THE DEVELOPMENT OF AN ES&H COMPLIANCE ACTION PLAN USING MANAGEMENT OVERSIGHT, RISK TREE ANALYSIS AND FUNCTION ANALYSIS SYSTEM TECHNIQUE

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Jim Wixson CVS, is an Engineer Specialist for EG&G Idaho, Inc., a prime contractor for the Department of Energy's Idaho National Engineering Laboratory in Idaho Falls, Idaho. He is a graduate of the Univ. of Utah (1977) with a BSIE and has an MBA from the Univ. of Phoenix (1986). He is a Certified Manufacturing Engineer. His contributions of linking classical root cause analysis techniques with Value Management methodologies played a key role in development of the INEL Corrective Action Plan in response to a DOE-HQ Tiger Team Audit in the Summer of 1991.

Jim has over 15 years experience in Industrial and Manufacturing Engineering, Facilities Engineering, Pricing and Contracts, and Design-to-Cost with various commercial and DOD contractors. He authored, or co-authored papers for the 1987 and 1991 SAVE Conference Proceedings.

ABSTRACT

This paper deals with how a multi-disciplined team of Department of Energy and contractor personnel used Management, Oversight and Risk Tree (MORT) based root cause analysis to determine the root causes and causal factors of numerous Environmental, Safety, and Health (ES&H) findings identified by a DOE-HQ Tiger Team Audit of (ES&H) compliance at the Idaho National Engineering Laboratory (INEL). Value Management (VM) techniques, in particular Functional Analysis System Technique (FAST) Modeling, were then used to created a framework for a comprehensive compliance action plan (CAP) to address the key findings, management findings and root causes identified by the Tiger Team and to help develop solutions to these findings.

INTRODUCTION

In June 1989, Secretary of Energy James D. Watkins announced a 10-point Initiative to strengthen safety, environmental protection, and health activities at DOE's production, research, and testing facilities. In support of the 10-Point Initiative, the Secretary established independent "Tiger Teams" to conduct environmental compliance assessments at DOE facilities. The assessments are on-site, independent reviews of DOE environment, safety, and health programs (ES&H) to ensure compliance with applicable Federal, state, and local regulations; permit requirements; agreements, orders and consent decrees; and DOE Orders. In addition, the Tiger Teams assess DOE operations for conformance with applicable "best" and "accepted" industry practices and the adequacy of DOE and site contractor management programs.

During the spring of 1991, the INEL prepared for a site-wide Department of Energy audit of ES&H practices. The audit began on June 17, 1991 and lasted through August 2, 1991. The audit was conducted by a DOE-HQ Tiger Team consisting of over 150 professionals in ES&H disciplines.

A Tiger Team Assessment was conducted at the Idaho National Engineering Laboratory between June 17 and August 2, 1991. The assessment was conducted by approximately 150 specialists from a range of DOE offices and subcontractor organizations. The Tiger Team found INEL operations to be basically safe and environmentally sound. However, a significant number of procedural and documentation deficiencies and management issues were identified that required attention and corrective action to achieve the goals of excellence in ES&H programs desired by the DOE. Of 1491 total findings, 101 were environmental findings, 619 safety and health concerns, and 24 management and organization findings. Additionally, there were 17 findings specifically aimed at the INEL self-assessment program, and 46 summary findings identified as key findings by the Tiger Team. Also, there were 684 OSHA findings.[i]

Prior to the Tiger Team Audit, in the spring of 1991, the INEL Action Plan Task Force led by the DOE, Idaho Field Office and staffed by INEL contractor representatives and consultants was convened to perform a systematic evaluation of primary root causes and associated findings from a previous MESH audit conducted the year before and various contractor self-assessments in preparation for the Tiger Team audit. The INEL self-assessments augmented findings and action plans developed in the MESH review. However, little emphasis was placed on identifying and resolving the root cause of these problems.

From past Tiger Team Audits, the scope of the upcoming task seemed enormous. The averages were that the Tiger Team Report would be from between 600 - 700 pages with the corresponding corrective action plan being from 2,000 to 3,000 pages and worth around $2.0 Billion. The INEL team was very concerned about this in that no other DOE Laboratory was as complex as the INEL, nor had any other laboratory developed a methodology for taking an anticipatory approach to the development of the compliance action plan prior to a Tiger Team Audit.

