February, 1980

REPORT TO THE AIF POLICY COMMITTEE ON FOLLOW-UP TO THE THREE MILE ISLAND ACCIDENT BY THE WORKING GROUP ON ACTION PLAN PRIORITIES AND RESOURCES

I. Introduction

Publication of the NRC Action Plan (draft NUREG-0660) late last year raised serious concern within the nuclear industry that the constructive safety efforts in motion thus far would be diluted by a large mix of new items of lesser value. It also brought forward the prospect of extended and unnecessary delays in the resumption of the licensing process. These concerns were expressed forcefully in AIF Chairman Roger Sherman's January 9, 1980 presentation to the NRC and in AIF President Carl Walske's January 21, 1980 letter to NRC Chairman Ahearne.

In addition to the magnitude of requirements this new collection offered, great uncertainty was created by the lack of definition in many of the specific requirements, the indefinite schedules for implementation, and the open-endedness this suggested. It became apparent that the potential effect of these requirements extended not only to delays in receipt of operating licenses and retrofitting and down-time on operating reactors, but to potentially catastrophic stretchouts on plants in various stages of construction. This problem was discussed at the January 31, 1980 meeting of the utility Ad Hoc Nuclear Oversight Committee, and was specifically addressed at the February 6, 1980 meeting of the AIF Policy Committee on Follow-up to the Three Mile Island Accident.

The result of this was a Policy Committee decision to initiate an intense coordinated industry effort aimed at defining the scope, content, priorities and the individual and collective impacts of the Action Plan requirements. A Working Group on Action Plan Priorities and Resources (see Attachment 1) was thus formed, under the co-chairmanship of

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Stephen H. Howell of Consumers Power Company and Ed Zebroski of NSAC, to define what the Action Plan items mean, what our judgment of priorities is, and to provide our resource and cost estimates for these items.

The course of action the Working Group took and a description of the methods used follow the Results and Conclusions and Recommendations noted below.

II. Results

The product of this report is:

(1) A defined scope description and a priority assessment (see Appendix A) for each line item from Draft 2 of NUREG-0660 that is a licensee action and has not yet been ordered by the NRC;

(2) A summary sheet of priority groups (Attachment 2);

(3) The aggregate of technical man-hours and costs for these line items for all operating plants and all plants with more than 25% construction complete (see Attachment 3);

(4) An estimate of the range of costs and the technical man-hours required for a single unit (Attachment 4).

The cost of all the evaluated items has been included in these totals both for operating plants and those under construction. It is further assumed that changes to operating plants would be made during normal refueling outages or extensions thereto rather than requiring the plant to shut down to incorporate these changes only.

With no further reduction in the number of proposed Action Plan items, a grand total of $3.5 billion capital cost plus $32 billion delay and outage costs and 13 thousand technical man-years would be required industry-wide. On a per unit basis, costs would range from $28 million to $700 million and approximately 100 technical man-years would be required.

The above grand totals are in addition to the cost of those items already ordered, and no cost estimates have been prepared for these previous items. Furthermore, they do not include the impact on plants with less than 25% construction complete or those plants which have applied for construction permits. Consideration of these plants provides an additional cost of $1 billion (this includes an arbitrary 25% reduction in the calculated cost to take into account the potential for less costly changes in this category of plants).

III. Conclusions and Recommendations

It is concluded that:

- The large number of requirements proposed by this Action Plan can be prioritized and reduced by a responsible selection process. This process can lead to an orderly and positive increase in overall safety;

- Failure to reduce this number can have grave impacts on plants in operation and under construction.

To fail to do so would be contrary to safety in that resources would be diverted from important tasks, and contrary to the national interest in that the cost and availability of electrical power would be severely and adversely affected. It would also impose resource requirements beyond the capability of the industry and NRC.

It is recommended that:

- The suggested scope, priority assignment, and target schedules of line items in Appendix A to this report be given serious consideration by the NRC;

- Clear functional objectives and bounding statements be completed on each item that is made a regulatory requirement;

- A realistic "backfitting" policy be developed for both operating plants and plants under construction that recognizes the type and special circumstances of each plant, takes into account measures already underway, and recognizes that it is not necessary, and can be detrimental, to perform all actions immediately or to implement all these before granting operating licenses.

It is stressed that the results and conclusions of this report are the product of this Working Group which, while formed from a broad base of expertise and wide range of company affiliations, are not intended to represent the commitment or conclusions of individual companies.

IV. Working Group Action

Using the combined resources of AIF and NSAC, with contractor support under NSAC, a group of qualified industry representatives was formed and met from February 12 through 15, 1980, in the AIF Bethesda headquarters. Five subgroups were formed to review intensively a collection of prospective Action Plan items (Attachment 5) that had been divided by the Working Group into five functional categories (Attachment 6). The first mission of each subgroup was to develop a definition of the scope and content of each requirement, working with designated NRC liaisons to obtain further clarification.

Simultaneously, a special cost estimating subgroup developed a consistent framework for costing each item. Members of this subgroup were dispersed among each of the five functional subgroups and participated in the development of cost estimates for each specific Action Plan item.

Concurrently, another subgroup, consisting of NSAC and its consultant, Pickard, Lowe & Garrick, Inc., further developed a framework for consistently applying a prioritization methodology. These members were allocated among the functional subgroups to help develop priorities for the items analyzed in each subgroup.

V. Method

A. Scope of Action Items

Original descriptions of the tasks in the Action Plan have been expanded and restated, where necessary, to have sufficient definition of the item to provide a basis for evaluating safety impacts, and for estimating costs and schedules.

Many of the original task descriptions were difficult to evaluate, since the list included a mixture of items of varying levels of detail and intent, such as:

- Prescriptive: statements where a specific design or procedural fix is implied to attain a presumed but unstated safety benefit.
- Functional: statements where a functional objective is stated to attain a defined safety benefit.
- Administrative Process: statements where one or more of a set of administrative steps related to a given topic are given, but functional objectives and expected benefits are not fully specified.

In order to permit systematic evaluations of safety benefits and other attributes, it has been necessary to interpret many of the tasks as follows: Explicitly state the implied functional objectives, estimate a typical concept for implementation, and then develop cost and schedule estimates.

B. Priority Evaluation (See Appendix B)

The method used for evaluating each major component factor and for assigning the overall priority is called a multi-attribute value-impact assessment. The relevant component factors or attributes are assessed by teams of qualified people with the appropriate skills and experience. Semi-quantitative histograms are used to tabulate the prior judgment of each individual and to summarize the best judgment of the group on each attribute. Weightings are assigned to the factors or attributes. The reported assessment is a nonquantitative category judgment based on this process.

The primary attribute of the proposed action is framed in terms of an incremental reduction in public risk realized by the implementation of that item. The factors considered for each item were: (1) the number and importance of accident sequences affected; (2) the likelihood that the action as specified can be implemented and will succeed in gaining significant risk reduction; (3) assessment of hazards or counterproductive effects that implementation of the action might introduce; and (4) the time for implementation of the item assuming good quality assurance.

The "impact" is assessed in terms of the costs, including the factors described below in the summary of the cost methodology.

Each item is evaluated in the context of other related safety actions taken over the years, including those already implemented or committed since TMI-2.

A qualitative categorization of the implementation priority (I, II or III) is made by weighing the various value and impact attributes for each item (Attachment 7). The items are then ranked in order of importance within each of the three priority categories. The ranking within a category implies that sequences or end dates of implementation of lower-ranked items can be stretched out as necessary to optimize the quality of implementation of higher-ranked items.

Plant specific items such as the design, siting, stage of construction, and age could produce different results for each plant. The methods used in this generic evaluation should be used for such a plant-specific application where the generic costs or benefits assumed are not fully applicable.

C. Cost and Schedule Estimates (see Appendix C)

The following logic was followed to develop cost and schedule estimates for each line item:

(1) The scope descriptions were utilized as a starting point from which more refined and detailed requirements were developed. Where possible, quantities of materials, equipment and installation labor were estimated.

(2) In all cases, the required man-years of engineering effort to implement the line item were assessed.

(3) Standard unit costs were applied to the estimated quantity of resources (e.g., a man-year of professional engineering work was priced at $100,000).

(4) Indirect costs such as "Allowance for Funds Used During Construction" and "Owners" costs were applied to the previously estimated direct capital costs.

(5) Annual operations and maintenance costs were estimated where applicable (e.g., control room personnel and supplies).

(6) Schedule durations were estimated for the engineering, procurement, and installation activities associated with each line item.

(7) The cost of delayed construction completion and, in the case of operating plants, the cost of forced or extended outages (attributable to the implementation of NUREG-0660 requirements) were assessed.

(8) The costs were aggregated on an industry-wide basis and a range prepared on a per plant basis.

The schedules and cost estimates were prepared in cooperation with experienced utility and architect-engineer representatives.

D. Relationship of the Action Plan to Overall Activities Associated with Public Safety

The evaluation and priority effort was limited to approximately 51 items which were the additional steps to be taken for operating licenses. The evaluation of these items must be taken in the context of the much broader range of regulatory activities which the NRC has under way for all plants. Most of these items represent added requirements (or shifts in priority or accelerated schedules) which must be closely coordinated with the on-going activities.

In nearly every case there is a group of related activities aimed at a common objective. Any one task of such a related group could be evaluated separately and might show significant value (that is, practical and beneficial safety impact). However, the same task may have marginal or no value when taken in the context of a group of related tasks which are already committed to the same objective. Marginal or duplicative items can even be directly counter-productive to safety:

- If they are mandated on a short schedule, diverting or diluting the effort and quality of implementation of related tasks of higher direct value, or

- If they are inadequately defined, the effort to accomplish them is open-ended and they further divert and waste resources by needing to be redone.

