February 4, 1997

Dr. Robert L. Seale, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory commission
Washington, D.C. 20555

Dear Dr. Seale:

This responds to the letter from Dr. Kress dated December 30, 1996, in which he asked the staff to respond in writing to four questions (Questions 1, 2, 3 and 11) concerning its Human Performance Program Plan. The ACRS' questions and the staff's responses are enclosed.

Sincerely,
Original signed by
Hugh L. Thompson, Jr.
Hugh L. Thompson, Jr.
Acting Executive Director
for Operations

Enclosure: As stated

cc: Chairman Jackson
Commissioner Rogers
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
SECY

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97-24

Dr. Thomas S. Kress, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory commission
Washington, D.C. 20555

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DATE	1/ /97		1/ /97		1/ /97		1/ /97		1/ /97		/ /97	

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ENCLOSURE

RESPONSES TO ACRS' QUESTIONS ON THE HUMAN PERFORMANCE PROGRAM PLAN

Question 1. What are the staff plans for developing a Human Performance Program Plan (HPPP) activities road map, which would be useful for allocating resources, scheduling, and understanding the relationship between the activities?

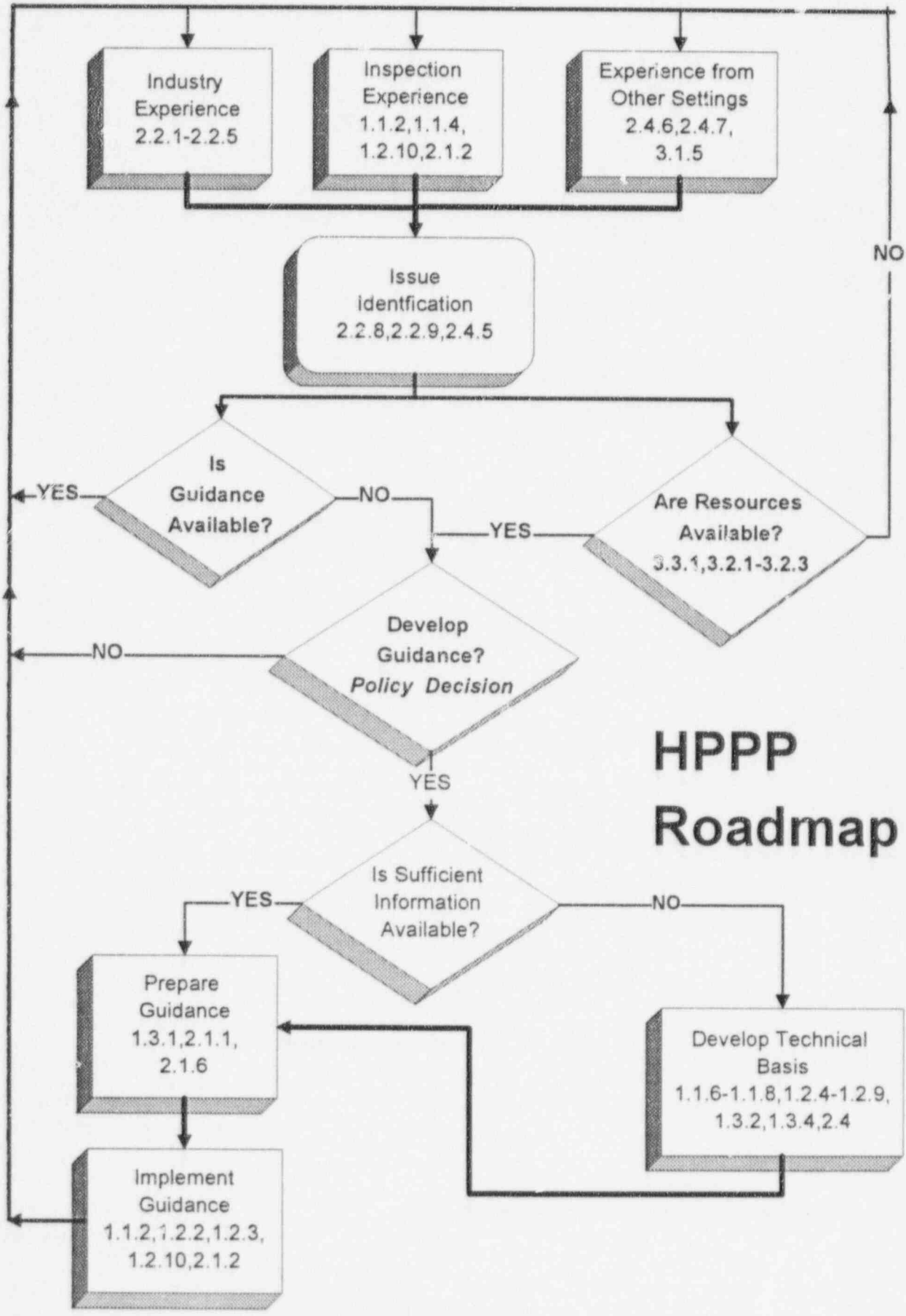
Response: The HPPP was intended to function as a focal point for the coordination of human factors activities among the NRC offices. Planning and implementation of these activities, including allocation of resources, is the responsibility of the individual offices.

