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ORGANIZATIONAL CULTURE, SAFETY CULTURE, AND SAFETY PERFORMANCE AT RESEARCH FACILITIES.

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Organizational culture surveys of research facilities conducted several years ago and archival occupational injury reports were used to determine whether differences in safety performance are related to general organizational factors or to 'safety culture' as reflected in specific safety-related dimensions. From among the organizations surveyed, a pair of facilities was chosen that were similar in size and scientific mission while differing on indices of work-related injuries. There were reliable differences in organizational style between the facilities, especially among workers in environment, safety, and health functions; differences between the facilities (and among job categories) on the safety scale were more modest and less regular.

BACKGROUND

During 1991, assessments of organizational culture were conducted in connection with 'Tiger Team' evaluations of Department of Energy research facilities. The assessments were designed to reveal organizational and management issues that might have a bearing on these operational evaluations. The organizational assessments, performed by researchers from Brookhaven National Laboratory, consisted in part of an organizational culture survey. The survey included a standardized, general-purpose organizational culture instrument and various other scales reflecting the quality of communication, the coordination of work, the employees' commitment to the organization, the cohesiveness of work groups, and environmental and safety concerns. The survey also included a specialized safety scale developed by researchers at Berkeley based on their work on the culture of 'high-reliability organizations.'

PURPOSE OF THE STUDY

Because the surveys of DOE facilities were conducted several years ago, it is possible to look back at the safety performance of these organizations at the time and to determine whether differences in safety are related to general organizational factors or to 'safety culture' as reflected in specific safety-related dimensions.

METHOD

The Department of Energy issues reports of occupational injury and property damage which contain statistics for each contractor-operated research facility. In addition to the year-to-date statistics, the annual reports include average incidence rates for total reportable cases and lost workday cases for the previous five years. Thus it was possible to obtain from archival reports safety performance data averaged over a five-year period bracketing the administration of the organizational culture survey. From among the organizations for which organizational data were available (i.e., those surveyed by the Brookhaven researchers), a pair of facilities were chosen that were similar in size and scientific mission while differing consistently on indices of work-related illness and injuries.

For the years 1989-1993, the total recordable case rate and the lost workday case rate for the two facilities differed by a factor of roughly two. The facility with lower rates of injury will be referred to as Facility A; the other will be called Facility B.

The information collected in the survey about employees' group affiliation and job function was tailored to each facility; therefore, the specific information provided in the surveys was used to sort cases from both facilities into five general categories: administrative, business, environment, safety, and health (ES&H), research/scientific, and technical/engineering. Each of the various organizational dimensions included in the surveys was analyzed by facility and employee category.

Organizational Culture Inventory

The Organizational Culture Inventory (Cooke & Szumal, 1993) measures an organization's normative beliefs and behavioral expectations. The inventory consists of 120 statements describing behaviors that might be expected of members of an organization; respondents rate the extent to which each expectation applies in their organization. The items are interpreted as reflecting twelve styles; these are defined in the sidebar. The groupings of the styles (i.e, constructive, passive-defensive, and aggressive-defensive) are based on factor analyses of the styles.

Specialized Scales

Several other short scales and items expected to be relevant to the safety of operations were included in the organizational culture assessments. Some of these were developed by researchers at Berkeley and used in their work with high-reliability organizations (Roberts, 1993); other were adapted from the general organizational literature.

Safety Scale. Based in part on their work with personnel serving on aircraft carriers, the Berkeley group developed a set of 40 rating items to more directly tap the cultural characteristics that distinguish high-reliability organizations (Koch, 1993).

Communication. Several items assessed various aspects of intra-organizational communication, including its perceived trustworthiness and accuracy, the desirability of communication with others, and the general level of satisfaction with

communication in the organization. These were developed by the Berkeley group; their use in assessments by Brookhaven researchers is described in (Haber, O'Brien, Metlay, & Crouch, 1991).

Environment, Safety, and Health. The four items in this area addressed the onsite and offsite consequences or poor performance, the perceived degree to which management emphasizes environmental issues, and how well informed employees are about hazards in their work environments.

Other Organizational Dimensions. The organizational assessments included scales adapted from the literature which assessed organizational commitment (the strength of the respondent's identification with the organization as a whole), cohesion (the strength of respondents' identification with their own work groups), and coordination (how well the subunits of the organization are able to work together). The sources of these scales and their use in assessments by Brookhaven researchers is described in (Haber et al., 1991).

RESULTS

Results for each type of measurement in the assessment are briefly described below, followed by a summary. Data for some of the organizational dimensions are shown in graphs. In the illustrations, the results the plotted for each of the five occupational groups identified above, with facility indicated by the symbols. Results for Facility A are circles, those for Facility B are squares. The crosses in the figures represent a third facility, which is described later.