Some of the items which are barely mentioned in the Action Plan have the potential for larger impacts on resources and on plant operability than all of the other items combined. This leaves open a major contingency on the evaluation and priority of many of the items evaluated here. For example, specific concerns are noted on filtered vented containment and on the treatment of class 9 events. Both of these activities have the potential for dominant impacts in that they could imply change or abandonment of some fundamental elements of design bases for containments and de-emphasis or abandonment of probabilistic analysis as a guide to improved design and operation. Both of these activities appear to be driven by perceptions of a "narrowly averted (much greater) catastrophe" at Three Mile Island which are notions that have become popular but are not supported by analysis. For such major-impact items it is especially crucial to actual public safety that an orderly, deliberate, rational, and analytical process be used in treating such issues. Specifically, it is important that functional objectives be developed and the full range of options to meet the functional objectives be identified and evaluated with a systematic decision process before committing to uncharted options of uncertain value.

ATTACHMENTS TO THE REPORT

1. Working Group Membership List
2. Summary Sheet of Priority Groups
3. Cost and Technical Man-Years for Action Plan Line Items
4. Range of Costs and Technical Man-Years Required Per Unit
5. Listing of Action Plan Items Evaluated by Category
6. Grouping of Action Plan Items by Objective
7. Definition of Priority Groups

APPENDICES TO THE REPORT

A. Scope Statements and Priority Evaluation Summaries

B. Description of Methdology for Priority Evaluation

C. Description of Cost and Schedule Estimation Methodology

Attachment 1

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Attachment 2

SUMMARY SHEET OF PRIORITY GROUPS
(with items ranked within Priority Groups by Category)

Category*

Priority Group	A	B	C	D	E
I	II.C.1.1 & II.C.1.3 I.B.1.2 & I.C.5 I.E.6	I.A.2.1(Part) I.A.3.1(Part)		II.B.4 II.E.4.4 II.K.1 II.E.1.1	
II	II.E.2.1 I.E.4	I.C.7(Part) I.A.2.1(Part) I.A.4.2 I.A.2.2 I.G I.A.4.1	III.D.3.4 I.A.1.3 I.D.3 I.D.1 I.D.2 II.F.3	II.E.2.3 II.B.7 II.B.9	III.D.1.2 III.D.1.6 III.A.1.3 III.D.3.3
III		I.A.2.5 I.C.8 I.B.1.1 II.J.3.1 I.A.3.1(Part) III.A.3.3 I.A.3.2 I.B.1.5 III.D.3.1 I.A.2.1(Part)	I.C.9 II.K.3	II.E.4.3 II.D.4	III.D.1.3 III.D.1.5 III.D.2.4 III.D.3.5 III.D.3.2 III.D.2.3 III.D.2.5 III.D.2.1

*Description of Categories is attached.

Note: 1. Items are identified by the numbering system from Draft 2 of NUREG-0660. A list of titles is attached.

2. Some items have had scope or schedule clarified or redefined.

3. Item II.K.3 is listed under Priority III; this item has many parts, some of which are judged to be Priority I and II--see the Priority Evaluation for details.

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

SUMMARY OF ALL PRIORITY GROUPS

Priority Group	Annual Operating & Maintenance		Engineering Man-Years					Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
	Cost	Man Years/Year	1980	1981	1982	Beyond 1982	Total					
I	53.5	549	713	87	89	142	1,031	114.8	14.0	128.8	21.0	1,260
II	32.1	434	2,780	4,361	1,521	2,050	10,812	2,405.2	401.1	2,806.3	[illegible]34.0	5,544
III	21.5	641	531	451	105	377	1,464	511.1	110.1	621.2	115.2	31,580
Total	107.1	1,624	4,024	4,899	1,815	2,569	13,307	3,031.1	525.2	3,556.3	670.2	(See Note)

Note: Schedule delay costs shown represent the most critical single action item from each Priority Group.

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

SUMMARY OF ALL CATEGORIES

Category	Annual Operating & Maintenance		Engineering Man-Years					Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
	Cost	Man Years/Year	1980	1981	1982	Beyond 1982	Total					
A	24.8	248	5	87	89	98	279	40.3	6.1	46.4	-	210
B	31.2	865	322	221	54	376	973	146.8	9.2	156.0	115.2	4,748
C	12.3	247	2,461	4,013	1,479	1,769	9,722	2,164.4	378.1	2,542.5	534.0	5,514
D	25.9	70	772	149	-	131	1,052	188.3	20.2	208.5	21.0	1,260
E	12.9	194	464	429	193	195	1,281	491.3	111.6	602.9	-	31,580
Total	107.1	1,624	4,024	4,899	1,815	2,569	13,307	3,031.1	525.2	3.556.3	670.2	(See Note)

Note: Schedule delay costs shown represent the most critical single action item from each Category.

Priority Group I

Category A

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance Cost	Annual Operating & Maintenance Man Years/Year	Engineering Man-Years 1980	1981	1982	Beyond 1982	Total	Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
II.C.11	6.2	62	-	52	52	82	186	18.6	4.2	22.8	-	-
I.E.6	3.1	62	-		26	5	31	15.5	1.6	17.1	-	-
I.B.1.2	15.5	124	5	35	11	11	62	6.2	0.3	6.5	-	210
Total	24.8	248	5	87	89	98	279	40.3	6.1	46.4	-	

Priority Group I

Category B

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance Cost	Annual Operating & Maintenance Man Years/Year	Engineering Man-Years 1980	Engineering Man-Years 1981	Engineering Man-Years 1982	Engineering Man-Years Beyond 1982	Engineering Man-Years Total	Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
I.A.3.1	9.4	161	104	-	-	-	104	5.2	0.4	5.6	-	-
I.C.7	-	-	12	-	-	-	12	1.2	0.1	1.3	-	-
I.A.2.1(a)	3.1	62	31	-	-	-	31	3.1	0.2	3.3	-	-
I.A.2.1(d-1)	-	-	-	-	-	-	-	-	-	-	-	-
I.A.2.1(e)	1.6	31	-	-	-	-	-	-	-	-	-	-
I.A.2.1(f)	0.7	[illegible]	-	-	-	-	-	-	-	-	-	-
I.A.2.1(g)	1.6	3	-	-	-	-	-	-	-	-	-	-
Total	16.4	30	147	-	-	-	147	9.5	0.7	10.2		

Priority Group I

Category D

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance Cost	Annual Operating & Maintenance Man Years/Year	Engineering Man-Years 1980	Engineering Man-Years 1981	Engineering Man-Years 1982	Engineering Man-Years Beyond 1982	Engineering Man-Years Total	Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
II.B.4	12.3	0.2	149	-	-	36	185	18.5	2.0	20.5	-	-
II.K.1	-	-	304	-	-	-	304	30.4	1.8	32.2	-	-
II.E.1.1	-	-	76	-	-	-	76	7.6	0.6	8.2	-	-
II.E.4.4	-	-	32	-	-	8	40	8.6	2.8	11.4	21.0	1,260
Total	12.3	0.2	561	-	-	44	605	65.1	7.2	72.3	21.0	

Priority Group II

Category B

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance		Engineering Man-Years					Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
	Cost	Man Years/Year	1980	1981	1982	Beyond 1982	Total					
I.G	-	-	12	8	14	72	106	5.3	0.3	5.6	-	1,187
III.D.3.1	-	-	6	12	28	144	190	24.8	7.3	27.1	-	
III.A.3.3	1.2	31	-	168	12	72	252	68.5	2.8	71.3	-	4,748
I.A.4.1	-	-	18	28	-	-	46	4.6	0.1	4.7	-	-
I.A.4.2	-	-	-	-	-	-	-	-	-	-	-	-
I.A.2.2	3.1	62	-	-	-	-	-	0.1	-	0.1	-	-
II.J.3.1	-	-	1	5		-	6	0.6	-	0.6	-	-
II.A.2.1(b)	1.6	31	-	-	-	-	-	-	-	-	-	-
I.A.2.1(c)	0.7	16	-	-	-	-	-	-	-	-	-	-
Total	6.6	140	37	221	54	288	600	103.9	5.5	109.4	-	

Priority Group II

Category C

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance Cost	Annual Operating & Maintenance Man Years/Year	Engineering Man-Years 1980	Engineering Man-Years 1981	Engineering Man-Years 1982	Engineering Man-Years Beyond 1982	Engineering Man-Years Total	Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
I.D.3	6.1	123	823	1,485	743	720	3,771	602.7	124.1	726.8	-	5,544
I.A.1.3	-	-	124	124	-	60	308	64.6	9.7	74.3	-	-
I.D.1	-	-	198	297	99	144	738	179.6	29.8	209.4	-	2,184
I.D.2	3.1	62	229	297	149	144	819	442.8	72.9	515.7	-	2.457
III.D.3.4	-	-	153	128	26	-	307	54.3	9.3	63.6	-	-
II.F.3	3.1	62	896	1,667	448	48	3,659	803.7	132.3	936.0	534	2,457
II.K.3(6)	-	-	17	-	-	-	17	1.7	-	1.7	-	-
Total	12.3	247	2,440	3,998	1,465	1,716	9,619	2,149.4	378.1	2,527.5	534	