The HPPP describes the mission, goals, objectives and activities of the Agency's human performance program. The HPPP's goals and objectives are aimed at assuring that (1) an acceptable level of human performance is maintained at nuclear facilities, (2) sufficient information is available to support the regulation of human performance and (3) adequate resources are available to carry out its human performance program. The HPPP also describes the activities that are necessary to accomplish the goals and objectives, the office that is responsible for accomplishing each activity, the schedule for completing each activity, the relative priority of each activity and the relationships between and among the various activities.

The framework for the HPPP was developed at a facilitated workshop using a panel of internal human performance experts, some from the former Human Factors Coordination Committee. The panel started from a simplified organizational systems model and used its extensive education and experience to develop the mission statement, goals and objectives of the HPPP. It then developed the activities necessary to support the HPPP's goals and objectives. A "roadmap" depicting the relationships between and among the various elements of the HPPP is shown in Figure 1.

We find that the HPPP adequately serves its intended purpose—to function as a focal point for the coordination of the Agency's human factors activities. An additional HPPP roadmap developed from a human performance model is not needed and cannot be justified, especially in light of the Agency's higher priority human factors work and limited human factors resources. Nevertheless, it is important to note that the staff does have a commitment to periodically consider the need to update and refine the HPPP.

FIGURE 1


Industry Experience 2.2.1-2.2.5
Inspection Experience 1.1.2,1.1.4, 1.2.10,2.1.2
Experience from Other Settings 2.4.6,2.4.7, 3.1.5
Issue Identfication 2.2.8,2.2.9,2.4.5
Is Guidance Available?
YES
NO
Are Resources Available? 3.3.1,3.2.1-3.2.3
YES
NO
Develop Guidance? Policy Decision
NO
YES
Is Sufficient Information Available?
YES
NO
Prepare Guidance 1.3.1,2.1.1, 2.1.6
Develop Technical Basis 1.1.6-1.1.8,1.2.4-1.2.9, 1.3.2,1.3.4,2.4
Implement Guidance 1.1.2,1.2.2,1.2.3, 1.2.10,2.1.2
HPPP Roadmap

Question 2. The activities delineated in the HPPP appear to be focused on reducing the assumed risk-worth of human actions used in probabilistic risk assessments (PRAs). What is the risk-worth of human actions? Why does the staff believe the risk-worth is too high and should be reduced?"

