton Beazley, chairman of the Strategic Leadership Group in Arlington, Va., and formerly a professor of organizational sciences at George Washington University. Companies need to have effective methods for transferring employee know-how. That’s where the concept of knowledge continuity management comes into play.”

The Basic Steps to Knowledge Continuity Management

Beazley, et al., has developed the basic theory of KCM. He espouses six critical steps:¹¹

- 1) Create a KCM assessment to determine the state of existing knowledge continuity.
- 2) Determine objectives and scope of the KCM program.
- 3) Establish management and coordination responsibility for implementing the KCM program.
- 4) Plan the KCM activities and prepare a budget.
- 5) Create methods to harvest, catalog, and transfer critical operational knowledge.
- 6) Transfer the knowledge as needed.

Each step is explained below.

Step 1. Create a KCM assessment.

Essentially, a knowledge assessment identifies the critical tufts, pools, and harbors of knowledge in the organization. What is needed is to determine what critical knowledge exists throughout the organization. In organizations with a large portion of knowledge workers, such as Sandia, most of the knowledge resides within the workers themselves, with only a portion recorded (if any). That is, most of the critical knowledge is tacit rather than explicit.

The ten objectives of the KCM assessment include:

- Developing the business case for KCM by providing evidence of knowledge discontinuities and their costs.
- Identifying knowledge that is critical to the organization, especially as it relates to core competencies.

- Assessing how well employees analyze their knowledge in relation to their jobs and performance.
- Identifying specific job classifications that are critical to the organization and determining the extent to which knowledge is critical to each classification.
- Ordering by rank each job classification according to the amount of knowledge discontinuities and criticality. The highest level of discontinuity and organizational criticality would have the highest rank for action within the KCM plan.
- Identifying how knowledge continuity is handled now and how effective it is.
- Identifying where KCM can be integrated with existing knowledge or continuity management activities.
- Identifying existing information management capabilities that can be adapted to KCM.
- Determining metrics for progress and success of KCM.
- Determining what cultural hurdles and obstacles need to be circumvented or altered for success.

The seven activities to conduct the KCM assessment include:

- Calculate turnover statistics by job classification.
- Calculate retirement eligibility statistics by job classification.
- Determine which job classifications warrant participation in the KCM program.
- Determine the existing level of continuity between incumbent and successor.
- Generate a knowledge-loss damage assessment.
- Identify links between KCM and existing knowledge management systems.
- Assess how the organizational culture values knowledge sharing.

Step 2. Determine objectives and scope.

Beazley recommends that the KCM management team members agree on an objective. Here is a typical one:

The mission is to make KCM an integral part of managing this company and to insure that it serves primarily to preserve critical operational knowledge.

The scope refers to these four factors:

Factor 1: *Breadth*—How many workers will be involved.

Factor 2: *Depth*—How much information will be harvested and transferred.

Factor 3: *Technological sophistication*—The extent to which the process will be automated as well as the extent of using special tools to harvest the knowledge, assure its quality, organize its storage and retrieval, and operate the mechanisms and transfer it.

Factor 4: *Support*—The level of management support for KCM in the organization.

While addressing these four factors, the business case for KCM should be articulated. This is basically the justification for the program by showing the costs of lost knowledge versus the cost of the KCM program, and then showing the net benefit.

Step 3. Establish management and coordination responsibility for implementing the KCM program.

In order for the KCM to be effective, it must be institutionalized. Essentially, it must become part of the normal operational features of the organization.

After that, someone must be primarily responsible to ensure that it continues to be used and to implement changes in the program as lessons are learned. The amount of time allocated to the KCM coordinator depends on the depth and breadth of the program. Most likely, the coordinator will initially spend a lot more time at the job than later, after the program matures and the changes become less frequent.

Beazley contends that KCM is a management responsibility and, therefore, requires management involvement. Unlike quality improvement, which is a goal for all employees, KCM is a process. It is more likely, therefore, for there to be a KCM officer just like there is a financial or security officer in a company. Support staff is assigned to the KCM project consistent with the business needs and the depth/breadth of the program. In other words, the KCM manager's job is tailored to the application.

Step 4. Plan the KCM activities and prepare a budget.

In this step, the need is established, a coalition is formed, a company vision is developed, and the vision is communicated to the organizational members. Some restructuring might be required; but, as much as possible, it should be integrated into the existing constitution.

Depending on the size of the KCM program and the extent of the organizational change required to implement it, a more formal approach might be needed. Kotter, in his book *Leading Change*, presents a comprehensive outline for managing organizational change.¹²

Step 5. Create methods to harvest, catalog, and transfer critical operational knowledge.

This step is where the details of the plan are developed. It is essentially the blueprint for the KCM structure, with details about how to gather the knowledge, organize it, store it, retrieve it, and transfer it to successor personnel.

In this step, a *knowledge profile* (K-Pro) is developed for each job type whose incumbent's knowledge is to be captured. A K-Pro is a basic description of the job type and the kind of knowledge required by a successful employee. The K-Pro starts out as a set of questions, but ends up with answers, which are the harvested knowledge for that job.

A *knowledge profile analysis question set* (K-Quest) contains the set of questions that, when answered, would capture the essential, critical operational knowledge for a job. The main objective of the K-Quest is to harvest a comprehensive base of operational knowledge that can be captured in the K-Pro and be available for transfer to a succeeding worker.

Beazley and his team provide the following guiding principles in developing the K-Pro and K-Quest.

Principle 1: K-Pro should contain only critical operational knowledge. “Critical” is defined as knowledge that (a) is essential to effective performance, (b) would make a difference in organizational productivity or quality, and (c) would have a negative impact on the organization if it were missing.

Principle 2: The K-Pro and K-Quest are essential to capturing knowledge. Existing knowledge workers need the structure of a formal harvesting process to extract the critical knowledge that they possess. Most high-performing knowledge workers are hardly aware that the critical skills they have used routinely for years and apply with great skill and ease are worthy of note to a second party.