Priority Group II

Category D

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance Cost	Annual Operating & Maintenance Man Years/Year	Engineering Man-Years 1980	Engineering Man-Years 1981	Engineering Man-Years 1982	Engineering Man-Years Beyond 1982	Engineering Man-Years Total	Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
II.E.2.3	-	-	13	-	-	3	16	1.6	0.1	1.7	-	-
II.B.7	10.5	8	79	-	-	19	98	14.4	1.2	15.6	-	-
II.B.9	-	-	99	-	-	24	123	52.0	5.5	57.5	-	-
Total	10.5	8	191	-	-	46	237	68.0	6.8	74.8	-	

Priority Group II

Category E

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance		Engineering Man-Years					Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
	Cost	Man Years/Year	1980	1981	1982	Beyond 1982	Total					
III.A.1.3	0.1	-	12	-	-	-	12	1.2	0.2	1.4	-	-
III.D.3.3	1.2	25	25	49	49	-	123	37.0	5.5	42.5	-	1,386
III.D.1.2	-	-	40	41	-	-	81	14.2	1.7	15.9	-	504
III.D.1.6	1.4	14	35	52	53	-	140	31.5	3.3	34.8	-	-
Total	2.7	39	112	142	102	-	356	83.9	10.7	94.6	-	

ATTACHMENT 3

Priority Group III

Category B

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance		Engineering Man-Years					Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
	Cost	Man Years/Year	1980	1981	1982	Beyond 1982	Total					
I.B.1.5	-	-	-	-	-	-	-	-	-	-	68.4	-
I.B.1.1	5.0	-	-	-	-	-	-	-	-	-	-	-
I.A.3.1	-	-	-	-	-	-	-	-	-	-	-	-
I.A.2.5	3.1	52	-	-	-	-	-	-	-	-	46.8	-
I.C.8	-	-	18	-	-	-	18	1.8	0.1	1.9	-	-
I.A.3.2	-	-	-	-	-	-	-	0.6	-	0.6	-	-
I.A.2.1 (d-2)	0.1	372	120	-	-	88	208	31.0	2.9	33.9	-	-
Total	8.2	424	138	-	-	88	226	33.4	3.0	36.4	115.2	

ATTACHMENT 3

Priority Group III

Category C

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance		Engineering Man-Years					Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
	Cost	Man Years/Year	1980	1981	1982	Beyond 1982	Total					
I.K.3(1)	-	-	15	15	14	-	44	5.1	-	5.1	-	-
II.K.3(2)	-	-	-	-	-	53	53	6.8	-	6.8	-	-
II.K.3(3)	-	-	-	-	-	-	-	2.5	-	2.5	-	-
II.K.3(7)	-	-	6	-	-	-	6	0.6	-	0.6	-	-
Total	-	-	21	15	14	53	103	15.0	-	15.0	-	

Priority Group III

Category D

ATTACHMENT 3

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance Cost	Annual Operating & Maintenance Man Years/Year	Engineering Man-Years 1980	Engineering Man-Years 1981	Engineering Man-Years 1982	Engineering Man-Years Beyond 1982	Engineering Man-Years Total	Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
II.E.4.3	3.1	62	-	149	-	36	185	49.2	5.7	54.9	-	-
II.D.4	-	-	20	-	-	5	25	6.1	0.5	6.6	-	-
Total	3.1	62	20	149	-	41	210	55.3	6.2	61.5	-	

ATTACHMENT 3

Priority Group III

Category E

COST AND TECHNICAL MAN-YEARS
FOR ACTION PLAN LINE ITEMS

Total Nuclear Industry
(All Costs in $ Millions)

Item	Annual Operating & Maintenance Cost	Annual Operating & Maintenance Man Years/Year	Engineering Man-Years 1980	Engineering Man-Years 1981	Engineering Man-Years 1982	Engineering Man-Years Beyond 1982	Engineering Man-Years Total	Direct Capital Costs	AFUDC & Owner's Costs	Total Capital Costs	Outage Costs	Cost of Schedule Delays for Plants Under Constr./NTOL
III.D.3.2	1.4	-	62	-	-	-	62	6.1	0 .5	6. 6	-	-
III.D.2.5	-	-	31	-	-	-	31	1.6	0.1	1. 7	-	-
III.D.2.1	4.4	82	-	-	-	164	164	208.8	76.2	285. 0	-	31,580
III.D.3.5	1.5	31	-	-	31	31	62	7.8	0.6	8.4	-	-
III.D.2.3	0.4	7	14	124	-	-	138	15.8	1.5	17.3	-	-
III.D.1.5	0.6	4	80	60	20	-	160	100.0	16.5	116. 5	-	-
III.D.2.4	1.9	31	124	62	-	-	186	47.1	2.4	49.5	-	504
III.D.1.3	-	-	41	41	40	-	122	20.2	3.1	23.3	-	1,386
Total	10.2	155	352	287	91	195	925	407.4	100.9	508.3	-	

Attachment 4

Range of Costs and
Technical Man-Years Per Unit

($ Millions)		Priority Group	
I. Operating Units	I	II	III
A. Minimum Average Cost Per Unit	1.1	22.8	5.1
B. Maximum Average Cost Per Unit	1.4	30.4	6.7
II. Under-Construction Units			
A. Minimum Average Cost Per Unit	1.1	22.8	5.1
B. Maximum Average Cost Per Unit	232.1	526.8	1,055.1
III. Engineering Man-Years Per Unit	8.0	88.0	12.0

Notes:

A. It is important to recognize that the per-unit figures are indeed averages and carry with them all of the potential interpretational hazards inherent with averaged data. Obviously, the cost for any specific unit may be substantially more or less than the averages stated.

B. The costs displayed in the above table were developed in the following manner:

(1) Minimum Average Cost Per Unit was determined by dividing the Total Industry Capital Cost for each priority group by the number of operating and under-construction units considered. For example:

(a) Total industry capital cost for Priority Group II is $2,806.3 Million (see Attachment 3);

(b) Total number of units (operating and under-construction) considered was 123 (see Exhibit A to Appendix C);

(c) Therefore, the minimum average capital cost per operating or under-construction unit is:

$2,806.3 Million ÷ 123 = $22.8 Million.

(2) Maximum Average Cost Per Operating Unit was calculated by adding the Minimum Average Cost Per Unit to the average outage cost per unit, which was determined as follows:

(a) Total industry outage cost for Priority Group II is $534.0 Million (see Attachment 3);

(b) Total number of operating units considered was 70 (see Exhibit A to Appendix C);

(c) Therefore, the average outage cost per operating unit is $534.0 Million ÷ 70 = $7.6 Million.

(3) Maximum Average Cost Per Under-Construction Unit was calculated by adding the Minimum Average Cost Per Unit to the maximum schedule delay cost per unit, which was determined as follows:

For Priority Group II, the Action Item was identified which had the most critical construction schedule impact, which was I.D.3. The Total Industry cost for the schedule delay associated with this Action Item was $5.5 Billion (see Attachment 3). Of the group of units included in the $5.4 Billion figure, the cost to the single most adversely affected unit was $504 Million. $504 Million is, therefore, the maximum schedule delay cost per unit.

Attachment 5

LISTING OF NUREG-0660, DRAFT 2 ITEMS EVALUATED BY CATEGORY

CATEGORY A

Number	Title
I.C.5	Licensee Dissemination of Operating Experience
I.E.4	Coordination of Operational Evaluation Program
I.E.6	Reporting Requirements
I.B.1.2	Safety Engineering Group
II.E.2.1	Determine and Decrease Frequency of ECCS Challenges
II.C.1.1	Mini-IREP
II.C.1.3	Reliability Assurance

CATEGORY B

Number	Title
I.A.3.1	Revised Scope and Criteria for Licensing Examinations
I.A.2.1	Immediate Upgrading of Operator and Supervisor Training and Qualification
I.A.2.5	Plant Drills
I.A.4.1	Initial Simulator Improvement
I.A.4.2	Long-Term Training Simulator Upgrade
I.A.2.2	Training and Qualification of Other Operations Personnel
I.B.1.1	Organization and Management Criteria
I.B.1.5	Loss of Safety Function
II.J.3.1	Organization and Staffing
III.A.3.3	Communication
III.D.3.1	Radiation Protection Plans
I.A.3.2	Personnel Selection Process

CATEGORY B (Continued)

Number	Title
I.C.7	NSSS Vendor Review of Procedures
I.C.8	Pilot Monitoring of Selected Emergency Procedures for Near-term Operating License Applicants
I.G	Training During Low Power Testing

CATEGORY C

Number	Title
I.A.1.3	Shift Manning
I.C.9	Long-term Program for Analysis of Transients and Accidents for Procedure Development and Upgrading, Including IE Inspection of Procedures and Lead Plant Onsite Audit
III.D.3.4	Control Room Habitability
I.D.1	Control Room Design Reviews
I.D.2	Plant Safety Parameter Display Console
II.F.3	Instruments for Monitoring Accident Conditions (Regulatory Guide 1.97)
I.D.3	Safety System Status Monitoring
II.K.3	Generic Review Matters - Small Break LOCAs and Loss of Feedwater Accidents

CATEGORY D

Number	Title
II.B.4	Degraded Core - Training
II.E.2.3	Treatment of Uncertainties in ECCS Performance Predictions for Small Break LOCAs
II.B.7	Containment Inerting
II.E.4.3	Gross Containment Integrity Check

CATEGORY D (Continued)

Number	Title
II.B.9	Conceptual Designs for the Mitigation of Severe Core Accidents
II.D.4	Automatic Closure of the PORV Block Valve
II.E.4.4	Containment Purge
II.E.1.1	Auxiliary Feedwater System Reliability
II.K.1	IE Bulletins on Measures to Mitigate Small Break LOCAs and Loss of Feedwater Accidents

CATEGORY E

Number	Title
III.D.1.3	Secondary Systems
III.D.1.5	Auxiliary and Radwaste Building Ventilation
III.A.1.3	Maintain Supplies of Thyroid Blocking Agent (Potassium Iodide)
III.D.2.3	Liquid Pathway Radiological Control
III.D.3.3	In-Plant Radiation Monitoring (Partial)
III.D.3.5	Radiation Worker Exposure Data Base
III.D.2.4	Offsite Dose Measurements
III.D.2.5	Offsite Dose Calculation Manual
III.D.3.2	Health Physics Improvements
III.D.1.2	Improved Vent Gas Systems
III.D.2.1	Radiological Monitoring of Effluents
III.D.1.6	Radioiodine Adsorber Criteria

GROUPING OF RELATED ITEMS BY OBJECTIVE

CATEGORY A = MAKING THE CUMULATIVE LEARNING PROCESS WORK.