Organizational Culture Inventory

In general, there were no statistically significant differences between the facilities on the twelve organizational style measured by the OCI; neither were there many reliable differences among the occupational groups. However, for all but one of the styles the interaction of group with facility was significant. The differences between facilities tended to be least in technical/engineering and administrative groups and greatest in the research/scientific and ES&H groups.

For each occupational group, the ordering of the facilities on related styles, especially the constructive and passive-defensive styles, tended to be the same. For example, the pattern of ratings for the 'humanistic' style shown in Figure 1, (e.g., among ES&H personnel ratings were higher in Facility A, but for research/scientific staff ratings were higher in Facility B) is also seen in the other three 'constructive' styles.

Ratings of ES&H personnel on the 'passive-defensive' styles tend to be higher in Facility B than in Facility A; the differences are not as large as those for the constructive styles. Ratings of research/scientific staff tend to show larger differences on the 'passive-defensive' styles, with ratings of Facility A consistently higher on this factor for this group. The pattern of results is illustrated in the ratings for the 'avoidance' style shown in Figure 2. It is interesting to note that the 'crossing' interaction between the ES&H and research/ scientific groups is present in the data for almost all of the styles.

Other Scales

There were no significant differences between facilities or among groups on the safety scale. Interactions such as those

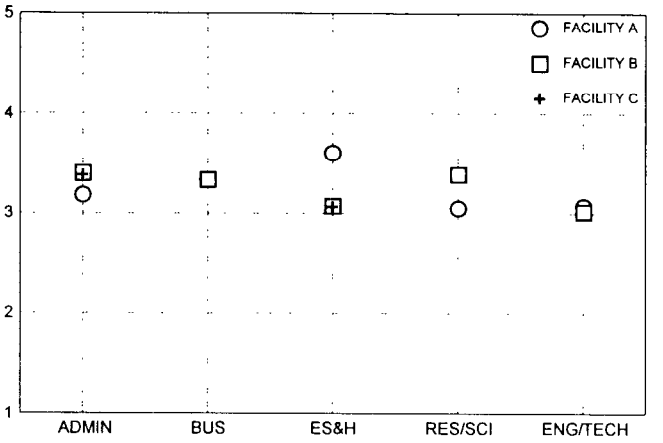

Figure 1. Ratings on the OCI's 'humanistic' style for occupational groups in different facilities.

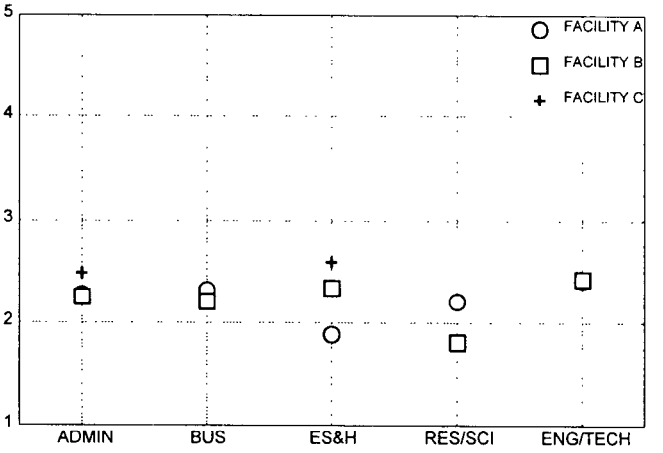

Figure 2. Ratings on the OCI's 'avoidance' style for occupational groups in different facilities.

described above were also absent on this measure. There were some differences on selected subsets of 40 items that comprise the scale, but these were not as large or reliable as those for the other measures. This is consistent with other findings (Haber et al., 1991) and with Cooke and Szumal's (1993) suggestion that specialized scales are not necessarily more sensitive to safety-relevant organizational differences than are general-purpose inventories like the OCI.

There were substantial differences in the ratings of ES&H personnel at the two facilities on the organizational commitment (Figure 3) and cohesiveness scales; ratings in Facility A were higher on both. Facility differences for the other occupational groups were small.

There was little difference either between facilities or among groups in ratings of the trustworthiness and accuracy of communication. However, although the other groups did not differ, ES&H personnel in Facility A rated interaction with others (subordinates, peers, superiors) more desirable than did those in Facility B. ES&H personnel in Facility A also rating their satisfaction with communication higher.

There were no significant differences between the facilities in the perceived onsite or offsite hazards as a result of poor performance. ES&H personnel in both facilities rated these hazards much higher than their fellow workers; there was no interaction of facilities and occupational groups on these items. There were highly reliable differences between the facilities on the other two ES&H-related items, however.