Principle 3: The knowledge worker’s working arrangement affects the K-Pros. A full-time worker who primarily works on site and is highly interactive with others will have a different K-Pro than one who works part-time, primarily from his/her home. Harvesting the information from each will require different questions.

Principle 4: K-Pros could be used to identify knowledge holes, weaknesses, and threats as well as hidden strengths and potential opportunities.

Principle 5: The decision to apply a K-Pro to a job should be based primarily on the value of that job to the organization.

Principle 6: K-Pros should be easy to understand by both incumbent and successor.

Principle 7: Access to some portions of a K-Pro should be restricted and protected.

Outlined below is a list of some of the contents of the K-Pro:

- Operating data, including key information, reference data, information sources, etc.
- Basic operating knowledge, including primary job functions, reporting lines, primary job responsibilities, etc.
- Key operating knowledge, including current issues, hibernating issues, tabled issues, key customers, potential customers, etc.
- Background operational knowledge, including knowledge network, skill sets, unexplored ideas, performance evaluations, etc.

Depending on the exact job, the K-Quest would be developed by selecting the appropriate set of questions for a departing employee. The employee should make an attempt to answer independently the questions on the K-Quest. The results could be reviewed and, if more information is needed, an interview could be arranged, probably conducted by the cognizant manager or the KCM administrator. At the completion of the application, the information from the K-Quest and the interview is consolidated into the K-Pro.

Beazley offers the following guiding principles in developing the K-Quest.

Principle 1: K-Quest should be tailored to each job.

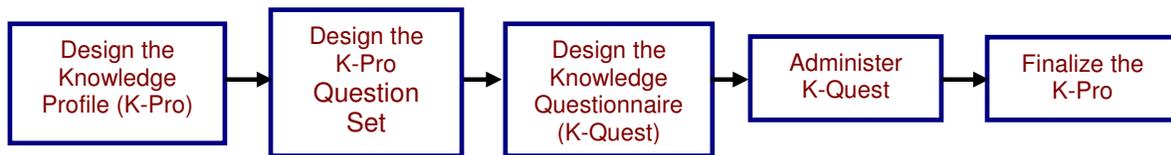
Principle 2: K-Pro questions that address knowledge requirements and usage should be included in the K-Quest.

Principle 3: Provide clear guidance on completing the K-Quest to ensure consistency in the information that is harvested.

Principle 4: Use all the tools available to help expedite the application of K-Quest.

Figure 4 is a flow diagram outlining this process.

Figure 4. Flow Diagram Outlining the Process for Developing the K-Pro



Once the K-Pro is developed, it should be cataloged and stored for future use. It should be updated as new information is gathered and lessons are learned. It probably should be protected, as it might contain sensitive information.

Step 6. Transfer the operational knowledge.

This step is the culmination of all the previous steps and is where the knowledge is actually turned over to an incoming employee.

In summary, after the K-Quest has been administered and the K-Pro has been developed, these conditions exist.

- Operational knowledge has been harvested (primarily through the K-Quest).
- Operational knowledge is recorded in the K-Pro.
- Knowledge transfer can occur by presenting the information in the K-Pro to the new employee.

All three of these elements must be operating for knowledge transfer to effectively take place.

Guidance for Implementing the Knowledge Continuity Management Program

In considering knowledge transfer, there are two important precepts.

- 1) People most readily share knowledge in an atmosphere of trust, and
- 2) People are likely to share their most critical knowledge when they believe that they will be rewarded for it. This implies that the KCM program should budget for some extrinsic rewards for those who agree to share their knowledge.

When new employees come into the organization they bring knowledge with them from their previous experiences. What they lack is experience and operational knowledge of the specifics of the new job. What they need and what is advantageous to the organization is for them to

acquire this critical operational knowledge quickly, so that they might begin to assimilate their knowledge with that of their predecessors and become expeditiously productive.

When knowledge transfer begins, both tacit and explicit knowledge are conveyed. The primary vehicle for the conveyance is the K-Pro. An existing employee (probably the manager), acting as the host, would introduce the new hire to the K-Pro as part of the new-hire orientation. The host essentially guides the new employee into the organization, first supplying explicit information and then helping to understand and interpret tacit information that is in the K-Pro.

Hosting is almost essential to help the new hire feel comfortable and encourage the learning process. But *phased mentoring* is most effective in transferring knowledge, especially where the departing (or departed) employee works directly with his/her replacement.

Initially, there is much interaction between the mentor and the mentored; but, eventually, the new hire begins to operate independently and the mentor fully departs. If possible, the mentoring should occur before the incumbent leaves the organization, but it can also be accomplished by bringing the departed employee back for mentor consulting.

PART III. A PLAN TO IMPLEMENT KNOWLEDGE CONTINUITY MANAGEMENT IN CENTER 6200

After thinking about the guidance that Beazley and others have provided for developing and implementing a KCM program, and considering the practical limits of manpower and money, I have selected a subset of the KCM theory that would be effective in transferring knowledge from departing to incoming workers and that can be practically implemented in the Center.

Detailed below is a description of the KCM elements that I selected for the Center's plan, along with my rationale for their inclusion. After that, I discuss how the plan will actually work. Finally, I have laid out the timeframe and budget for implementation and estimated the savings benefits to be reaped. I provide a suggestion on how to measure the program's effectiveness after it is implemented.

Here are the proposed KCM program elements:

- 1) Create a KCM team, secure resources for its operation, and obtain upper management buy-in for its activities.
- 2) Conduct a minimal KCM assessment.
- 3) Develop a KCM mission statement. Agree on simple, clear goals and objectives, and define fundamental metrics for determining success.
- 4) Develop K-Pros for the various critical job classifications, starting with the highest-priority ones.
- 5) Develop K-Quests for the K-Pros as required.
- 6) Develop a mentoring plan for separatees and new hires.
- 7) Develop a simple database for the information, specifically the K-Pros and K-Quests.
- 8) Document the KCM development and implementation as well as associated critical data, such as the K-Pros.

Each of these items bears some discussion so that the reader can understand better what is proposed and how much it will cost.

Program element 1, the *creation of the KCM team*, is essentially complete. The team consists of John Boyes, Donna Filip, Judy Jewell, and me. Center support funding has been allocated for the team to operate.