CATEGORY B = ORGANIZATION/TRAINING THAT SET THE PROPER ENVIRONMENT OR CLEARLY HELP THE OPERATOR TO AVOID MISINTERPRETING AN ABNORMAL EVENT OR MAKING AN OPERATIONAL ERROR.

CATEGORY C = DIRECTLY ASSISTING THE PLANT OPERATOR TO AVOID MISINTERPRETING AN ABNORMAL EVENT OR MAKING AN OPERATIONAL ERROR.

CATEGORY D = DIRECTLY PREVENTING, OR COPING WITH DEGRADED CORE COOLING.

CATEGORY E = PREVENTION, EVALUATION, OR MITIGATION OF RADIOLOGICAL RELEASES.

Attachment 7

Definition of Priority Groups

Group I

Items that are desirable to do on a priority basis with realistic schedules. NRC scope and schedule have been refined and modified in some cases.

Group II

Items that may be desirable to do but should be planned and scheduled to stay within resource capabilities and not detract from the accomplishment of Priority Group I items or completion of the plant. Some items may need additional limiting definition.

Group III

Items that should be removed from the Action Plan as they are presently defined because (a) the item is clearly defined and a safety evaluation shows that there is insufficient benefit to pursue; (b) the item is inadequately defined to make a benefit judgment and therefore additional study is required before an assessment can be made; or (c) the item appears to have some benefit, but more information and definition is needed to determine the appropriate action.

REPORT TO THE AIF POLICY COMMITTEE ON FOLLOW-UP

TO THE THREE MILE ISLAND ACCIDENT

BY THE

WORKING GROUP ON ACTION PLAN PRIORITIES AND RESOURCES

APPENDICES

A. Scope Statements and Priority Evaluation Summaries

B. Description of Methodology for Priority Evaluation

C. Description of Cost and Schedule Estimation Methodology

Appendix A

Scope Statements and Priority

Evaluation Summaries

CATEGORY A

SCOPE STATEMENTS AND PRIORITY EVALUATIONS

(IN ORDER OF PRIORITY)

Number	Title
II.C.1.1 and II.C.1.3	Mini-IREP and Reliability Assurance
I.B.1.2 and I.C.5	Safety Engineering Group and Licensee Dissemination of Operating Experience
I.E.6	Reporting Requirements
II.E.2.1	Determine and Decrease Frequency of ECCS Challenges
I.E.4	Coordination of Operational Evaluation Program

II.C.1.1 Mini-IREP
and
II.C.1.3 Reliability Assurance

SCOPE STATEMENT

Clarification Based on NRC Discussion

The NRC presented two separate and distinct items involving reliablity, Items II.C.1.1 and II.C.1.3, Integrated Reliability Evaluation Program (IREP) and Reliability Engineering, respectively. Discussions with Frank Rowsome of NRC/RES/PAS indicated the two items were closely linked. The evaluation team has assumed that items II.C.1.1 and II.C.1.3 will be combined to form an overall program providing assurance of plant reliability.

NRC and their consultants will perform Interim Reliability Evaluation Program (IREP) studies; licensees will be required to furnish information. The first six plants (after Crystal River-3) will be completed in 1980, and the remaining operating plants during the next three years. IREP studies will not be required of NTOL applicants prior to receiving an operating license, but these plants will be covered eventually by the IREP program.

Licensees will be required to implement a Reliability Assurance Program based on NRC developed criteria (to be issued in late 1981). It is assumed that initial licensee action will be use of insights gained from IREP studies and multidisciplinary engineering review (performed by a group such as the Safety Engineering Group). (See item II.B.1.2.)

PRIORITY EVALUATION

Overall risk improvement resulting from these Action Plan items was judged to be high. Accomplishment of an IREP for each reactor could certainly impact dominant core melt and core damage sequences, as well as many less likely sequences. Reliability engineering, relying upon good engineering judgment in evaluating plant design, procedures, and operations, could also impact dominant core melt and core damage sequences as well as less likely sequences. Hazard introduction was felt to be minimal or low. However, depending upon how the Reliability Assurance Program is established and implemented, manpower resources could possibly be diluted from other significant items.

Application or implementation of the IREP would have a high likelihood of success. This is basically due to the methodical approach used in this type of study. It will probably take at least three (and more likely four) years to complete an IREP for all reactors. Applications of generic results will begin at the completion of the Crystal River-3 study, but will not have a major impact until the next six plants are completed, which is likely to be in late 1980.

An important factor requiring consideration is the integration or combining of functions under the Reliability Assurance Program with the Safety Engineering Group (Item II.B.1.2) on a long term basis. This would minimize the incremental manpower required to implement both programs and is therefore highly recommended.

A cost of $100K/year during 1980 through 1984, and $30K/year for several more years would be required. This effort would be required to apply IREP generic results to each plant and support the IREP study by providing necessary data on each plant. No estimate of resulting changes at each plant is included.

This program is judged to be Priority I based on the high risk improvement with a relatively low cost.

I.B.1.2 Safety Engineering Group
and
I.C.5 Licensee Dissemination of Operating Experience

SCOPE STATEMENT

Items I.B.1.2 and I.C.5 were judged to be closely related and therefore were combined for purposes of this evaluation.

Condensation of NRC Description

NRR will develop criteria for a full time, clearly identifiable on-site safety engineering group. NRR will consider the interaction of this group with other committees and groups to assure its effectiveness and to avoid duplication. Each licensee will review its administrative procedures to assure that operating experience from within and outside its organization is continually provided to operators and other operations personnel and is incorporated into training programs.

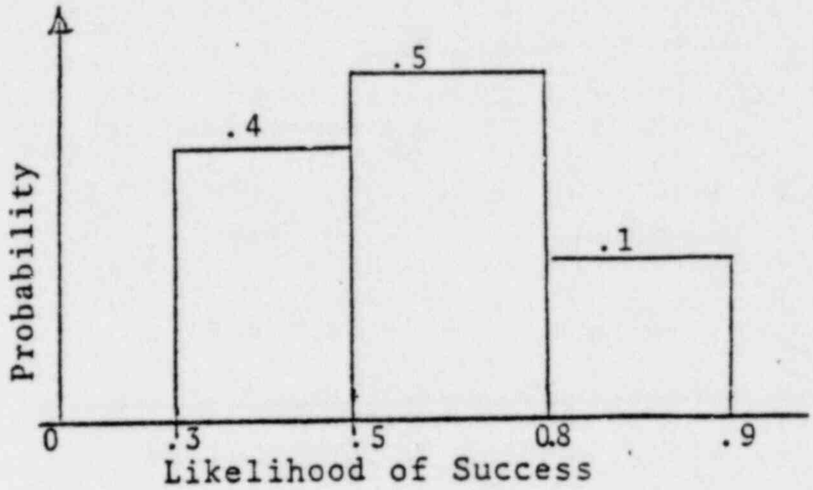
Clarification Based on NRC Discussion

The above scope statement indicates that this group should be located "onsite", but our judgment, confirmed by discussion with NRC personnel, indicates a full time "onsite" requirement is unnecessary; on the other hand, the group should be fully aware of site activities and their relationship to activities of other licensees. The feedback from the onsite activities of other licensees can be obtained by having direct input from the entity responsible for distributing operating experience.

The general function of this group is to review, evaluate, and disseminate operating experience reports, both external and internal (sources such as NSAC and INPO could be utilized for information). Since the actual objectives of the group are not clear, it is strongly felt that the NRC should define the more specific functions. Once this is done, industry can assist in developing specific requirements and procedures - such as through INPO. Following this, the various licensees would develop and identify the group as best fits the individual utility structure so as to accomplish the function in the most efficient manner. Efficiency will minimize cost and maximize the effectiveness in affecting plant safety in a positive manner.

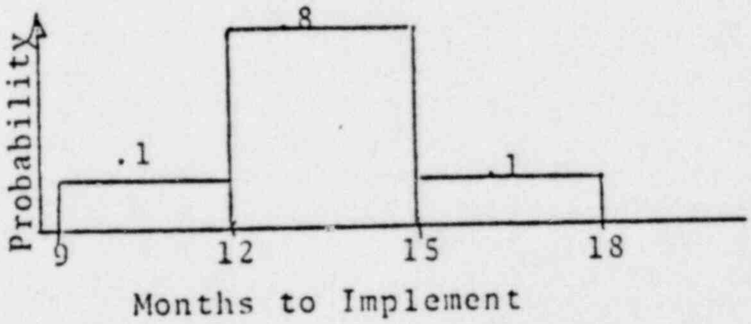
PRIORITY EVALUATION

Because this group will be reviewing all significant occurrences at all nuclear plants, it is judged that they could impact all accident sequences. The likelihood of success was derived by a histogram as shown below. It was assumed that the NSAC LER program was in place.