The basic approach used by this interdisciplinary team was focused on the identification of systemic problems at the INEL through the correlation of deficiencies identified by MORT root cause analysis of the findings and the use of FAST modeling to facilitate the development of over-arching, or "umbrella" action plans to address these problems. The reason for this approach was to create a framework that would a) anticipate the Tiger Team key findings and root causes to identify deficiencies that could be addressed in advance of the Tiger Team audit; b) evaluate actions that were already in place that addressed known deficiencies; and c) identify potential actions which could be put in place to address newly identified deficiencies.

ROOT CAUSE ANALYSIS METHODOLOGY

John Dewey once said, "A problem well-defined is half solved."[2]

Several methods of root cause analysis were reviewed. Among these were "Cause and Effect" diagrams, Kepner-Tregoe Problem and Decision Analysis and several variations of fault tree analysis, in particular MORT analysis. The primary objective of any root cause analysis method is to identify the underlying cause of a deficiency, or set of deficiencies and to clearly define the problem, or problems at hand.

Root cause analysis is any methodology which enables a person to identify less than adequate elements in the control of a system which did, or could lead to losses of any nature.

Regardless of the methodology used in root cause analysis, it should be used not only for accident investigation in a reactive mode (correcting what is already broken) but in an anticipatory mode to prevent future occurrences.[ii]

Figure 1 is an illustration of the "MORT Based Root Cause Analysis Form" which was used initially to develop root causes for the MESH and Self-Assessment Findings.[iii] The way this form is used is to list each finding/ concern in the left hand column, then mark as many causal factors that apply to each

finding, or concern. The result will show groupings of particular causal factors that apply to the specific set of findings. This form may be completed by an individual, or a small group by consensus. The INEL team chose the consensus approach.