Program element 2, the *KCM assessment*, includes:

- a. developing a business case,
- b. identifying critical job classifications whose associated knowledge should be harvested,
- c. identifying and coordinating with other knowledge management or KCM activities in the organization, and
- d. identifying obstructions to KCM implementation and developing mitigating solutions.

This assessment is already under way and some results are emerging.

a) *The business case* was essentially laid out in Part I of this document. The Center is dominated by knowledge workers, many of whom are highly skilled and harbor valuable, even critical, knowledge that should be harvested before they depart.

b) *Critical job classifications* have been considered. Some jobs, such as the ES&H Coordinator, have excellent knowledge continuity from incumbent to successor because much of the knowledge is already documented because it is the nature of the job to be so. Other jobs, such as those involving professional support personnel (e.g., the Personnel Representative), have reasonably well-defined and documented explicit job definitions along with implicit ones, but many aspects of these jobs might be in the form of tacit knowledge.

Technical jobs, especially staff positions, are usually poorly defined because they are held by highly trained professionals who act with extraordinary autonomy, essentially carving and crafting the job to meet the ever-changing needs of sponsors and customers. These jobs are the ones that are occupied by incumbents who harbor the most critical operational knowledge but which have virtually no existing means or methods to convey this knowledge to a successor.

For the purpose of this program, critical jobs in the Center might include Management, Technical staff, Technician, and Professional Support. Within the management category, there are two classes—line and upper. I can imagine at least three kinds of technical staff classes—purely technical (including technical staff and technicians), project management, and program development.

Figure 5. Knowledge Jobs in Center

Technical Staff		
Purely Technical	Project & Program Management	Program Development
Technician		
Line Manager		
Professional Support Staff		

Support jobs fall into two classes. *Professionals* include financial analysts, ES&H coordinators, technical writers, and the like. The incumbents in these jobs typically are degreed professionals who provide direct support to the line personnel. *Other* support personnel include administrative/clerical support, such as secretaries and students.

All of these jobs provide varying degrees of value to the Center and should be candidates for the KCM program. A summary is provided in Figure 5. Note that technicians are broken out as a separate job type. No prioritization is implied in the layout.

Upper management jobs and related Administrative Assistant positions are not included in the list. Usually administrative assistant positions are filled with represented workers and their jobs are very well defined already. Upper management

jobs are few in number and very specialized, and I suspect that personnel within these job classes are carefully nurtured as they move up the ranks.

However, any job could be included in the program at the discretion of the manager and the Center director.

There are some *existing Knowledge Management programs* at Sandia. One is the Knowledge Preservation Project in Organization 2900, in which there is an effort to transfer “knowledge from one generation of ‘weaponeers’ to another through searchable video archives.” There is also a similar program within the Center, operating within the Knowledge Systems Design and Engineering (KSD&E) Department (6223).

Superficially, there appears to be minimal overlap between this KCM effort and the existing KM efforts. While the KM programs focus on knowledge management in general, the KCM program focuses specifically on knowledge continuity, the management of knowledge when employees leave.

However, after extensive discussions with the staff of the KSD&E department, it is clear that they have expertise to bring to this project, specifically:

- 1) Assist in managing the K-Pros by creating a special Web FileShare database that would be both secure and accessible to Center managers and other authorized users.
- 2) Assist the manager in developing the K-Quest.
- 3) Assist the manger in the follow-up interview with the departing employee and creating the K-Pro.

Additionally, the KSD&E department might be able to elicit fundamental organizational knowledge from the K-Pros that would be valuable to the Center as a whole.

I have investigated other possible KCM activities within Sandia. As far as I can see and based on web searches and discussion with people outside the Center, no KCM activity exists anywhere at Sandia.

Existing barriers to the KCM program apparently do not exist. I have sought counsel from the Sandia legal department about any potential problems with the program and the opinion is that, as long as the program is consistent with Sandia policies on discrimination and other employee-related items, there is nothing in the KCM program that is obviously problematic. A specific suggestion is to ensure that the program applies to all departing employees, not specific groups, such as retirees.

In the end, I believe the KCM plan will receive widespread acceptance because it sensibly addresses a problem that Sandia (and the rest of the world) faces—preventing a loss of a precious commodity. Additionally, it creates benefits to all of

the participants, and it might lead to the development of a broader knowledge database in the Center.

Program element 3, the *mission statement, goals and objectives, and metrics*, has also been considered. I propose a simple mission statement that states the fundamental objective:

“Our mission is to make KCM an integral part of managing this Center in order to preserve our critical operational knowledge.”

I propose a twofold objective. Our primary objective is to develop and institute a KCM program, even if it is rudimentary. A second one is to engage a large percentage of departing employees in the program and successfully transfer the harvested knowledge to their replacements. Specific objectives and metrics are described below.

Program elements 4 and 5, the *development of the K-Pros and K-Quests*, remain largely to be done, mainly because they are accomplished within the KCM program, which is yet to begin. However, I have begun thinking about what knowledge we might want to harvest for the K-Pro and what questions we might have to ask in the K-Quest to harvest that information. This information is contained in Appendix A.

Program element 6, a *mentoring program*, has already received a good deal of work. The KCM team has considered the various ways that mentoring can take place between an outgoing incumbent and an incoming replacement.

The most effective mentoring, of course, is to have the new hire work directly with the departing employee before he/she leaves the organization. (Sometimes this is called “shadowing.”) In some support jobs, shadowing will be possible because there exists overhead funding that can support two people concurrently in a job for a limited time. In most cases, especially line management and staff, funding is typically not available for such an arrangement.

Two conditions create a vacant position and require a replacement that might benefit from a mentoring relationship with the previous employee:

- a) an employee might move from full- to part-time status or
- b) an employee might separate or retire.

Appendix B contains detailed information about the various ways that a separatee or part-time employee might mentor. Specific details of how the technical consulting will be conducted will be developed by the manager on a case-specific basis.