Important factors in this assessment are group size, thoroughness of analysis work dsone by the group, education and experience of the group, and attitude of operating staff to the working group. No hazards were identified that could result from this action; an overall risk improvement was judged to be medium.

The following histogram represents an evaluation of the time required to implement the program and achieve maximum effectiveness.



An additional expenditure of $100K/year (two additional engineers full-time) would be needed to support this group.

This item is judged to be Priority I based on the medium degree of risk reduction at moderate cost.

I.E.6 Reporting Requirements

SCOPE STATEMENT

NRC Description

Improved reporting requirements are necessary to assure that the information for the assessment of facility performance and operational safety is uniformly provided by all licensees in the most efficient manner. A rule is being prepared for Commission action to cover the immediate reporting of significant events. Licensees will propose technical specifications that incorporate revised reporting requirements.

Alternative Scope Statement

The present LER system has resulted in various interpretations by licensees as to what is to be reported or when a report is required. In addition, the negative connotation given to LERs may be a detriment to the reports themselves.

It was judged that the wording of this item could be improved to reflect the concerns and a meaningful result could be achieved in event reporting. Such improved requirements would convert LERs to more meaningful "Operational Experience Reports," and this item was evaluated on this basis.

PRIORITY EVALUATION

In evaluating this item it has been assumed that the improved requirements will be structured to do away with the negative and punitive connotation for reporting of operating experience. Instead, the improved requirements are assumed to incorporate a reporting philosophy similar to that embraced by NASA in their highly successful efforts to learn from experience. Reporting of experience must <u>never</u> be the basis for punitive action--only <u>failing to report or willful violation of approved practice should be the basis for</u> punitive action.

It is also assumed that the improved event reporting system will not require reporting of minor failures or malfunctions as "Operating Experience Reports" but will relegate them to a data collection system. NPRDS as currently configured is not a suitable data system for this purpose since it does not contain demand data (to allow computation of failure rate), and it covers only a portion of the systems and components of interest. If these two shortcomings are remedied, the reconfigured system could serve to collect this data. Implementing a reconfigured reliability data system is outside the scope of this item and has not been included in the cost estimate.

Improved reporting requirements would cover a broad range of sequences and lead to improved plant availability since additional information would be made available. The more important sequences are judged to be largely covered in the current LER reporting scheme. The overall risk reduction, then, was felt to be moderate. No hazard was determined to be introduced by this Action Plan item.

Success likelihood is high since the improved reporting would be designed to make information readily available and apparent. It is anticipated that it will take 18 to 20 months to implement this item. This assumes that the NRC schedule is adhered to, and comments back to the NRC are timely in both reporting and implementation. The implementation costs are judged to total $25K per plant per year.

This item is judged to be Priority I because of the high potential for improving plant availability and safety with a low expenditure of resources.

II.E.2.1 Determine And Decrease the Frequency of ECCS Challenges

SCOPE STATEMENT

NRC Description

NRC will instruct all licensees and applicants to provide a report that details experience with ECCS actuation (such as conditions, cause, frequency, and results), compares cumulative experience with design bases for ECCS, and assesses the reliability of the system to perform its intended function under these conditions. The licensee will develop experience analysis and conclusions on ECCS operations and identify intended changes with an implementation schedule.

Alternative Scope Statement

It has not been shown that there is a need to decrease the frequency of ECCS actuation. This fact was concurred with during discussions with an NRC/NRR representative. It was also agreed that a more reasonable action would be the collection of data on operating experience with the ECCS. When the operating experience actuation data are obtained (i.e., conditions, cause frequency, results, etc.) a factual basis will be available so that a determination can be made as to whether the actuation frequency should be changed. Thus the group evaluated this item assuming its title and intent is limited to: "Determine the Frequency of ECCS Activation During Plant Operations and Testing."

PRIORITY EVALUATION

It was judged that in the process of collecting data from its own records a utility may gain additional insights into plant performance. While an accurate record of ECCS experience is likely to result, the likelihood of achieving a reduced risk was judged to be low as the person collecting data is not doing so with the intent of plant improvement. While no hazard is introduced by this activity, the chances of reducing the overall risk were felt to be small.

Although only six months would be required to search out the data, record it, and mail, additional time might be required for resolution of comments on the data with the NRC via phone.

Despite the small commitment of resources, the overall risk reduction potential resulted in a judgment that this item should be Priority II.

I.E.4 NRC Coordination of Operational Evaluation Program

SCOPE STATEMENT

Condensation of NRC Description

This item is primarily an NRC action to assure regulatory coordination with industry operational data assessment.

PRIORITY EVALUATION

As this is an organizational item, it would only catch those operational events which are relatively insignificant. The coordination does not directly contribute to the evaluation effort and was judged to have a likelihood of success of only 20%. Although no new hazards would be introduced by this activity, the overall risk reduction is potentially low.

Only a few meetings should be required to agree upon a level of information exchange; these could be conducted over a six-month period for a cost that should not exceed $5K/plant.

Despite the low commitment of resources, this item is judged to be Priority II due to its low impact on risk improvement.

CATEGORY B

SCOPE STATEMENTS AND PRIORITY EVALUATIONS

(IN ORDER OF PRIORITY)

Number	Title
I.A.2.1	Immediate Upgrading of Operator and Supervisor Training and Qualification
I.A.3.1	Revised Scope and Criteria for Licensing Examinations
I.C.7	NSS Vendor Review of Procedures
I.A.4.2	Long-Term Training Simulator Upgrade
I.A.2.2	Training and Qualification of Other Operations Personnel
I.G	Training During Low Power Testing
I.A.4.1	Initial Simulator Improvement
I.A.2.5	Plant Drills
I.C.8	Pilot Monitoring of Selected Emergency Procedures for Near-term Operating License Application
I.B.1.1	Organization and Management Criteria
II.J.3.1	Organization and Staffing
III.A.3.3	Communication
I.A.3.2	Personnel Selection Process
I.B.1.5	Loss of Safety Function
III.D.3.1	Radiation Protection Plans

I.A.2.1 Immediate Upgrading of Operator and Supervisor Training and Qualification

SCOPE STATEMENT (condensation of NRC description)

Immediately upgrade operator and supervisor training and qualifications. The following items are specified:

a) Provide specific improvements in training and qualifications of operating personnel including the shift supervisors, senior operators and control room operators.

b) Certify the fitness of candidates for operator licensing at a higher corporate level of management than previously required.

c) NRC would review the contents of revised training programs and the I&E staff would audit implementation of the program.

d) Qualifications for shift supervisor and SRO include having been a licensed operator 1 year; in the long term, educational requirements include having a B. S. degree in engineering or related science by about 1985.

e) Training for the shift supervisor would emphasize and re-enforce the responsibility for safe operation and a management function to assure safety.

f) Applicants for senior operator (shift foreman) shall have 3 months of shift training as on the job training.

g) Applicants for RO licensing shall have 3 months training on shift as an extra person in the control room.

PRIORITY EVALUATION

The scope of this item is very broad and to set priorities properly, each item in the scope is discussed individually.

a) Providing specific additional training for licensed operators has merit, introduces no new risks and will enhance safety to a small degree; therefore this item is judged to be Priority I.

b) Requiring higher corporate level management to certify fitness of license candidates has very little merit, introduces no new risks, but will provide a very small risk reduction. This item is judged to be Priority III.

c) The NRC's review and audit appear appropriate and do not affect industry's effort; therefore this item is judged to be Priority II.

d-1) Requiring a candidate for shift supervisor and SRO to have been licensed at the RO level for one (1) year would improve his qualifications by increasing his level of knowledge through experience gained at the RO level. There would be no adverse effects on safety or increase in risks by this requirement. The experience gained would result in a better qualified SRO and therefore a reduction in risks. This item is judged to be priority I.

d-2) The long term requirement for a B. S. degree could have adverse effects on plant safety in that it probably would result in a higher turnover rate for these positions, thus reducing experience in this position at most plants industry wide. The turnover is expected because the person is likely to consider himself over qualified for the usual daily operations; he would not be gaining professional satisfaction. There would be no risk reduction attributable to the degree per se is because it is assumed that he has sufficient fundamental education in the proper engineering disciplines. If this requirement is implemented, risks from plant operation will increase due to personnel turnover. It is suggested this item be reviewed with a consideration toward increasing requirements for funmdamental education, but not requiring a degree. This item is judged to be priority III.

e) Training emphasizing the shift supervisor's importance in safe operation and in his managerial responsibilities will have no adverse effect on plant safety and will reduce risk to some degree. This item is judged to be priority I.

f) Requiring an applicant for SRO to have at least 3 months on shift before assuming the position has merit. It introduces no risks and by providing a better qualified SRO in the plants will provide a degree of risk reduction. It is assumed this requirement would not apply to a control operator upgrading to the SRO level. This item is judged to be priority I.

g) Requiring an RO license candidate to have 3 months in the control room as on-the-job training will create no risks and should improve his operating proficiency when he assumes the RO position. Overall risk will decrease; therefore this item is judged to be priority I.

I.A.3.1 Revised Scope and Criteria for Licensing Examinations

SCOPE STATEMENT

This scope statement is based on discussions with the NRC, but follows closely the NRC statement except in format:

A. The operator and senior license examination will be expanded to include the additional category of thermodynamics and related subjects. In particular, this category would cover the fundamentals as applied to the specific power plant and would not be a general study of thermodynamics or mechanical engineering.