Response: The HPPP was built upon feedback from experience and the staff's expertise accrued from studying human performance issues over time, both within the nuclear industry and from other applications, e.g., military, aerospace, transportation. Feedback from operating experience demonstrates that more than half of the incidents reported for both nuclear power plants and nuclear materials facilities have human performance as a contributing factor. Associated with this data is the staff's experience with the risk focus of the agency. Though there was no explicit attempt to apply quantitative risk-worth to the activities, one of the premises on which the HPPP was developed (as delineated in the August 1995 version of the HPPP) was that "human error is a significant contributor to risk associated with operational events at nuclear facilities."

Several studies allude to the "risk-worth of human actions used in PRAs." The early Brookhaven National Laboratory (BNL) sensitivity studies (NUREG/CR-1879) and the S-curves BNL generated for a PWR, for example, showed that the core damage frequency (CDF) is significantly increased by an increase in human-error rates. The Individual Plant Examination (IPE) draft report, NUREG-1560, lists BWR and PWR scenarios in which human actions are important and categorizes them by percentage of the plants at which they are important, as follows: "Human actions are important contributors to plant CDFs in the IPEs, with correct operator actions often significantly reducing the CDFs. However, there are considerable uncertainties associated with determining human error probabilities for operator actions. As a result, improved modeling of human actions would significantly improve the understanding of the risk associated with operating nuclear power plants." Therefore, human actions may increase or reduce the level of risk.

Determining "risk-worth of human actions in PRAs" requires that human actions be converted into some risk measure. Past methods by which human actions are converted into some risk measure involved large uncertainties in determining the risk-worth of human actions. The methods appear incomplete, particularly in modeling errors of commission and cognition. It is premature to establish quantitative values for "risk-worth" of human actions before developing a more complete method to convert human actions into a risk measure. Therefore, feedback from operating experience and the collective experience and expertise of those formulating the HPPP was the primary basis for the HPPP. The premises that served as the basis of the original HPPP are listed in the August 1995 version.

Question 3. How does the staff set the priorities for the HPPP activities and what does the priority ranking mean?

Response: The actual or effective priorities of each of the HPPP's activities are determined by the office director that is responsible for completing the activity in the context of that office's total workload using its own work prioritization scheme. The priorities listed in the HPPP are considered in the office director's priority determination.

The priorities listed in the HPPP — high, medium and low — represent the former Human Factors Coordination Committee's qualitative assessment of each activity's relative importance, taking into consideration perceived safety significance, immediacy, management direction and regulatory need. The HPPP priorities were determined by consensus from the Committee's members and, thereby, indirectly reflect the perspective of each of the offices represented by the Committee membership. The activities' priorities are expected to change as their underlying considerations change. The priorities of each of the activities will be reconsidered periodically, as will the need to update the HPPP.

Question 11. How are standards adopted by the staff formulated? How does the staff assure that the standards are necessary and sufficient to meet regulatory needs?

Response: Human factors consensus standards are primarily based on the accrual of evidence from experience. They are used as appropriate in lieu of expending substantial resources to develop an experimental base. The limitations on experimental evidence do not preclude a technical basis for standards. It is important to check that the scope of the consensus standard should not exceed the scope of the experience base. Human factors consensus standards are produced through an open and mature process by national standards organizations composed of working groups interested in specific topics. General practice is to reassess these standards approximately every 5 years.

The NRC's use of consensus standards is consistent with the policy established for Executive Branch agencies by OMB Circular No. A-119, Revised, October 20, 1993. That circular states, in part,

> It is the policy of the Federal Government in its procurement and regulatory activities to: Rely on voluntary standards, both domestic and international, whenever feasible and consistent with law and regulation pursuant to law ....

NRC Direction Setting Issue 13 encourages the use of consensus standards in stating that

> The codes and standards that are established and referenced by NRC incorporate many years of accepted, good engineering practice and are relied on to provide a rational basis for many NRC regulations.