Appendix C summarizes the internal process of converting a departed Sandian to a consultant. Appendix D discusses the financial aspects of bringing back departed employees as consultants to mentor their replacements. As can be seen, a mentoring

relationship between a returning consultant and his/her replacement is possible within a fixed budget.

Program element 7, the *creation of the database for the K-Pros*, has been considered only cursively. Initially, I expect that a very simple database will be used. The K-Pro and K-Quests can be stored in a specific, secure folder somewhere within the Center. The data will be contained in Microsoft Word files and a descriptive labeling scheme will be used to allow certain pieces of information to be retrieved by searching manually. Later, if the program grows and the data become extensive, then a more formal database might be constructed.

Each K-Pro should probably be designated as Official Use Only and protected from distribution. Some of the information might relate to personnel situations or other sensitive matter that should remain private between the manager and the departing employee. The manager might want to edit the sensitive information before providing it to the new employee, but the original data are probably best retained intact.

Program element 8, *documentation of the KCM development and implementation*, will be handled by the coordinator. This report will serve as the starting document. Daily entries into a notebook will serve to document day-to-day activities. At the end of each FY, the coordinator will prepare a report for the Center director outlining the activities throughout the year, including the costs and any significant events.

Summary of How the Program Will Work

The essential working description of the KCM program is outlined below.

- 1) The Center will institutionalize the KCM program by announcing it to all employees. The KSD&E Department (6223) will coordinate the effort with assistance from me, at least for the first six months. The KSD&E Department will ensure that the program remains operational, manage the K-Pros and other associated data, and assist the managers in developing K-Quests and K-Pros and interviewing the departees (if the manager requests assistance). Initially, the coordination might consume about 0.1 FTE. After the program is operational, the level of effort is expected to be between 0.05 and 0.1 FTE.
- 2) The plan will focus on those employees who are most critical to the organization and only those who have declared their intent to leave. Full-time, on-site staff augmentation contractors will be included, if possible, but will not be able to receive SPOT awards.
- 3) At the discretion of the manager, the departing employees will be invited to participate in the KCM program and will be rewarded with a SPOT for agreeing to do so. A proposed SPOT amount might be based on the longevity in the Center and the type of job. Participation will involve a commitment to complete the K-Quest, help the coordinator or manager develop (or update) the K-Pro, work with the manager to draft a job description, and advise on the selection of a replacement. Table 3 provides some suggestions on SPOT awards.

Table 3. Suggested SPOT Awards for KCM Participants

Years of Service in Center	If K-Pro Exists	If K-Pro Does Not Exist
<5	\$100	\$200
≥5 to <13	\$250	\$500
≥13 to <20	\$350	\$700
≥20	\$500	\$1000

Note that a smaller SPOT is awarded when a K-Pro is pre-existing, because there would be less work for the incumbent to update it versus creating a new one.

It is possible that a manager might not nominate a departing employee to participate in the program. In some cases, the departing employee might not have performed well and manager might be pleased to see him/her leave. In other cases, the employee might be leaving because he/she is upset or angry with the situation and the manager might conclude that his/her participation in the program might not be fruitful. In any case, these kinds of decisions are typical of those that managers make.

- 4) The primary responsibility for implementing the KCM processes and hosting the new hire will reside with the cognizant manager. The manager will work with the KCM coordinator in developing or updating the K-Pro, applying it to the new employee, and providing orientation to the new employee.[‡]
- 5) When appropriate, the departing employee will be invited to return to the organization to provide mentoring to his/her replacement. If the incumbent is moving to part-time status, mentoring a replacement would be a stipulation for approval for proceeding to part-time status. If the employee is moving to another job within Sandia, some limited matrixing might be arranged.

However, it is important that the departing employee understands that participation in the KCM program is no guarantee that a consulting agreement will be arranged immediately or at a later time. In some cases, there might be budgetary limits that would prohibit the employee's return to mentor the replacement. In other instances, a replacement might not be anticipated until a later date. Various other circumstances might also preclude a consulting agreement for the departee.

[‡] Most of this activity is already the manager's job. The manager should be motivated to participate in the KCM activities because it helps reduce the burden of bringing on new employees and eliciting productivity from them in minimal time.

Institutionalizing the KCM Program

To be successful, the KCM program must have management approval and support. Employees must understand that the Center management values knowledge, especially with respect to critical jobs at both staff and line management levels. Appointing a KCM coordinator who reports directly to the Center director is a key element, because it conveys the perceived importance of managing knowledge in an organization whose core mission involves knowledge.

It is difficult to persuade Sandians to participate in activities that they deem to be frivolous or wasteful. The endless proliferation of bureaucratic activities (e.g., training, stand-downs, mind-numbing ES&H requirements, quality programs, etc.) have driven the level of cynicism to all-time highs, especially among long-time staff, and is often a factor in an employees' decision to depart.

The SPOT awards provide an incentive to participate and send two positive messages. First, it says that the activity is important and worthy of an award to have the employee involved. Second, it flatters employees by telling them that their knowledge has real value.

The KSD&E Department will also provide professional management of the captured knowledge and assistance to the managers in harvesting knowledge from departees. It is possible that they might be able to use the captured knowledge to develop a broader knowledge database for the Center.

Proposed Implementation Schedule for the KCM Program

I believe that the program can be quickly and easily implemented. The majority of the work to comprehend the existing state of knowledge about KCM is already done. A basic KCM program has been developed for the Center based on some of the fundamental concepts that are essentially proven in industry, or at least rational and reasonable.

The following tasks are proposed to implement the KCM program. All tasks are expected to be implemented within six months.

- 1) Present the concept to the Center Leadership Team.
- 2) Appoint a temporary KCM technical coordinator.
- 3) Begin to advertise the concept to Center staff via web site and email from Center Director.
- 4) Present the program to Center staff at an all-hands meeting.
- 5) Amend the program as needed based on input from staff.
- 6) Finalize KCM program details.
- 7) Implement the program in the Center and operate as a pilot program for several months with the KSD&E Department and me coordinating the effort.
- 8) Permanently turn the KCM program over to the KSD&E Department and begin routine operation.