B. The license examinations will become timed tests; that is the individual taking the exam will have a predetermined time span to complete the exam.

C. The passing grade will be increased to a minimum of 70% in each category with a minimum grade of 80% overall.

D. In the examination process, senior license applicants will be required to take oral examinations in addition to the examination technique presently in place.

E. The requalification programs will be changed to include items A through D above.

PRIORITY EVALUATION

Each of these items addresses refinements to the existing process for licensing operators. Since this item also affects the training of operators, which is a fundamental part of plant safety, there is an impact on all sequences. However, the changes are relatively minor and the consequential impact on overall risk reduction is slight. Some of these modifications are worthwhile and are recommended for immediate implementation. Others appear to have adverse consequences.

The cost associated with implementing this item is about 100K initially and 180K annually thereafter.

A specific discussion of those items identified as A through E in the scope definition follows:

A. Priority I
This action introduces no hazards and can be successfully implemented; however, once implemented the overall risk reduction would be low.

B Priority III
An examination is a relatively objective means of determining whether a candidate has learned the subject

matter and can reproduce it in a reasonable length of time. The examination is thus a test both of the candidate and of the teaching he has received. The grading of the examination should be primarily on the subject matter and not on the quality of the writing so long as the candidate shows, by what he writes, that he understands the subject. The time allowed for completion of the test should not be so short as to put a premium on making snap judgments. Even the best operators are likely to appear to arrive at their conclusions more slowly than some others. This item appears to reduce risk only slightly.

C. Priority III
   It is agreed that the applicant should score at least 70% (this part is Priority I) in each category; however, the additional requirement of an overall passing grade of 80% (this part is Priority III) seems excessive. The rationale for this conclusion is based upon the fact that a requirement for each test section to be passed with a 70% score represents a significant upgrade of the requirements. It is felt that any additional risk reduction achieved by the 80% overall score requirement would be small. Generally it is felt that an operator who scores 70% on every section should be licenseable.

D. Priority I; same comments as A above.

E. Priority I; same comments as A above.

I.C.7 NSS Vendor Review of Procedures

SCOPE STATEMENT

Near term OL applicants obtain vendor review of their low-power test procedures, power ascension test procedures, and emergency procedures.

Schedule: NTOL's adopt prior to full power operation.

PRIORITY EVALUATION

This item addresses the fact that reactor vendor personnel have knowledge of sequences and resultant procedures which could help avert or minimize a problem during tests and in emergencies. It is generally felt that this item does address most sequences through the emergency procedures clause. Since the vendor does have useful information, this item should have a high probability of being successful. There does not appear to be any hazard associated with this item with the possible exception of licensee complacency due to outside review. This potential is quite small in light of the fact that vendor review is already in place for many utilities. This item should cause some additional cost, possibly $200K. Nevertheless, it is felt that this item should be implemented on a non-interfering basis. Therefore this item is a category II.

I.A.4.2 Long Term Training Simulator Upgrade

SCOPE STATEMENT

Condensation of NRC Description

Research studies will be performed to improve the use of simulators in training operators, develop guidance on the need for and nature of operator action during accidents, and gather data on operator performance. Tasks include the following:

a. Simulator capabilities will be examined to identify those combinations of failures and operator errors that can be reproduced.

b. Operating experience will be reviewed to determine actual response times for safety-related operator action. Recommendations for automation will be made.

c. Experiments will be conducted to determine operator error rates.

ANS-3.5 will be updated at the urging of the NRC. A regulatory guide will be prepared on training simulators with the expectation of endorsing ANS-3.5.

PRIORITY EVALUATION

This item addresses some accident sequences in that it relates to long-term simulator modeling improvements. These improvements should provide a nominal but positive effect on decreasing the risk of an accident. The safety effect is one of improved operator understanding of facility operations and transient response.

The development of a standard for the quality and depth of modeling of nuclear power plants has definite merit. The more exact the model, the greater its service as a training tool. Needless expense can be incurred by requiring modeling past the point of diminishing return: that point at which more sophisticated modeling fails to increase the operator's conceptual understanding or appreciation of event magnitude. Focus must be maintained on the operator's learning, not on the mathematical sophistication of the training tool.

Existing simulators have a defined scope of hardware and software capabilities. Their required upgrading should be reasonably commensurate with their existing hardware. The requirement must take into account the improving sophistication of computers with time and not unduly restrict the service performed by currently operating simulators.

Although not specifically mentioned in the scope for this item, the ability to train operators at a simulator located at another facility should be preserved.

The cost of these improvements could range from very minimal on a new computer to a high of about $5 million if an old simulator had to be replaced.

This item is judged to be Priority II.

I.A.2.2 Training Qualification of Personnel

SCOPE STATEMENT

Condensation of NRC Description

Each licensee will be required to review its training program for all operations personnel and to justify the acceptability of each part of the program to provide assurance that safety-related functions will be effectively carried out. Training programs should be related to position task descriptions, including normal and emergency responsibilities.

PRIORITY EVALUATION

This worthwhile task should be pursued jointly by the NRC and INPO, where INPO will perform a task analysis for those positions that are generally used industry wide. These analyses would be conducted by professionals and include recommendations for qualifications and training needed for a particular position. Each utility would then evaluate in a similar manner any unique position in their organization not addressed in the INPO study. These studies by INPO should be completed by early 1981 and would greatly reduce individual utility costs.

Evaluating positions affecting safe operation other than the licensed operators to ascertain that their training and qualifications are adequate has considerable merit. It would introduce no plant safety hazards and would have a small degree of positive effect on reducing overall risks if a need for additional training is identified. The cost for a utility-unique analysis would be an unnecessary use of resources for each utility at an aggregate cost which is large.

In view of the value of this item and taking into account the time needed for proper task evaluation and any needed training modifications, this item is judged to be Priority II.

I.G. Training During Preoperational and Low-power Testing

SCOPE STATEMENT

The NRC will develop acceptance criteria for low power test programs to provide "hands on" training for plant evaluation and off-normal events for each operating shift. Licensees will modify existing or future testing programs to include new requirements.

PRIORITY EVALUATION

The following assumptions were made in making the evaluation of this item:

- that this training does not include any plant transients that would require automatic operation of safety systems that cause high plant thermal or loading stresses, and thus does not introduce safety hazards.
- that overall schedule effects are the same for BWR and PWR but that most PWR training will be accomplished during hot functional testing.
- that each training evolution will require an additional four days and that there will be eight evolutions per plant.

The requirement for hands-on training of each operating shift of certain plant evolutions will increase the time required for testing which is the time used to verify equipment operability. If this training included transients that required automatic initiation of safety systems, it would increase the number of plant thermal and loading stress cycles unnecessarily. There is the general concern that this appears to be an encouragement to experiment with the plant which is clearly not conducive to plant safety or efficiency. Very careful controls are needed to keep this requirement within the bounds of useful learning in a cost effective way.

Risk reduction would be small for this method of training and would include only the start-up personnel and not future replacements. This training is also redundant to the simulator training. Overall risk reduction is small because this training is now being received.

Some additional cost could be be incurred, possibly $100,000 plus replacement power cost due to the extended start-up period.

This item is judged to be Priority II.

I.A.4.1 Initial Simulator Improvement

SCOPE STATEMENT

NRR and RES will collaborate on a short-term study to collect and develop corrections for the presently identified weaknesses of training simulators. The short-term objective is to establish and sustain a higher level of realism in the training of operators, including dealing with transients, where such gains can be quickly made.

PRIORITY EVALUATION

The scope appears to imply simulator software changes and minor hardware changes which can be readily accomplished within the framework of the existing simulator central processing unit and peripherals. As an example, if the simulation of core damage and release of fission products from a small break LOCA event require additional computer hardware, then the simulation would only be carried as far as the existing central processing unit capability permitted.

It is expected that only one or two events involving reactor coolant inventory control (including equipment failures) would need to be modeled to teach operators the fundamental principles in the short-term.

This item addresses some accident sequences in that it relates to short-term simulator modeling improvements. These improvements will have a small but positive effect on decreasing the risk of an accident. The safety effect is one of improved operator understanding of facility operations and transient response.

There is no hazard with short-term simulator modeling improvements as long as it is done within the framework of existing computer hardware and does not require a long computer outage. The computer should not be subjected to a long outage when simulators are in short supply to fulfill existing training needs.

The modeling and change costs could be expected to be about \$250,000 for an existing simulator and about \$50,000 for a new simulator. This item is judged to be Priority II as it will be of some small help in increasing overall operator knowledge, but should be done on a non-interfering basis.

I.A.2.5 Plant Drills

SCOPE STATEMENT

NRC will require licensees to develop and conduct in-plant drills by shift operating personnel. Normal and off-normal operating maneuvers will be required to be simulated for walk-through drills on a plant-wide basis. Drills will also be required to test the adequacy of reactor and plant operating procedures.

In the long term, consideration will be given to having the plant maneuvered for drill purposes with the drill intitiated by the NRC-resident inspector.

PRIORITY EVALUATION SUMMARY

Some plant walk-throughs and drills would be effective in training and introduce no hazards. Therefore, this item would result in a small reduction in risk. NRC needs to further define its position for the long term and should consider the introduction of hazards in any requirement for plant maneuvering for drills and resident inspector-initiated drills.