Facility A produced significantly higher rating of how much their management emphasized environmental issues and of how well employees were informed of potential risks (Figures 4 and 5). While the differences between Facility A and Facility B were widest among the ES&H personnel, the differences were evident in other groups as well. The differences were attenuated in the administrative and business groups; the facility-by-group interaction was significant only for the measure of awareness of potential risks.

Summary

The most marked differences between the two facilities were in the responses of their environment, safety and health personnel. In Facility A, this group reliably exhibited a more 'constructive' and less 'defensive' organizational style than their co-workers; they were also more committed to the organization, and saw their work as being more coordinated. This was not true in the other facility; therefore, facility-by-group interactions for many scales were statistically significant, even when judged conservatively (owing to the large number of significance tests done). Interestingly, differences between the facilities (and among job categories) on the safety scale (which was designed specifically to tap perceptions and expectations related to safety) were more modest and less regular.

A FURTHER COMPARISON

Despite the consistent differences between the responses in the two facilities, the relationship of these results to safety performance might nevertheless be coincidental. Therefore, a limited comparison with another facility was made. Because in the comparisons of the two facilities differences were often limited to ES&H personnel, a similar occupational group was identified in a third facility–one that, like Facility B, tended to perform less well than its peers during the period in question on the Department of Energy's occupational injury metrics. Average results for some of the measures described earlier were then compared to those of the first two facilities. Because the responses of administrative staff tended to differ least between facilities, a data collected at the third facility from this occupational group were included as a 'calibration' point. As expected, responses for this group did not differ greatly from those in the other two facilities.

Ratings of ES&H personnel in the third facility, shown in the figures as Facility C (indicated by crosses), were higher than those of the same occupational group in Facility B on all four of the passive-defensive styles of the OCI; ratings on the two of the constructive styles were similar to those for Facility B - on the other two ratings were lower. Thus, relative to Facility A, Facility C appears to differ in the same ways as Facility B, except that on certain measures the differences are greater. (Both of the occupational injury statistics referred to

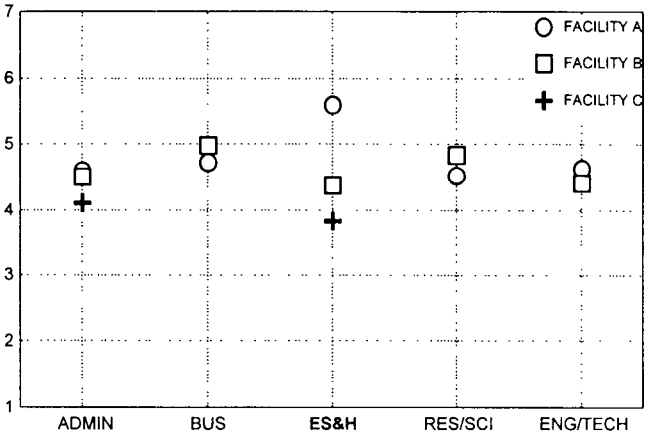

Figure 3. Ratings of organizational commitment by occupational groups in different facilities.

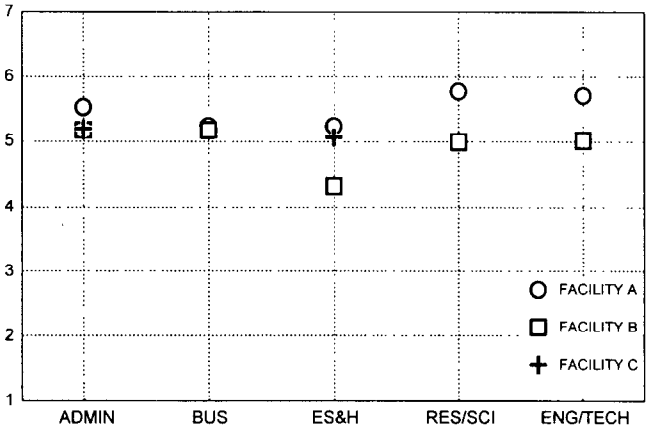

Figure 4. Ratings of awareness of potential hazard by occupational groups in different facilities

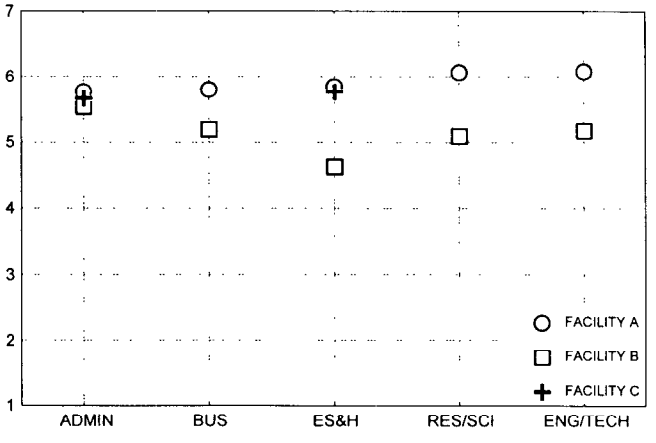

Figure 5. Ratings of management emphasis of environmental issues in different facilities.

earlier were higher for Facility C than for Facility B; i.e., by these measures, Facility C had higher rates of injury than Facility B.)