PART IV. COSTS AND BENEFITS RESULTING FROM THE KNOWLEDGE CONTINUITY MANAGEMENT PROGRAM IN CENTER 6200

The KCM program is fundamentally a reasonable process designed to save money and improve organizational efficiency. Implementing it in the Center is consistent with Sandia's prime contract, which states that:

*The Contractor shall...do all things necessary for, or incident to providing its best efforts so as to carry out in an efficient and effective manner all necessary and related services to manage and operate the Government-owned Sandia National Laboratories...*¹³

Estimating the cost of the KCM program requires some assumptions. In the analysis below, I assumed the following:

- The Center population is stable.
- About 20 people per year continue to depart for various reasons.
- Of the 20 who leave, 13 are assumed to be invited to participate in the KCM program.
- The average longevity of each departee is ten years.
- A coordinator would be assigned to manage the program and the level of effort would be about 0.07 FTE.
- The KCM project would be funded out of Center Support.
- In estimating the cost of lost knowledge, Table 2 is used as guidance and those costs are assumed to be comparable to Sandia's costs.
- The KCM program could cut these lost knowledge costs by half.

This last assumption bears some discussion.

Beazely and others are not clear on how much a program like this could actually reduce worker replacement costs. Some suggest that a very high percentage could be saved and others are more conservative, such as myself.

Part of the difficulty in this prediction is that the concept is relatively new and there are not a lot of data available. Furthermore, savings like these are extremely difficult to measure because there are no simple metrics that can be applied. However, it is a well-conceived program and if it is reasonably applied, seasoned managers could provide anecdotal evidence as to its efficacy. A 50% cost savings is probably a safe assumption for analysis and planning purposes.

Projected Annual Expenditures for the KCM Program

Cost of SPOT awards:	\$6.5K
Cost of Coordinator:	<u>\$20.0K</u>
<i>Total Projected Costs</i>	<i>\$26.5K</i>

Projected Annual Value of Lost Knowledge from Departing Workers

Table 2 suggests that the costs for replacement workers are around \$830K when six people leave an organization. That equates to about \$130K per person, per year.

The projected total cost of 13 knowledge workers leaving the Center each year would be \$130K times 13, or approximately \$1.7M.

Projected Benefits from the KCM Program

The KCM program would cut in half the annual loss of knowledge when 13 people leave the center, saving an estimated \$850K.

The exact cost savings for the out-years are difficult to estimate due to variables, such as the number of retirements; but a conservative estimate is that savings in this range could continue for at least five years.

The return on the annual investment for the KCM program, which costs a projected \$27K per year but yields around \$850K in savings, is an astonishing 3100% per year (three thousand, one hundred percent).

In addition, personnel in the Knowledge Systems Department believe that this activity could be used as the kernel of a Knowledge Management system in the department.

Verification of Cost Savings

Verifying the cost savings might be difficult because the savings are a result of not doing things that one might ordinarily have done. This is quite difficult to measure directly, especially since we do not know exactly what it currently costs the Center to replace departing employees. The estimates that have been used in the analysis are based on other studies.

However, it is prudent to assess in some manner whether the program is working. One way is to query the managers who have been involved in the program and ask their opinions about whether and how much time was saved by the processes that were provided. Seasoned managers, especially ones who have managed employee turnover, should be able to estimate how much time the KCM program might have saved.

I recommend that the KCM program coordinator interview the participating managers at the end of six and 12 months and report the findings to the Center director. Specifically, three questions should be asked:

- a) Was the program easy to use and effective?
- b) How much time and effort did it save?
- c) Are there any suggested improvements?

If the verbal reports are consistent with the expectations, one could assume that the costs are also consistent and that savings are being realized. Suggestions for improvement should always be fed back into the process and changes made accordingly.

SUMMARY AND RECOMMENDATIONS

A growing recognition exists in many organizations throughout the world that, when employees leave, they take with them valuable knowledge that is difficult and expensive to recreate. The situation is at its worst when highly experienced employees leave, typically through retirement, because they often not only harbor a great deal of knowledge but wisdom as well.

With the first of the “baby boomer” population now reaching retirement age, the concern is that over the next 10 years, while the “boomers” are retiring, significant amounts of knowledge and wisdom could be lost. It is not only sensible but good business practice to capture and catalog this knowledge before they leave.

Knowledge Continuity Management (KCM) is a field of science that has recently evolved to mitigate and help prevent this lost knowledge. Literature searches conducted by the Sandia library have produced nearly all of the available published literature on the subject of KCM. The KCM concept has been thoroughly studied.

Based on information, a logical subset of the KCM techniques has been selected for implementation in the Center. A plan has been developed that is rational, workable, and has natural incentives for all concerned parties. Therefore, if implemented, there should be little need for the Center to encourage participants. It is likely that the program will be self-sustaining.

Additionally, the KCM plan will utilize the expertise in knowledge management that exists in the Center’s Knowledge Systems Design and Engineering Department to help ensure success.

The plan is not expensive and will probably net savings of one million dollars per year. It can be implemented and fully operational within six months. The costs will be modest and affordable with Center Support funding. The return on the investment is in the order of thousands of percent.

APPENDIX A. SAMPLE QUESTIONS FOR THE KNOWLEDGE PROFILE (K-PRO)

Outlined below are the key questions that form the basis of the K-Pro for the jobs in the Center. These are a superset of the questions from which the K-Quest will be developed and applied to a specific job and departing incumbent. It is probably that some questions that are obviously needed for specific jobs might be missing. These should be freely added to the K-Quest.

The answers to these questions constitute the K-Pro for the job. This harvested knowledge in the K-Pro forms the basis of the information that is transferred to the new hire.