Standards are selected for adoption by the NRC based on their relevance to the regulatory process. The human factors standards which are used currently by the NRC staff relate to personnel and operational issues, e.g., training and qualifications, medical qualification, simulator fidelity, procedures, system interface. These areas are cited in the regulations or the Standard Review Plan, NUREG-0800 (SRP). The standards are more detailed than the regulations or SRP. This level of detail is needed by the regulatory staff to use as part of their evaluation of licensee submittals or for inspections. The standards are selected with the intent of endorsing those that are sufficient to meet the Agency's primary regulatory need - maintaining the safety of nuclear facilities.

Consensus standards are endorsed by regulatory guides that are not

mandatory for licensees. Regulatory guides do not prescribe requirements: they only describe methods that the staff has determined to be acceptable ways of meeting the mandatory regulations.

Before the NRC endorses a consensus standard with a regulatory guide, there are additional checks and balances that accrue. The NRC can, and does, take exception to certain elements of the standard on the basis of Agency experience. There is also a mandatory public comment period, during which anyone can make comments on the document that must be considered and acted on by the staff. Finally, various levels of management, the CRGR, and the ACRS review the document.

Much of the NRC human factors guidance extant is not in the form of regulatory guides, but is promulgated as staff reports, e.g., NUREG-0700, NUREG-0899. These documents do not endorse standards in the same way a regulatory guide does, but incorporate guidance that has been adapted from standards developed for other applications, e.g., military, aerospace, transportation, industrial safety. Before these standards are incorporated in NRC guidance, efforts are made to determine the basis for the elements of the standards. The staff has followed a review process that determines (1) if the standard is based on laboratory or field research or experience, (2) the history of use of the standard in its intended application, and (3) the reasonableness of its fit in a nuclear application. These documents are frequently peer reviewed by subject matter experts and may be subject to public comment and CRGR and ACRS review.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 4, 1997

Dr. Robert L. Seale, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory commission
Washington, D.C. 20555

Dear Dr. Seale:

SUBJECT: ACRS QUESTIONS ON HUMAN PERFORMANCE PROGRAM PLAN

This responds to the letter from Dr. Kress dated December 30, 1996, in which he asked the staff to respond in writing to four questions (Questions 1, 2, 3 and 11) concerning its Human Performance Program Plan. The ACRS' questions and the staff's responses are enclosed.

Sincerely,

Hugh L. Thompson, Jr.
Acting Executive Director
for Operations

Enclosure: As stated

cc: Chairman Jackson
Commissioner Rogers
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
SECY

ACTION

EDO Principal Correspondence Control

FROM: T. S. Kress
ACRS

DUE: 01/22/97

EDO CONTROL: G960977
DOC DT: 12/30/96
FINAL REPLY:

TO:

James M. Taylor

FOR SIGNATURE OF : ** GRN **

CRC NO:

Executive Director

DESC:

ACRS QUESTIONS ON HUMAN PERFORMANCE PROGRAM PLAN

ROUTING:

Taylor
Milhoan
Thompson
Blaha
Mitchell
Paperiello,NMSS
Morrison,RES
Jordan,AEOD
Cyr, OGC
ACRS File

DATE: 12/31/96

ASSIGNED TO: NRR

CONTACT: Miraglia

SPECIAL INSTRUCTIONS OR REMARKS:

Prepare response to ACRS for EDO signature.
Put Commissioners and SECY on cc (shown on original) for reply.

Due DRCH 1/13/97

USE SUBJECT LINE IN RESPONSE.

NRR RECEIVED: DECEMBER 31, 1996
NRR ACTION: DRCH:BOGER

NRR ROUTING:
MIRAGLIA
THADANI
ZIMMERMAN
SHERON
TRAVERS
MARTIN
BOHRER

ACTION
DUE TO NRR DIRECTOR'S OFFICE
BY Jan. 16, 1997

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

December 30, 1996

Mr. James M. Taylor
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Taylor:

SUBJECT: ACRS QUESTIONS ON HUMAN PERFORMANCE PROGRAM PLAN

During the 437th meeting of the Advisory Committee on Reactor Safeguards, December 5-7, 1996, we reviewed the NRC activities identified in the Human Performance Program Plan. Our Subcommittee on Human Factors met on September 20 and December 3, 1996, to review these activities. After the September 20, 1996 Subcommittee meeting, a list of questions included in the attachment was developed. These questions were provided to the staff on September 27, 1996. During subsequent meetings, the staff responded to these questions. We believe that the staff's response to questions 1, 2, 3, and 11, did not fully address our concerns. We request that the staff provide written response to these questions.