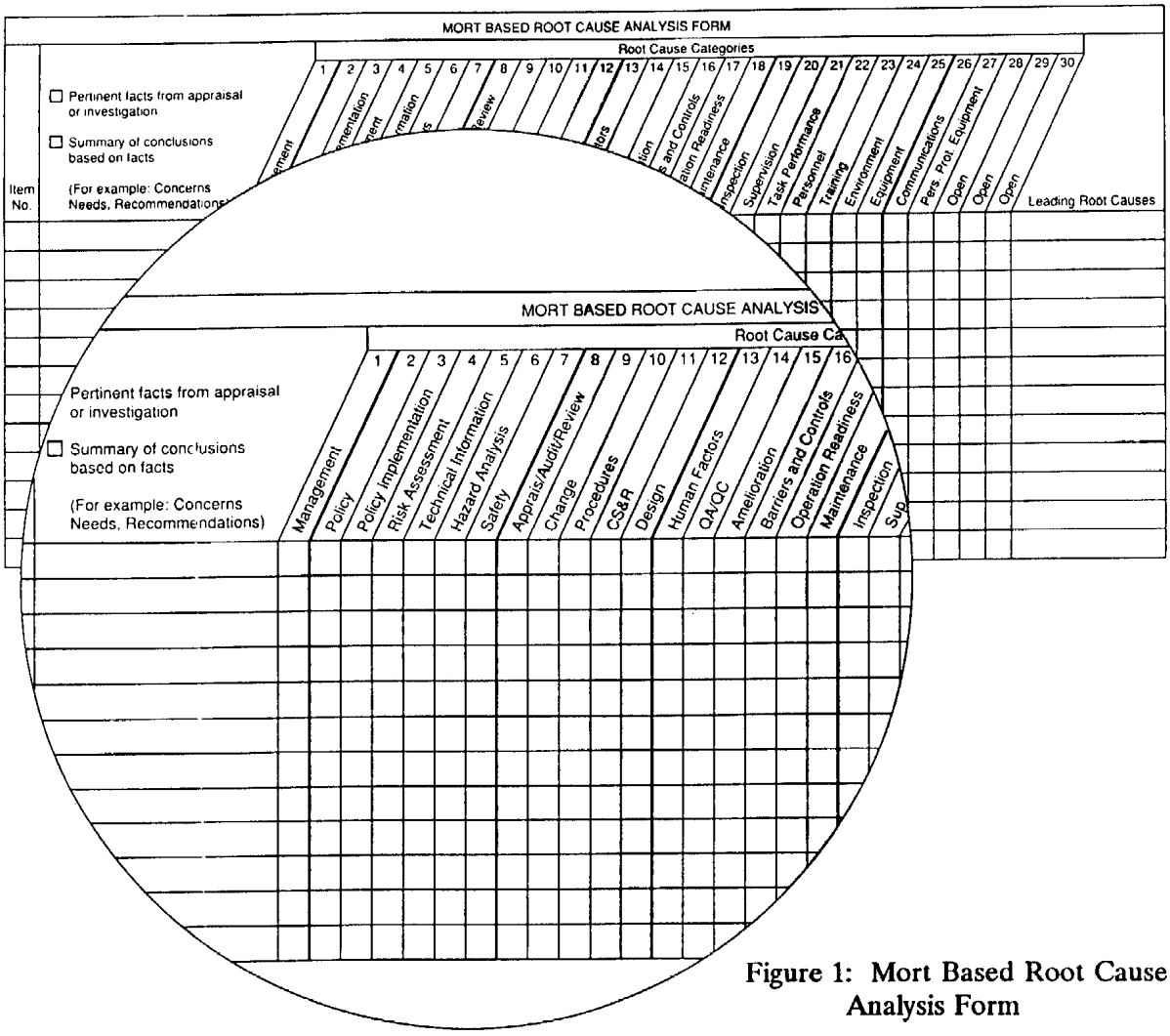

Figure 1: Mort Based Root Cause Analysis Form

The MORT root cause categories were selected with tailoring to fit the Tiger Team assessment needs, to be consistent with the Tiger Team approach and to use a recognized system of root cause analysis which focused on management deficiencies was necessary to tailor the MORT methodology to ensure consistency, facilitate rapid identification and categorization of causal factors for a particular finding and to facilitate electronic coding of the causal factors for computer analysis. This tailoring was accomplished through a facilitated brainstorming process that used the key findings from the previous Tiger Team audits at other DOE sites, the INEL MESH audit and self-assessments as a basis.

From the previous INEL MESH audit seven key findings were identified that embodied all of the individual MESH findings. Problem specifications were developed for each of the seven MESH key findings. Then, potential causes in each of the 28 MORT root cause categories that could result in the problem described in the problem specification were identified through the brainstorming process. This process was repeated until all possibilities seemed to be identified. The results of this effort was displayed in the form of a Mort-based Casual Factor Fishbone Diagram. In all, 97 potential causal factors were identified that could potentially result in a "less than adequate" condition within the 28 MORT causal factor categories.

The 28 MORT categories are: 1) Management; 2) Policy; 3) Policy Implementation; 4) Risk Assessment; 5) Technical Information; 6) Hazard Analysis; 7) Safety; 8) Appraisals, Audits and Reviews; 9) Change; 10) Procedures; 11) Codes, Standards and Regulations; 12) Design; 13) Human Factors; 14) Quality Assurance/Quality Control; 15) Amelioration; 16) Barriers and Controls; 17) Operational Readiness; 18) Maintenance; 19) Inspection; 20) Supervision; 21) Task Performance; 22) Personnel; 23) Training; 24) environment; 25) Equipment; 26) Communications; 27) Personal Protective Equipment; and 28) Funding/Resources/Manpower. Each potential causal factor was correlated one of the 28 MORT root cause categories and to an "umbrella action plan" topic creating a hierarchy of potential causes from which systemic problems could be quickly identified. Each potential causal factor was coded with a decimal number corresponding to the MORT root cause category that it was a sub-set of.