The profile is divided into three categories:

1. Critical Operational Information
2. Explicit Operating Knowledge
3. Tacit Operational Knowledge

Key Operational Information questions would address current sources of working information that is needed to do the job. Example questions include:

- What is your mission?
- What are your fundamental job requirements?
- What are your current performance goals and objectives on your Performance Management Form?
- Whom do you report to formally and informally? How do you report?
- Who reports to you? How do they report?
- Are there idiosyncrasies regarding the people to whom you report or who report to you?
- What do you typically do when you are on the job? Prioritize the duties and describe your time allocation on each.
- What key functions do you perform in order of importance?
- What technical data do you use for your job?
- Where do you get the data?
- What historical information is important to the job? Where are the sources?
- What kind of information do you currently get that is extremely valuable and where/how do you get it?
- What kind of information do you currently get that is not useful?
- What information are you passing on to others? How important is it? What is the typical form of the information transfer (i.e., reports, paper, presentations, etc.)?
- What information do you not have but would be desirable?
- What wastes your time?
- What have you found to be the best method to obtain the information you need?
- What external activities are you engaged in that generate useful data for you (i.e., committees, meetings, etc.)?

- How is your information stored (i.e., on computer, in files, etc.)? How can it be accessed? Do you have any classified data or information? Where is it?
- What/who is the best source for data and information to do your job?
- How important is teamwork in your job and how is it rewarded?

Explicit Operating Knowledge questions address the day-to-day activities relating to the job. Example questions include:

- What principal issues and/or projects (technical or administrative) are you currently dealing with?
- Why are they important? What are your objectives?
- Who are the critical players in these issues?
- What is your position relative to the issues?
- What is at stake in each issue/project? What is Sandia's position on each?
- What are your goals and deadlines in your projects?
- Who are your principal internal contacts, collaborators, colleagues, assistants?
- Who are your friends?
- Who are your antagonists?
- Whom or what do you turn to for information about the critical issues in your job?
- Are there any issues that are looming? What are they? Why are they important?
- Who are the main parties involved?
- What are your objectives relative to these issues?
- How do these issues fit into the current operational context?
- Describe the threats or opportunities that you can foresee.
- What kind of support are you going to need to address these issues, should they arise?
- What is your strategy for dealing with them?
- Who do you expect will be your allies and who are your antagonists?
- Who are your current customers? Describe them. Internal or external?
- Why are they important?
- Describe the customers and how you currently serve them.
- Describe your successes and failures with your customers.
- Who are your best customers? Why?
- Who are your problem customers? Why?
- Who serves you? Describe them. Internal or external?
- Why are they important?
- Describe the service they provide and how they provide it.
- Describe the successes and failures in the service provided.
- Whom do you get your best service from? Why?
- Whom do you have the most significant service problems with? Why?

Tacit Operating Knowledge questions address the knowledge that the incumbent has developed that has led to wisdom. This is knowledge that integrates existing information, couples it with historical information, and allows for thoughtful and wise decisions. Example questions include:

- Please provide some guidance on how to do this job most effectively and explain why the guidance is applicable.
- What have you found to be the most important skill sets to have for this job?
- What have you learned about effectively dealing with your superiors and your subordinates?
- How do you judge performance effectiveness for someone in your position?
- What do you believe are the most important skills to have for this job?
- What kind of training might be useful to manage this job?
- What were some of your big mistakes and what did you learn from them?
- What were some of your great successes and what came of them?
- Are you harboring any ideas that you feel have merit but have gone unexplored? If so, why and how could they be explored?
- What insight or advice can you offer about doing this job effectively?
- What are the most important factors or characteristics to succeed in this job?
- What are the most important factors or characteristics that might cause failure in the job?
- What other knowledge should be included in your Knowledge Profile?
- What advice can you provide to improve the KCM program?

APPENDIX B. HOW DEPARTING SANDIANS CAN BE USED AS MENTORS FOR THEIR REPLACEMENTS

Prepared by D. Menicucci

Outlined below are options for Sandians who are either separating from Sandia, retiring, or moving to part-time status and who wish to mentor their replacements on less than a full-time basis.

Option 1: Retire and return as *staff augmentation contractor*.

The retiree works for a Sandia staff augmentation contractor as a Contract Associate to Sandia for a specific job, in this case as a mentor for person or persons taking over his/her job. Sandia notifies the staff augmentation contractor of the need, and at the same time, the retiree negotiates a rate of pay with the contractor who in turn negotiates with Sandia.

Advantages:

- 1) Contractor can provide benefits to the Contract Associate which can include items such as savings, health insurance and vacation/holidays.[§]
- 2) Relatively easy process to implement with existing staff augmentation contractors.
- 3) Ninety-day break in service after retirement automatically waived if the Contract Associate works less than 250 hours per year for Sandia.^{**}
- 4) Normally, paid vacation and holidays accrue at rate proportional to the percentage of full-time hours worked for the staff augmentation contractor.^{††}
- 5) Can work a regular schedule (e.g., 12 hrs per week) or irregular schedule (e.g., one week on, two weeks off) as needed by Sandia.
- 6) Benefits might be waived or reduced in lieu of additional rate of pay, depending upon the HR policies of the contractor.
- 7) Does not count as a Sandia full-time equivalent (FTE) or on-roll person.
- 8) Contract Associate could serve other staff augmentation contractor customers (i.e., other than Sandia), thus increasing total income.

Disadvantages:

- 1) Rate of take-home pay to Contract Associates might be lower than previous Sandia salary or consultant fees due to contractor overhead and benefits.
- 2) Ninety-day break in service after retirement is enforced if Contract Associate works greater than 250 hours per year for Sandia.^{**}

[§] Staff augmentation contractors generally offer a benefit package that is comparable to Sandia's benefits. However, benefits are significantly reduced for part-time employees. It should also be noted that though benefits are reduced the multiplier charged to Sandia is not.

^{**} Normally any retired Sandian must wait for 90 days before he/she can serve Sandia as a paid contractor, either a consultant or indirectly as a subcontractor/employee to an existing Sandia contractor. It is often referred to as a "break in service." Vice president approval needed to waive requirement, but is rarely obtained.

^{††} If the Contract Associate works less than full time, then the vacation accrual is usually proportional to the fraction of full-time effort.

- 3) 800 hours is maximum number of working hours allowed by Contract Associate relative to Sandia tasks.^{‡‡}
- 4) Contract Associate cannot represent Sandia in any way.
- 5) Contract Associate cannot supervise Sandians or lead projects.
- 6) Can be terminated from Sandia assignment without cause and with no notice.
- 7) Can be used on an on-call, as-needed basis; no obligation to use the consultant.