Sincerely,

T. S. Kress
Chairman

Attachment: List of ACRS questions on Human Performance Program Plan

cc: J. Mitchell, OEDO
F. Miragila, NRR
B. Boger, NRR
C. Thomas, NRR
D. Morrison, RES
W. Hodges, RES

EDO -- G960977

9701100285 6pp.

ATTACHMENT 1

LIST OF ACRS QUESTIONS ON HUMAN PERFORMANCE PROGRAM PLAN

The ACRS requested that the staff provide information at a future ACRS Subcommittee meeting concerning the following questions.

1. What are the staff plans for developing a Human Performance Program Plan (HPPP) activities road map, which would be useful for allocating resources, scheduling, and understanding the relationship between the activities?

2. The activities delineated in the HPPP appear to be focused on reducing the assumed risk-worth of human actions used in probabilistic risk assessments (PRA). What is the risk-worth of human actions? Why does the staff believe the risk-worth is too high and should be reduced?

3. How does the staff set the priorities for the HPPP activities and what does the priority ranking mean?

4. How does the staff decide that an independent program element is required? Why has the staff decided that data gathering should be separated from developing guidance and that the two activities should have different priorities?

[NOTE: The attached figures are examples of models that may be used to develop a master diagram that could serve as the road map to answer many of the questions raised here. These figures are just the starting point; they must be adapted to the NRC's needs using judgment and operational experience.]

5. What does the staff mean by "effective" and "adequate" as used in the objectives and goals in the HPPP? How does the staff know what must be done and when the goal or objective is achieved?

6. Should the staff be pushing licensees toward the state-of-the-art in human factors and human reliability rather than a proven adequate state?

7. Numerous human errors have resulted in the misadministration of medical treatments by licensees of the Office of Nuclear Materials Safety and Safeguards (NMSS). Why isn't NMSS as involved with human performance efforts as the other offices?

8. How does the staff plan to respond to the ACRS advice concerning developing metrics for organizations and managements that correlate with risk or performance?

9. What are the technical bases for defining the staffing levels inside and outside of the main control room, and for communication procedures?

10. What are the deficiencies or "holes" in NUREG-0700?

11. How are standards adopted by the staff formulated? How does the staff assure that the standards are necessary and sufficient to meet regulatory needs?

12. The staff scheduled item 1.2.11 of the HPPP, "Develop Guidance for Computerized Job Performance Aids," to be completed "as technology is developed." What standards does the staff have for such aids that would foster the development of such technology? If the standards do not exist, what are the staff plans for developing such standards?

13. What is the staff approach to developing a performance-based fitness-for-duty criteria?

14. What is the staff approach to evaluating the task network model espoused by the Department of Defense, and how will the staff decide if the model is applicable and useful for regulatory needs?

15. How does the staff decide on the allocation of resources between human factor research and other research activities such as thermal hydraulic models?

16. How does the staff assure simulator fidelity? How important is good fidelity to Emergency Operating Procedure training? What does the staff expect an operator to do if unexpected plant behavior occurs during a severe accident?