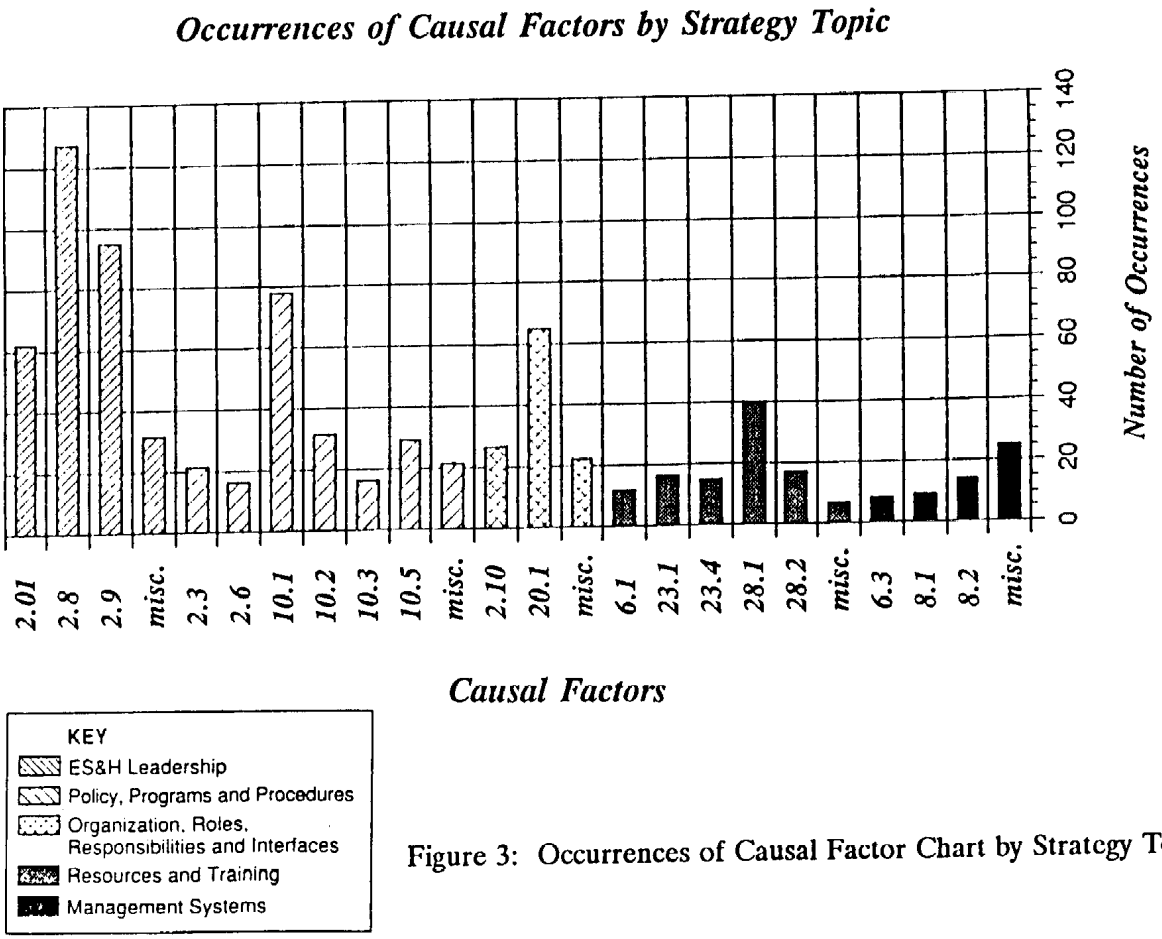

Figure 3: Occurrences of Causal Factor Chart by Strategy Topic

Use of the Causal Factor Fishbone Diagram facilitated the rapid coding of each observation, finding, or concern with the causal factor code number and ultimately with a corresponding umbrella action plan topic number. This facilitated statistical analysis and correlation of the causal factors.

Further coding of each observation, finding or concern to identify contractor and discipline provided a means to quickly correlate deficienciesfor each INEL contractor by ES&H discipline. This was a valuable tool to each contractor in the evaluation of their individual causal factors, root causes and associated key findings.

STRUCTURE DEVELOPMENT

An over-arching framework that represented the systemic management problems was required. The solution to this was to define a structure which would effectively focus on the individual causal factors while suggesting a fix for the individual finding and also identify systemic changes which would prevent similar occurrences site wide. This was accomplished by developing a shell or template structure to provide an incisive evaluation which would specifically point to the appropriate corrective action.