Option 2: Retire and return as a *Sandia consultant*.

A Purchase Requisition is initiated by the involved organization specifying the Sandia retiree as the supplier of choice for the service. The retiree then negotiates a fee-for-service consulting contract with Sandia.

Advantages:

- 1) Consultant pay is generally determined as 40% above base compensation for last full year as active Sandia employee.
- 2) Ninety-day break in service after retirement can be waived if employee works less than 250 hours per year for Sandia.^{§§}
- 3) No third party between the consultant and Sandia.
- 4) Can work regular or irregular hours.
- 5) Compensated for expenses similar to a regular Sandia employee.
- 6) Does not count as a Sandia FTE or on-roll person.

Disadvantages:

- 1) No employee benefits, vacation accrual, or holiday pay.
- 2) 800 hours is maximum number of billable hours allowed by consultant at Sandia.^{‡‡}
- 3) Ninety-day break in service after retirement required.^{‡‡}
- 4) Cannot represent Sandia in any way.
- 5) Cannot supervise Sandians or lead projects.
- 6) Can be terminated without cause and with no notice.
- 7) Work is generally of a consultative nature rather than hands-on activity.^{***}

^{‡‡} Can be waived by Vice President, but this rarely occurs.

^{§§} Normally any retired Sandian must wait for 90 days before he/she can serve Sandia as a paid contractor, either a consultant or indirectly as a subcontractor/employee to an existing Sandia contractor. It is often referred to as a “break in service.” Vice president approval needed to waive requirement, but is rarely obtained.

^{***} There is an alternative. Procurement could place a Professional Services Agreement that allows individuals acting on their own behalf to provide independent, expert services of a technical or professional nature and which involves hands-on activity.

Option 3: Drop from full-time to *part-time Sandian*.

The Sandian does not retire but drops from full-time status to part-time status that allows more personal time similar to retirement (typically used to allow employee to phase into retirement).^{†††,‡‡‡}

Advantages:

- 1) Remains in essence a Sandian with appropriate rights and privileges.
- 2) Employee benefits are available but some are pro-rated depending upon number of hours worked, and premium shares go up at certain hour worked points.^{§§§}
- 3) Term of employment (service credit) is not affected by part-time employment. See note for further details.^{****}
- 4) Savings plan is virtually unaffected.^{†††}
- 5) Flexibility in initially choosing number of work hours per week. Changes possible following a formal re-approval process.
- 6) Vacation time accrues at rate proportional to percentage of FTE worked.
- 7) Vacation time taken in one-hour increments with management approval.
- 8) Holiday time accrues at rate proportional to percentage of FTE worked.
- 9) Can use carryover vacation.
- 10) Can use A500 (time off without pay) for up to 160 hours to create flexibility in schedule with management approval.
- 11) Work in excess of planned part-time hours is compensated at regular pay rate; hours in excess of 40 hours are compensated at overtime rate, as appropriate.
- 12) Approval for part-time status is made at department level.
- 13) Approval to return to full-time status made at department level.
- 14) Employee can choose to retire from part-time status as desired.^{‡‡‡‡}

Disadvantages:

- 1) Rigid weekly schedule; each week's timecard must account for all hours just like a regular, full-time Sandian's.
- 2) Employee benefits are available but some are pro-rated depending upon number of hours worked, and premium shares go up at certain points.^{§§§§}
- 3) Flextime cannot be earned or taken.

^{†††} CPR300.6.19 (Part-Time Employment), <http://www-irn.sandia.gov/hr/policies/Benefits/Time/parttime.htm>

^{‡‡‡} Sandia subject matter expert for part-time, Valerie Mascaranas, 844-5471, VAGRIEG@sandia.gov.

^{§§§} Note that full medical benefits are maintained for part-time status equal to or greater than 24 hours per week.

^{****} However, credit for pension calculation purposes is accrued in proportion to percentage of FTE worked.

Retirement age factor is based on age at time of retirement, regardless of part- or full-time status. Average monthly earnings are computed at the full-time, equivalent rate.

^{††††} It is affected in the sense that the percentage contribution allowed by age is equivalent to a full-time employee, but the amount would be smaller due to prorated salary.

^{‡‡‡‡} Computed pension benefits are not affected by part-time status. Compensation, even though it is at a part-time rate, is computed in the pension calculation as the equivalent full-time rate.

^{§§§§} For example, for part-time employees working less than 24 hours per week, employee contributions for health care insurance are higher.

- 4) Holiday time accruals that are short due to part-time proportioning are compensated with vacation time, analogous to how adjustments are done for people on 9/80 schedule.
- 5) Pay is reduced proportionally to a percentage of FTE worked.
- 6) Work in excess of planned part-time hours is not counted in vacation accrual.
- 7) Business needs might drive part-time approval decision-making by Sandia.

Option 4: No-Fee Agreement

Advantages:

- 1) Applicable for a separatee who wishes to return as a consultant after the 90-day break in service but wishes to maintain clearance, access to facilities, and contact with project activities.
- 2) Simple and easy to place; Procurement not involved.
- 3) Travel costs might be reimbursed using a Non-Employee Travel Voucher.

Disadvantages:

No-fee agreements do not allow for any compensation for an individual's time and effort.

APPENDIX C. PROCESS TO CONVERT SANDIAN TO EXTERNAL CONSULTANT UPON RETIREMENT

Prepared by 6000 HR Consultant

1. The manager completes a Purchase Requisition Worksheet (SF 6430-RDO (3/03)), a Statement of Work and a Sole Source Justification (SF 6430-SSJ (8/01)), and processes it through Oracle and writes a Memorandum of Justification and sends it to the buyer. (Albert Valdez, MS-0216, 845-0641, in Procurement is the point of contact for former employee contracts.)