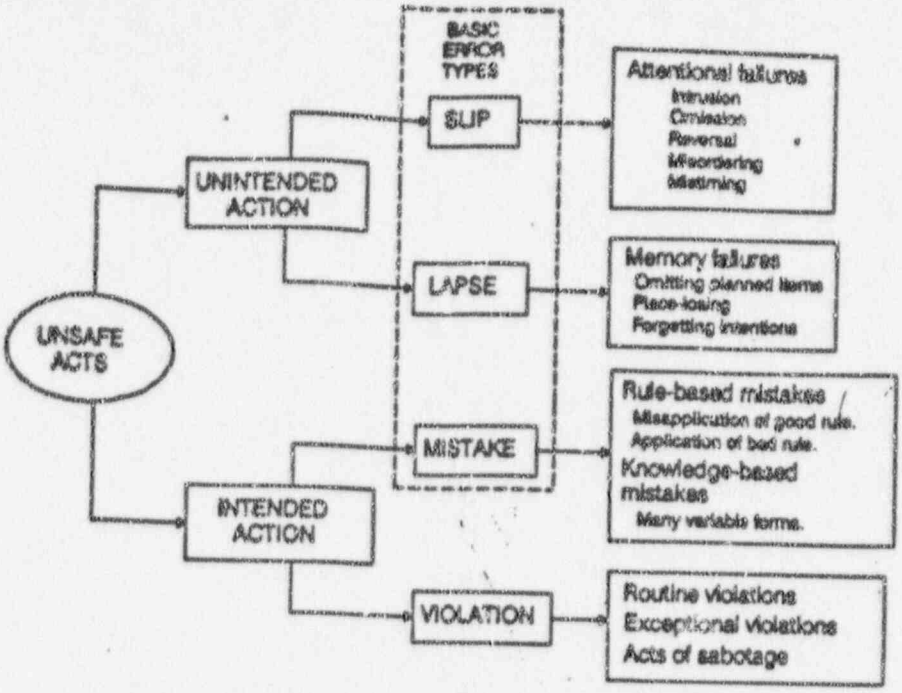


Figure 7.7. A summary of the psychological varieties of unsafe acts, classified initially according to whether the act was intended or unintended and then distinguishing errors from violations.

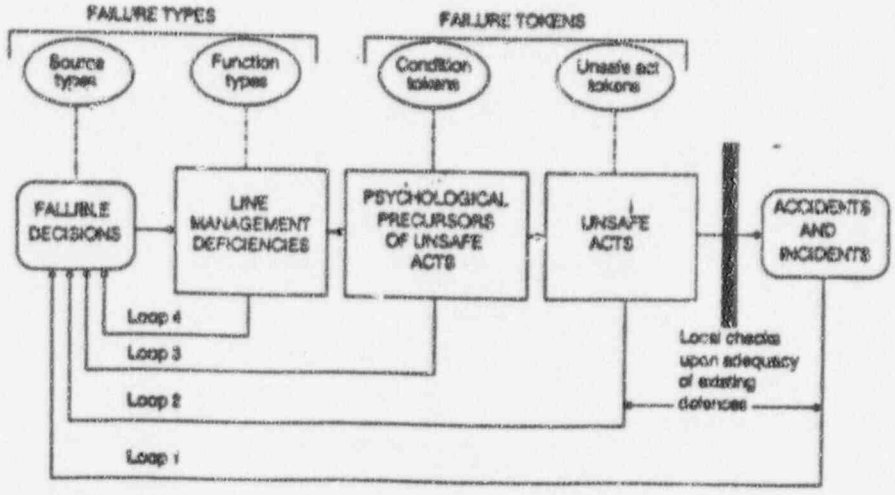


Figure 7.9. Feedback loops and indicators. The indicators are divided into two groups: *failure types* (relating to deficiencies in the managerial/organisational sectors) and *failure tokens* (relating to individual conditions and unsafe acts).