Plant maneuvers for drill purposes and drill initiation by the resident inspector would unnecessarily introduce a challenge to plant safety. Since the increase in operator knowledge can be accommodated without these challenges, the actual in-plant maneuvers would have a negative effect on safety without sufficient benefits to warrant the risk of the drill. Drills requiring plant maneuvering should be conducted on simulators. It is further recommended that INPO be asked to factor "drills for training" into their overall standard training program being developed. Operator training would be scheduled to utilize normal plant maneuvers.

Plant walk-throughs and utility-conducted drills that can be conducted without maneuvering the plant are judged to be Priority II. Those that require plant maneuvering or are conducted by the NRC are judged to be Priority III, pending further definition of the long term position.

I.C.8 Pilot Monitoring of Selected Emergency Procedures for Near-Term Operating License Applicants

SCOPE STATEMENT

Condensation of NRC Description

An interdisciplinary NRC task force will audit emergency procedures obtained from applicants to judge their adequacy. An in-depth review will be made of selected procedures. Review elements are specified by the NRC.

PRIORITY EVALUATION

This item requires the preparation of detailed Emergency Procedures and NRC review thereof for adequacy of procedure and training of personnel to know the procedure. In this context, a procedure is interpreted to mean a step by step series of required actions. Procedures would be in place for the entire range of design basis events from transients to accidents. Vendors would develop, provide, justify, and defend parent analyses and guidelines. The procedures would be reviewed with the NRC. A simulated walk-through would be held for NRC review with attendance by shift crew and shift technical advisor. A plant walk-through would be held with participation by NRC, shift crew, shift technical advisor, technical support center, and operational support center.

The NRC would make and document findings on preparedness for the accidents covered by the procedure.

An alternative would be to have the NRC resident inspector review existing procedures. This would be effective in achieving most of the benefit with far less cost and with lower manpower impact.

This item is aimed at reducing risk through improving operator knowledge and understanding through preparation of and review of procedures. This item is reviewed against a base set of procedures and practices which is in place to address both accidents and transients. In addition, plant walk-throughs of events are considered under a separate task item. Therefore, the risk aversion potential for this item is evaluated as an increment over existing activities and the risk reduction is correspondingly small since existing procedures and practices are considered to be essentially complete and effective. This task would introduce little or no hazard, but would add to manpower requirements.

This item is judged to be Priority III.

The alternate proposal (where the NRC inspector reviews the procedures) should be tried for at least a year, with the possibility of reconsideration after that period.

I.B.1.1. Organization and Management Criteria

SCOPE STATEMENT

Condensation of NRC Description

The NRC will develop criteria for onsite and offsite management and technical staffs that will upgrade them in the areas of 1) staff size, 2) education and experience, 3) plant operating and emergency procedures, 4) management awareness of safety matters, and 5) number and types of personnel available for accidents.

PRIORITY EVALUATION SUMMARY

If this item could be implemented it would impact all accident sequences; however, because of manpower limitations, and the hazards addressed below there is little likelihood of success. In the long term (many years), a well planned program could have a moderate impact on risk reduction. In the short term (implementation by 3/81, as suggested), this program could have a negative impact on safety.

The NRC should wait and assess the industry's response through INPO and other cooperative organizations. The hazard is that this area addresses diverse organizations which is difficult to do effectively without great care. Government intervention by way of mandated changes that require rapid implementation, could confuse and complicate the organization effectiveness. This would be a hazard to safety during accidents when clear lines of communication and authority are required.

The cost associated with this item could be extremely high depending on the staff increases that the NRC would try to implement. Preliminary audits by the NRC have led to findings that some organizations staffing is not in accordance with NRC objectives. The industry can expect to increase staff sizes by at least 25 and increase annual expenditures by at least $5 million.

In consideration of the large impact and small increase in safety, coupled with potential organization disorientation due to generic changes, this item is judged to be Priority III.

II.J.3.1 Organization and Staffing

SCOPE STATEMENT

Condensation of NRC Description

NRC will develop criteria requiring license applicants and licensees to improve the oversight of design, construction and modification activities so that they gain the critical expertise necessary for the safe operation of the plant,including technical resources needed and the degree of management and technical control to be exercised.

Alternative Scope Statement

NRC,DOE,NSAC, and INPO will conduct a study to determine the characteristics of the most effective programs and the typical programs now in operation. Priority should be placed on the modification, construction, and design activities. Industry should make cost-benefit and experience studies and provide information to utility management for implementation into more effective staffing and management systems.

PRIORITY EVALUATION

This item seeks to improve operation and utility knowledge and understanding through increased participation in plant design, construction, and modification. Therefore, this item addresses all sequences. It is not clear how the NRC alone could achieve the objective. Currently there are a number of steps being taken or continued to achieve the same result. Therefore, the potential for added actions by the NRC to be productive seems low. Since the details are unknown, this item is judged to be Priority III while NSAC and INPO, with NRC input, develop methods and a structure which would seek to enhance overview without unnecessarily wasting manpower.

III.A.3.3 Communications

SCOPE STATEMENT

Condensation of NRC Description

Provide two dedicated lines per unit to government agency terminals. One line is for plant information. One line is for environmental and health physics information. Also provide signal relay and processing equipment from existing sensors to input terminals of dedicated lines. These lines are for computer transmittal of data.

PRIORITY EVALUATION

This item raises the question of whether there is a potential benefit from having outside agencies participate in post-accident recovery and mitigation. The need for communications is real. The question is whether or not the computer oriented data transmittal would reduce or avoid accident consequences sufficiently to warrant the cost. All accident sequences are potentially treated. Of the two items, plant information and health physics information, the former is believed to be more useful for the short term. The problem in analyzing this item is the lack of clear criteria for determining what data should be transmitted. It seems likely that the useful information on a specific accident might be improperly displayed or lost in the detail of other items. There is a potential for increased risk due to the tendency for offsite personnel to direct or influence action without sufficient knowledge. In light of these concerns, the likelihood that this action would provide substantive additional protection over that provided by the Shift Technical Advisor is small. The hazard created by improper use of the data transmitted is judged approximately equal to the positive effect.

The cost is estimated to be $1 million dollars. Therefore, this item is judged to be Priority III because it requires further evaluation. An alternative for dedicated communication links for verbal transmittal of data from the plant to the NRC/Vendor/State would be a useful tool. This would be evaluated as being Priority II.

I.A.3.2 Personnel Selection Process

SCOPE STATEMENT

NRR will require that licensees develop auditable procedures to indicate a formal process of selecting shift supervisors and shift technical advisors, including input from top utility management.

PRIORITY EVALUATION

The goal of this requirement is interpreted to mean that there will exist some standard mechanism for selecting qualified personnel to key positions which directly ties top management to concurrence in the selection.

Since each utility functions separately, there will be varying degrees of management participation, various selection and qualification mechanisms and no industry standardization. Manpower will be needlessly wasted auditing mechanisms which are better carried out by the industry staff.

An alternative to this requirement would be to have INPO establish industry generic criteria for selecting, training, and qualifying shift supervisors and determining the degrees of management participation in the process. This action would achieve the desired result and enhance individual utility performance through standardization of criteria. The emphasis here would be on establishing criteria, not specific procedures that would be too prescriptive and not suitable for individual utilities.

This item relates to most accident sequences because it treats auditable procedures for selecting, training and qualifying key personnel. This item will have no effect on decreasing the likelihood of an accident because it requests only auditable procedures, not a standard set of industry wide criteria. Utilities already have top management directly involved in selecting key personnel through their existing procedures for promotions and payroll increases. NRC already retains final approval of key personnel through the mechanisms of the SRO examinations. Auditing of this proposed procedure will consume NRC manpower better spent reviewing items relevant to safety. The cost of preparing the procedures is minimal but the procedure itself has no safety value. This item is judged to be Priority III, as it does nothing to enhance safety.

I.B.1.5. Loss of Safety Function Rule

SCOPE STATEMENT

Condensation of NRC Description

The NRC will seek to reduce the occurrence rate of loss of safety function by either:

1. Requiring shutdown for plants experiencing two loss of safety functions in one year (or two years). NRC approval would be required for restart based upon acceptance of licensees corrective action, or
2. Issuing citations and fines plus possible shutdowns for each occurrence, or
3. Using a point system, license probation, or license revocation.

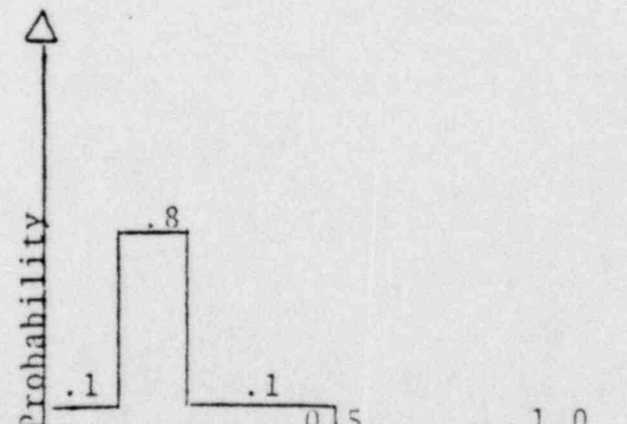
This item is assessed assuming Option 1, because Options 2 and 3 are not well defined.

Clarification Based on NRC Discussion

NRC interprets loss of safety function as exceeding any of the Limiting Conditions for Operation in the technical specifications.

PRIORITY EVALUATION

This action would affect some core melt sequences, but not all, since as implemented, Technical Specification Limiting Conditions for Operation are deterministically developed and are not risk-based. The probability of success of this item is estimated to be low-to-medium as depicted in the accompanying sketch.