Constraints:

- Consultant agreement is limited to 800 hours maximum per year (exceptions are rare).
- 90-day break in service is required, or first 90 days must be no-fee (complete SF 9521-NFA (12/02), No-Fee Agreement, if consulting is required during first 90 days).
- Employee can sign up with a Staff Aug contractor and start immediately if they plan to work less than 250 hours total over the next year. Staff Aug suppliers are listed at the following url: <http://www.sandia.gov/supplier/staffaug.htm>).

If there is a need to make an exception to the 90-day break in service, the above Memorandum of Justification must be written by the line Vice President to the Staffing Manager (Kate Rivera) outlining why. The memo must also be approved by the Human Resources Vice President (Kimberly Adams). This must then be sent to the Buyer.

If the retiree is returning for no fee, the Purchase Requisition, Statement of Work, and Memo of Justification do not need to be completed. However, the No-Fee Agreement is required along with the documents described in the following paragraphs.

2. The manager decides whether there is a need to keep the security clearance active. If yes, the manager completes the Contractor/Consultant Badge/Clearance Request form (SF 7643 CEC# (10/02)) and the Security Clearance Justification form (SF 7643-DOE# (5/02)). To keep the clearance active, this must be done before the retirement date (or, in Division 6000, you must contact Suzanne Weissman at 845-9331). If no clearance is required, only the Contractor/Consultant Badge/Clearance Request form must be completed.
3. The employee and manager complete all forms in the Separation Packet located at <http://www-irm.sandia.gov/HR/Staffing/seps.htm>:
 - On the form entitled “Security Termination Statement (DOE F 5631.29 (10/92)),” where it asks for the name and address of future employer, you should list Sandia Corporation. When delivering this Security Termination Statement to the Badge Office, include the forms referenced in paragraph 2 above so that the proper badge will be ready for the consultant to pick up in the Badge Office.
 - On the form entitled “Telephone and Calling Card Disposition Form (SA 1812-TD (3/01)),” the manager should note that the phone should be left active. The manager should also make a note that the employee will be returning as a consultant. Note that a separate form is required for each phone and/or calling card action.

4. Whether or not the former employee will continue to use the same computer, the property record will need to be revised. If a different computer will be used, contact CCHD, 845-2243, and arrangements can be made to save/transfer files to the new computer. Once the consultant agreement has begun, the former employee can get a Kerberos password assigned through WEBCARs (<https://workflow.sandia.gov/webcars/WebCars.html>), but this must be done by someone who already has a Kerberos password. If the former employee will need a Secure ID card or Entrust encryption software, the manager needs to contact Password Administration, 845-9986, for the latest guidelines.

APPENDIX D. COST ANALYSIS FOR MENTORS

This appendix shows the financial benefits to the center of bringing back departed employees on a part-time basis to mentor their replacements. The inputs are in the yellow cells and the computed values are in green. In this scenario, four senior staff depart and then return to work on a part-time, consulting basis. This particular analysis shows that four senior staff can depart,

Financial Analysis of Departed Employees Returning as Consultants

Prepared by D. Menicucci

Scenario:

Number of departed staff who return as consultants:	4	
Number of departed staff who remain as Sandians part time:	0	
Amount of consultant time on job:	750	hours per year
Amount of consultant time on job:	14.4	per week
Number of hours part timers work:	24	per week

Key:

input
computed

Assumptions:

Burden multiplier for full time and part time employees	3.1
Burden multiplier for consultants	1.6
Total working hours for an FTE	2080

Current Situation:

Average take home pay for staff working full time:	\$54	per hour	Note: Average close to labor band 20
Average cost to Sandia for staff working full time:	\$166	per hour	
Total cost to Sandia for departed staff working full time (base FTE):	\$344,822	per year	
Total cost to Sandia for all departed staff, full time (loaded FTE):	\$1,379,290	per year	

Proposed situation:

Average take home pay for consultants:	\$80	per hour
Average annual take home pay for consultants:	\$60,000	per year
Average cost to Sandia for consultants:	\$128	per hour
Average annual cost to Sandia for consultants:	\$96,000	per year
Total cost to Sandia for consultants:	\$384,000	per year
Total cost to Sandia for part timers:	\$0	per year
Total cost to Sandia for consultants and part timers:	\$384,000	

Net savings to Sandia from change in departed staff status:

\$995,290 per year

Average take home pay for younger staff working full time:	\$39	per hour	Note: Average close to labor band 18
Cost to Sandia for younger staff working full time:	\$120	per hour	
Average annual cost for younger staff working full time:	\$249,038	per year	

Number younger staff capable of being hired using net savings:

4.0

Number younger staffs actually hired:

4

Total Net savings to Sandia:

-\$864 per year

		Options for 4 departing; all are consultants			
		Consultant hours per year			
		400	600	800	
consulting \$/hr	\$60	Hire 4 Save \$230K	Hire 4 Save \$153K	Hire 4 Save \$76K	
	\$70	Hire 4 Save \$204K	Hire 4 Save \$114K	Hire 4 Save \$25K	
	\$80	Hire 4 Save \$178K	Hire 4 Save \$76K	Hire 3 Save \$223K	

		Options for 4 departing; 3 consult, 1 part time			
		Consultant hours per year			
		400	600	800	
consulting \$/hr	\$60	Hire 4 Save \$61K	Hire 4 Save \$3K	Hire 3 Save \$194K	
	\$70	Hire 4 Save \$42K	Hire 3 Save \$224K	Hire 3 Save \$156K	
	\$80	Hire 4 Save \$23K	Hire 3 Save \$194K	Hire 3 Save \$118K	

		Options for 4 departing; 2 consult, 2 part time			
		Consultant hours per year			
		400	600	800	
consulting \$/hr	\$60	Hire 3 Save \$141K	Hire 3 Save \$103K	Hire 3 Save \$65K	
	\$70	Hire 3 Save \$129K	Hire 3 Save \$84K	Hire 3 Save \$39K	
	\$80	Hire 3 Save \$116K	Hire 3 Save \$65K	Hire 3 Save \$14K	

four mid-level replacements can be hired to replace them, and the center essentially breaks even in the exchange.

The boxes at the bottom show various scenarios with different assumptions. The general conclusion is that this approach is very feasible.

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