J. Reason, Human Error, Cambridge University Press, 1990.

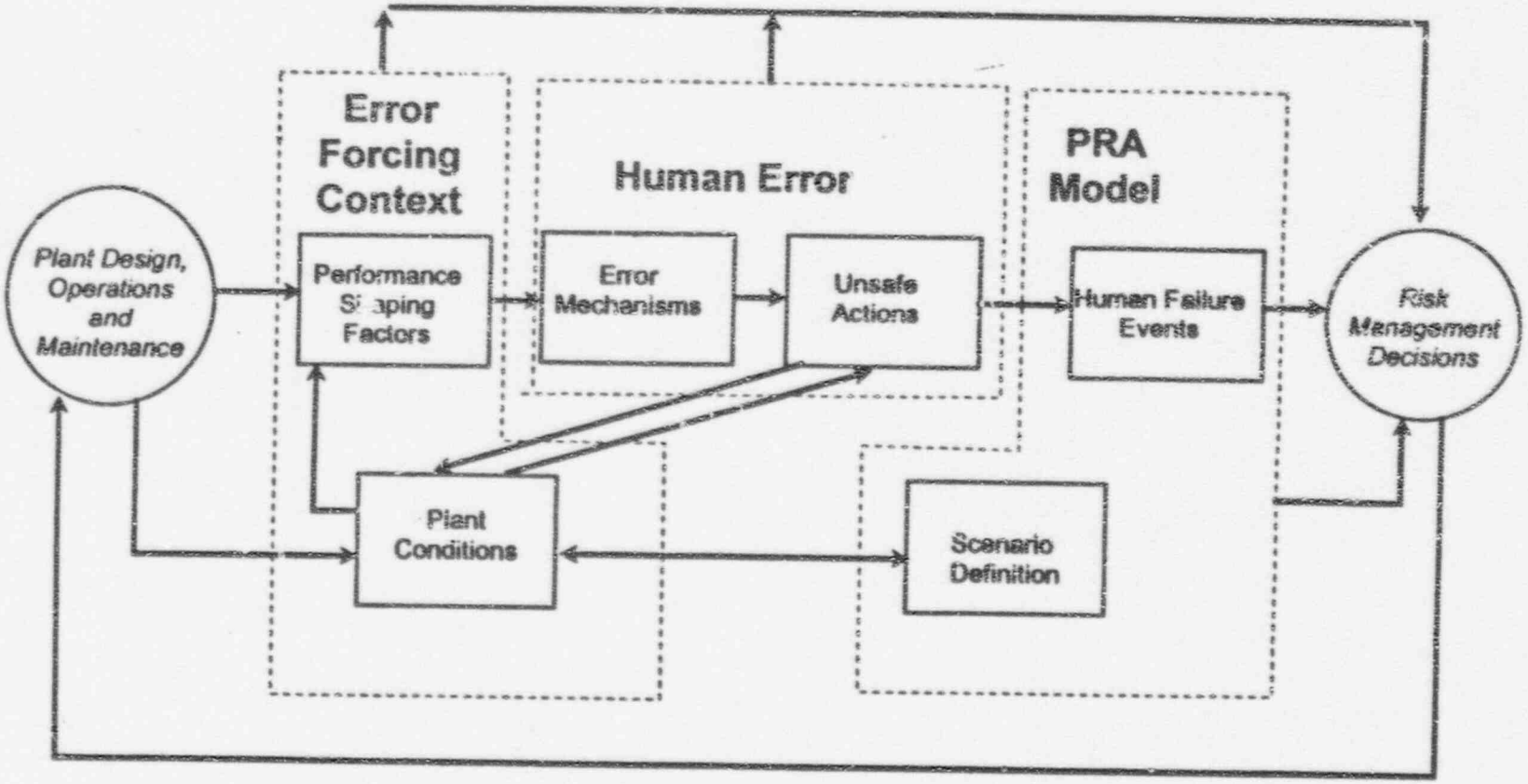


Figure 2.1 Multidisciplinary HRA framework

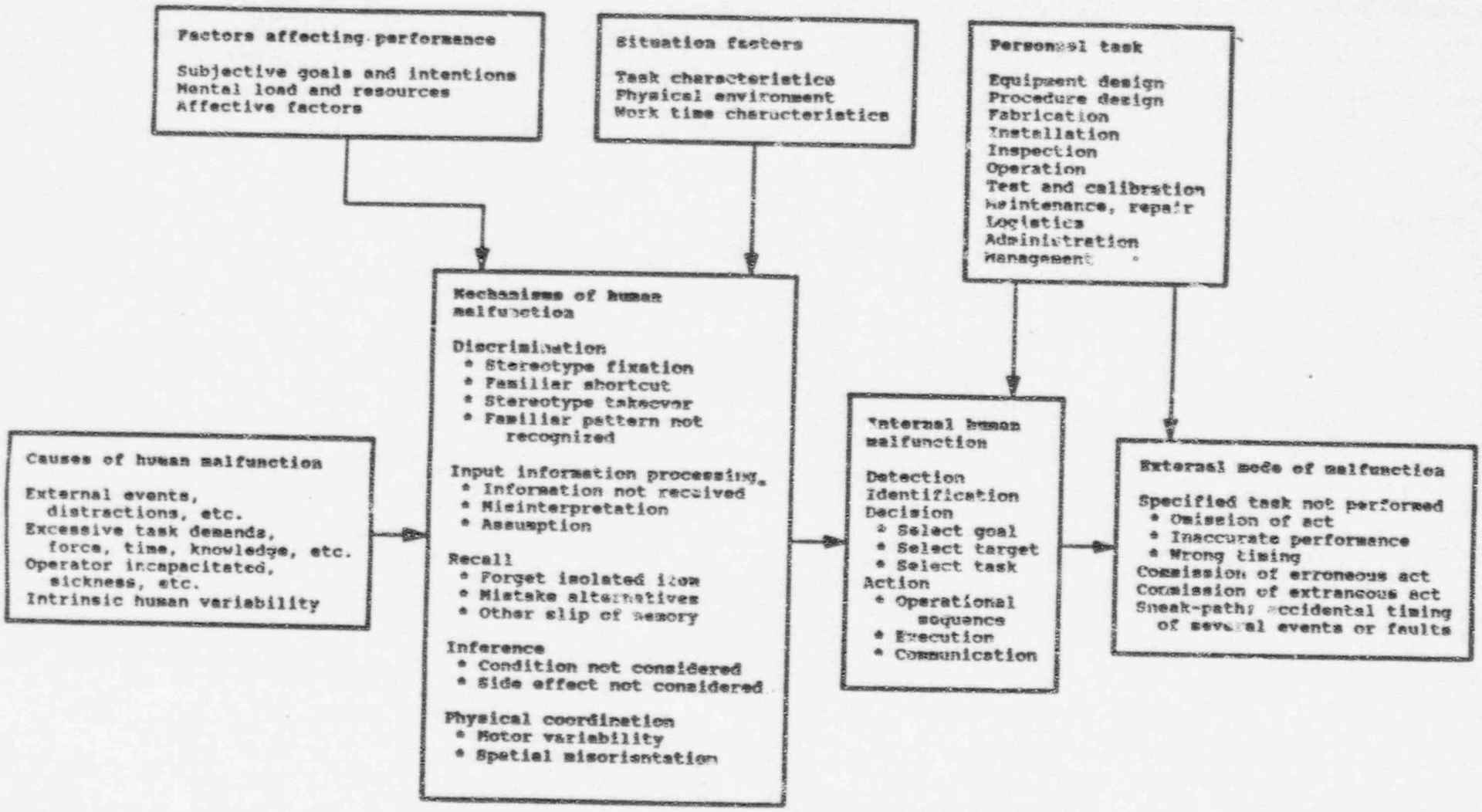


Figure 11.2. Multifaceted taxonomy for description and analysis of events involving human malfunction. [Reproduced from Rasmussen (1982) with permission from John Wiley & Sons, Ltd.]

J. Rasmussen, Information Processing and Human-Machine Interaction, North-Holland, 1986.