The same pattern of results holds for the ratings of organizational commitment, coordination of work and cohesiveness. Ratings on scales related to communication for Facility C were very similar to those for Facility B, differing from Facility A in the same ways.

DISCUSSION

It is tempting to conclude from the results presented here that facilities with ES&H personnel that are more constructive and committed will exhibit better safety performance. The relationship between Facilities A and B on a variety of organizational measures is very consistent, and the similarity of the results of Facility C to those of Facility B suggests that the relationship has to do with safety performance. However, it is not unreasonable to suggest that unfavorably rated safety performance may *produce* a defensive culture among those who are viewed as being responsible for that performance. To complicate the issue further, the rating of all occupational groups of the emphasis placed by management on environmental issues was much higher in the facility with the better safety statistics, and it might be (tentatively) suggested that differences in management's commitment to safety (which unfortunately was not assessed specifically in the surveys) underlies both the apparent difference in organizational culture and the differences in safety performance.

In the end, management attitudes, employee attitudes, and safety performance are probably so closely interwoven that real change in any one of them will be manifested in changes in the other two. It is clear from these results that at least some of the measures examined in this study can be useful in assessing such changes.

ACKNOWLEDGEMENT

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DESCRIPTIONS OF THE TWELVE STYLES MEASURED BY THE ORGANIZATIONAL CULTURE INVENTORY

Constructive Norms (Satisfaction)

[Styles Promoting Satisfaction Behaviors]

Achievement: do things well and value members who set and accomplish their own goals. Members of these organizations set challenging but realistic goals, establish plans to reach these goals, and pursue them with enthusiasm. (Pursuing a standard of excellence; openly showing enthusiasm)

Self-*Actualization*: value creativity, quality over quantity, and both task accomplishment and individual growth. Members of these organizations are encouraged to gain enjoyment from their work, develop themselves, and take on new and interesting activities. (Thinking in unique and independent ways; doing even simple tasks well)

Humanistic: managed in a participative and person-centered way. Members are expected to be supportive, constructive, and open to influence in their dealings with one another. (Helping others to grow and develop; taking time with people)

Affiliative: place a high priority on constructive interpersonal relationships. Members are expected to be friendly, open, and sensitive to the satisfaction of their work group. (Dealing with others in a friendly way; sharing feelings and thoughts)

Passive-Defensive Norms

[Styles Promoting People-Security Behaviors]

Approval: conflicts are avoided and interpersonal relationships are pleasant at least superficially. Members feel that they should agree with, gain the approval of, and be liked by others. (Making sure people accept you; 'going along' with others)

Conventional: conservative, traditional, and bureaucratically controlled. Members are expected to conform, follow the rules, and make a good impression. (Always following policies and practices; fitting into "the mold")

Dependent: hierarchically controlled and non-participative. Centralized decision making in such organizations leads members to do only what they are told and to clear all decisions with superiors. (Pleasing those in positions of authority; doing what is expected)

Avoidance: fail to reward success but nevertheless punish mistakes. This negative reward system leads members to shift responsibilities to others and avoid any possibility of being blamed for a mistake. (Waiting for others to act first; taking few chances)

Aggressive-Defensive Norms

[Styles Promoting Task-Security Behaviors]

Oppositional: confrontation prevails and negativism is rewarded. Members gain status and influence by being critical and thus are reinforced to oppose the ideas of others and to make safe (but ineffectual) decisions. (Pointing out flaws; being hard to impress)

Power: non-participative, structured on the basis of the authority inherent in members' positions. Members believe they will be rewarded for taking charge, controlling subordinates, and at the same time, being responsive to the demands of superiors. (Building up one's power base; motivating others any way necessary)

Competitive: winning is valued and members are rewarded for outperforming one another. People in such organizations operate in a 'win-lose' framework and believe they must work against (rather than with) their peers to be noticed. (Turning the job into a contest; never appearing to lose)

Competence: perfectionism, persistence, and hard work are valued. Members feel they must avoid all mistakes, keep track of everything, and work long hours to attain narrowly-defined objectives. (Doing things perfectly; keeping on top of everything)

(from Cooke & Szumal, 1993)