The results of the initial MESH evaluation (figure 2) were then extended to include consideration of the findings from the contractor self-assessments. The results of this analysis was to derive an ES&H Agenda consisting of eight objectives (figure 4). The objectives were deduced from the primary causal factor categories associated with the MESH findings, augmented by the self-assessments.

CAUSAL FACTORS OF EACH MESH KEY FINDING

KEY FINDING	PRIMARY CAUSAL FACTOR CATEGORIES								
	Policy	Hazard Analysis	Appraisal /Audits /Reviews	Procedures	Supervision	Training	Equipment	Communications	Staffing/ Resource
Emergency Preparedness is less than adequate	X			X			X		X
Personal Protection and Industrial Hygiene aspects of the INEI occupational safety and health programs are less than adequate					X				X
Safety Analysis Reports are not up to date or are non-existent		X	X	X					
Management, Oversight and Formality of Operations for health and safety are less than adequate	X		X	X		X			X
Radiation Protection is less than adequate			X	X					
Fire Protection is less than adequate				X	X				X
Noncompliance with environmental Regulations				X				X	

Figure 2

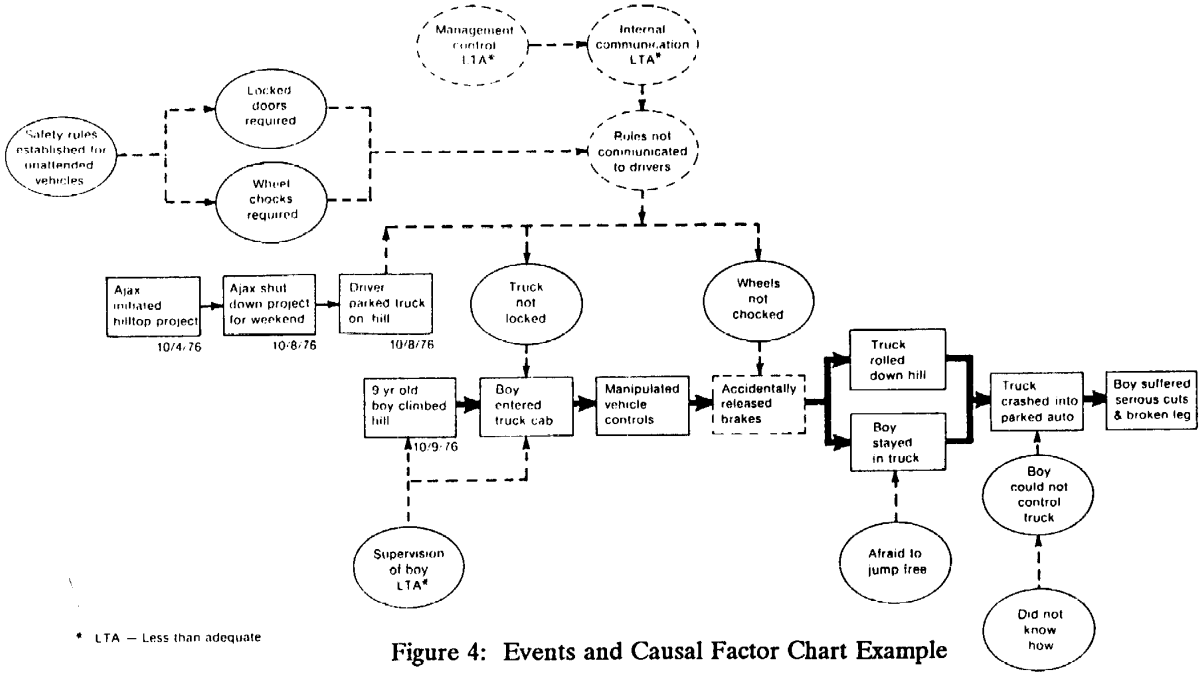

Figure 4: Events and Causal Factor Chart Example

Analysis of each of the eight umbrella action plan topics was then performed to determine which group of potential causal factors would be contributing causes to problems in each of the eight topics. The value of correlating potential causal factors to a specific umbrella action plan topic was that potential new key findings could be easily identified.

These results were then extended to include consideration of the findings of the contractor self-assessments. The result of this was to derive an ES&H Agenda consisting of eight objectives.

The objectives were deduced from the primary causal factor categories associated with the MESH findings, augmented by the self-assessments. Identifying potential new key finding early in the audit would permit the Task Force to get started on the action plans for these finding as early as possible. Thus, it was hoped that this anticipatory approach would enable the Task Force to meet the scheduled six week deadline for the completion of the Corrective Action Plan.

A preponderance of causal factors in an area identifies a potential root cause for deficiencies in that area and is an indicator of a potential key finding. Typically, the key finding areas represented systemic problems that required site-wide horizontal management. The umbrella action plan topics represent these all encompassing, systemic management issues that would require horizontal management at the INEL.

Figure 5 shows the results of this methodology in graphic form for the 807 Non-OSHA Tiger Team Findings. These fell into five basic categories identified by the Tiger Team of ES&H Leadership; Policy, Programs and Procedures; Organization Roles, Responsibilities and Interfaces; Resources and Training; and Management Systems. These five major categories embodied all of the eight objectives previously developed that comprised the INEL ES&H Agenda.

PROBLEM RESOLUTION

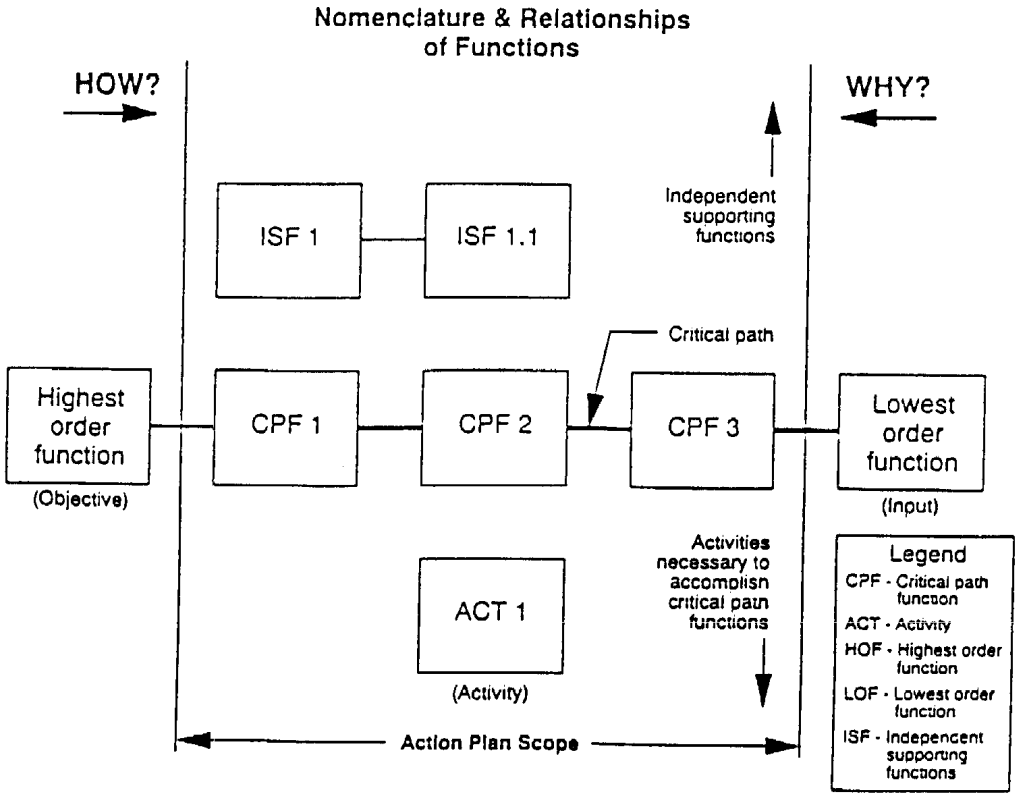

Figure 5

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The MORT root cause analysis and "cause and effect" techniques proved to be effective tools to identify the causal factors, and potential root causes of the findings and problems thus aiding in problem identification. Correlation of these causal factors to potential key findings and umbrella action plan topics was performed and served as an indicator of the severity and extent of each problem.

However, to effectively create action plans to address the systemic solution to these problems, an efficient problem resolution technique was required. One such technique is FAST used in Value Engineering.

FAST is similar to the root cause analysis method called "Events and Causal Factor (E&CF) charting."[iv] Both techniques use a verb/noun syntax with events being described as a noun and one active verb and events are charted in a logical flow. E&CF charts are typically built using 3M Post-it Pads just as FAST models are.

FAST can be used as a root cause tool in the same manner that E&CF is used by identifying functions that represent less-than-adequate elements that contributed to the problems.

However, the intuitive HOW/WHY logic of FAST and the opportunities that FAST opens for improvement of any product,

process, or service make it a superior tool for corrective action plan development. Also, FAST is an anticipatory approach to problem solving, whereas, E&CF is reactive in that it only describes the events that lead to the occurrence. Once an "umbrella" action plan topic is identified, this topic can be expressed as an action plan objective which corresponds to a highest order function in the function analysis technique. "Umbrella" action plan topics are, by necessity, very high level of abstraction objectives that potentially would embody all potential problems, or deficiencies within the subject area described. Each of the eight INEL ES&H action plan objectives (See figure 4) were examined in terms of the critical path functions, supporting functions, and activities necessary to achieve each objective.

This FAST diagram becomes the basis for evaluating each of the action plan topics and the functions necessary for successful implementation, or achievement of the objective function. All of the necessary functions for accomplishing each action plan objective is identified. Then, functions that are not being performed, or are deficient become target areas for action plans to assure the achievement of each objective.

Action Plans may also be developed to make supporting functions more effective, or to implement desired actions. Consequently, within the framework of the FAST diagram, all Action Plans necessary to close management and organization and root cause findings may be found, their relationships observed, and their relative importance in supporting multiple objectives recognized. Overall, the completeness of the managerial approach to ES&H performance excellence can be assessed, and the credibility of the overall compliance action plan is improved.

Once the FAST models are developed, they serve as a tool to identify the functions necessary to achieve each ES&H objective. This is consistent with the definition for Value Management in that the goal of any VM study is to produce an action plan that prescribes actions to improve any product, process, service (or program) at the lowest possible cost. This plan for improvement is the goal of the corrective action process.

The next step is to work with an inter-disciplinary team of cognizant professionals, management, financial, and other individuals in each discipline to develop specific actions, milestones, and budgets to accomplish each function along the critical path and a management structure to implement the plan. Ideally, this whole process is conducted in the format of a Value Management study where various alternatives are brainstormed and evaluated.

SUMMARY AND CONCLUSIONS

An effective corrective action process was necessary to respond to Tiger Team key findings and root causes to identify and implement those actions necessary to preclude recurrence. To be effective, the corrective action process required management involvement and be anticipatory instead of reactive in nature. The identification and correction of specific causes of failures helps prevent recurrence of these problems, thereby improving the performance of ES&H requirements[v]. The INEL Action Plan Task Force recognized that an effective corrective action program must assure problem resolution by validating the Tiger Team experience through a thorough understanding of the Tiger Team key findings and associated root causes.

Because of the initial short turn-around period required for the completion of this action plan of 6 weeks (a 20 week extension was subsequently granted) after the completion of the audit, it was necessary to develop a framework for the action plan that would represent all known, and potential ES&H findings at the site. Additionally, it was necessary to use some method that would appear anticipatory and create logical connections between the various actions so the action plan would be comprehensive and represent the INEL as a whole.

The development of this action plan framework to address the Tiger Team Key findings, and especially the Key Management findings was accomplished by using FAST Modeling. The FAST methodology was selected and was instrumental in instilling a Value Management approach in this very complex project.

Additionally, when classical root-cause analysis methodologies, such as MORT, cause and effect, Kepner-Tregoe, etc., are coupled with FAST modeling they can augment and be important tools in the information phase of the VE job plan. Since a major objective of the information phase is to understand and define the problem at hand, these tools will aid in getting to the root cause of the problem under study.

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