III.D.3.1 Radiological Protection Plans

SCOPE STATEMENT

Condensation of NRC Description

Prepare and implement a radiation protection plan that includes criteria from existing Regulatory Guides, the Standard Review Plan Chapter 12, the ALARA program and additional criteria to be developed from IE appraisal of health physics programs at all operating plants.

The radiation protection plan will require NRR approval and a Technical Specification amendment.

PRIORITY EVALUATION

This item will have a small impact on reducing the radiation exposure of plant personnel.

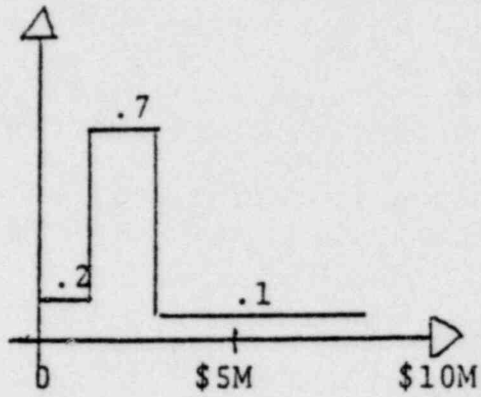
In the near term this would require an increased demand on the manpower of NRC, IE and NRR as well as industry which could be better used at this time.

This item would incorporate plant radiological programs that are in place into the technical specifications but would do nothing to reduce radiological hazards to the general public and little for plant personnel. The cost of this item would be approximately $400K. Since the probable reduction in exposure is small and the manpower requirement is relatively large, this item results in a poor expenditure of resources. Therefore, this item is judged to be Priority III.

Since the action is punitive and not constructive, and would not directly lead to constructive measures to prevent operational or maintenance problems or errors that would contribute to loss of safety function, this item does not appear to contribute to safety.

A significant hazard would be introduced by this requirement. Operating personnel faced with a heavy company financial penalty and possible adverse career impact could conceivably correct the situation and fail to report it, fearing the penalty. This action would rob the industry of the opportunity to learn from the experience.

Assuming that this rule was invoked twice in plant life, and that it resulted in a two week forced outage each time, the cost would be approximately as shown below:



Based on low-medium probability of success, high cost, and significant hazard introduced, this item is judged to be Priority III.

CATEGORY C

SCOPE STATEMENTS AND

PRIORITY EVALUATIONS

(IN ORDER OF PRIORITY)

Number	Title
III.D.3.4	Control Room Habitability
I.A.1.3	Shift Manning
I.D.3	Safety System Status Monitoring
I.D.1	Control Room Design Reviews
I.D.2	Plant Safety Parameter Display Console
II.F.3	Instruments for Monitoring Accident Conditions (Regulatory Guide 1.97)
I.C.9	Long-term Program for Analysis of Transients and Accidents for Procedure Development and Upgrading, Including IE Inspection of Procedures and Lead Plant Onsite Audit
II.K.3	Generic Review Matters - Small Break LOCAs and Loss of Feedwater Accidents

III.D.3.4 Control Room Habitability

SCOPE STATEMENT

NRC Description

This item involves a review of control room habitabilty design provisions against Regulatory Guide 1.78 (1974) and Regulatory Guide 1.95 (1977), and the Standard Review Plan, sections 2.2.1, 2.2.2, 2.2.3, and 6.4. Plant specific implementation schedules must be prepared if the need for design modifications is identified.

Alternative Scope Statement

It is assumed that plants with construction permits after June of 1974 will not be affected.

PRIORITY EVALUATION

The thrust of this item is the improvement in human reliability achieved by allowing the control room operators to function without wearing airpacks and the accompanying psychological impact of 1) wearing masks, 2) the reduced field of view, and 3) the weight of the tanks. An increased sense of security will accrue from knowing of their protection from adverse environments. It was recognized that plants operating pre-1973 will incur higher costs and longer implementation schedules than plants in operation since 1973. Plants with construction permits after June of 1974 should not be affected.

The maximum likelihood of success was evaluated as 0.9 with 90% confidence of exceeding 0.6. The probable time to implement is 20 months with 90% confidence of being between 12 and 30 months. The probable cost is $1M with an uncertainty of $0.5M/single unit plant. For plants in operation since 1973 the probable cost is $0.4M and the probable implementation is 22 months. This variability results from plant-to-plant variations in facilities and available equipment.

This item is judged to be Priority II, and should proceed on a high-priority basis consistent with resources.

I.A.1.3 Shift Manning

SCOPE STATEMENT

Condensation of NRC Description

NRC intends to require one RO and one SRO in the control room at all times other than cold shutdown (while still maintaining the capability for the shift supervisor (the SRO) to conduct plant tours). Limitations will be imposed on overtime.

Alternative Scope Statement

The evaluation team assumed that one of the two existing ROs may be qualified and licensed as SRO to meet this requirement. This will provide 2 SROs and 1 RO, with the capability for the shift supervisor to conduct plant tours and still have 1 SRO and 1 RO in the control room at all times. Overtime limitations will be those from NUREG-0585: not more than 2 consecutive 12-hour shifts in a row, with at least 12 hours rest between shifts. No overtime limits apply except when the operator is used in the mode for which he is licensed.

PRIORITY EVALUATION

This evaluation reflects an attempt to balance the benefits of the continuous presence of an SRO in the control room with the importance of continuing walk-through SRO inspections; the demands this item will place on individual training systems were also considered. It is important that walk-through inspections be continued by SROs. It is also important that the plant training department not be subjected to severe stresses by attempting to implement this item at operating plants at the same time that other more important training goals (addressed by the Action Plan) are being met.

To implement this program on a priority basis might require extensive overtime which would be counter to requirements for diminishing overtime required in this item. (These demands are placed by the conflicting requirements of continued shift manning during plant operation and the training and upgrading of operators.) Negative impacts from this program could result from reduced training in other areas due to overloading a training staff that is already heavily taxed due to administrative burdens and increased technical training resulting from other TMI task actions. Another negative impact could result from increased mobility of the upgraded operators and possible union involvement.

The maximum likelihood of success was assessed to be 0.7 with 70% confidence of exceeding 0.4. The probable cost is $0.5M/single unit with an uncertainty of $0.2M. The probable implementation time is 20 months with an uncertainty of 10 months, depending on the size and the load of the training at specific utilities.

This item is judged to be Priority II.

I.D.3 Safety System Status Monitoring

SCOPE STATEMENT

Condensation of NRC Description

NRC will backfit Regulatory Guide 1.47 (to be revised by NRC by about 3/1/80).

Alternative Scope Statement

For purposes of estimating risk reduction and costing, the evaluation team made the following assumptions:

1. All active components (including manual valves) within safety systems that can cause system degrading or cause the system to become inoperative will be subject to automatic monitoring. This assumes the deletion of the present exception for manual valves operated once per year.
2. Not required to be Safety Grade (but reliable).
3. Will not use plant computer.
4. Fault tolerant - reliable system rather than a fully redundant set of devices.
5. Required for all plants.
6. Mini-computer based system with 400 inputs.
7. Completely automatic system.

PRIORITY EVALUATION

Evaluation of this item involved assessing the value of automatic status indication against certain cautions. It is possible, for example, that a false sense of security may be engendered by automatic status indication, introducing decreased alertness on the part of the plant operators. It is also possible that status indicators may fail. Agreement could not be reached regarding the accident sequences that could be impacted, which appears to reflect uncertainties in the efficacy of the program.

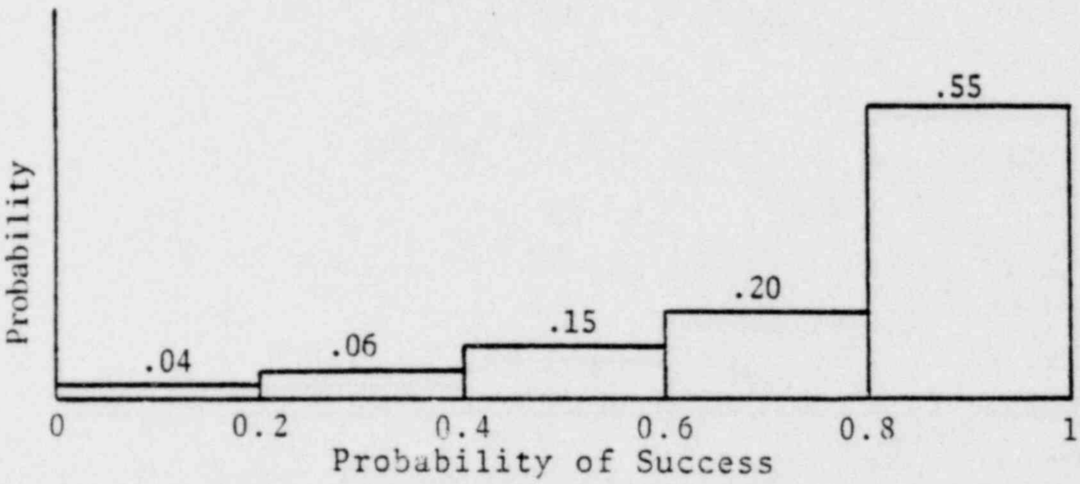
It was concluded that the likelihood of successful implementation is high (there is 90% confidence that the probability of success exceeds 0.4) but considerable uncertainty in achieving the desired result accompanies the effort. The probable implementation time is 30 months with 80% confidence that it can be implemented between 18 and 40 months. The probable cost is $5M per single unit but there is 40% probability of exceeding $7M.

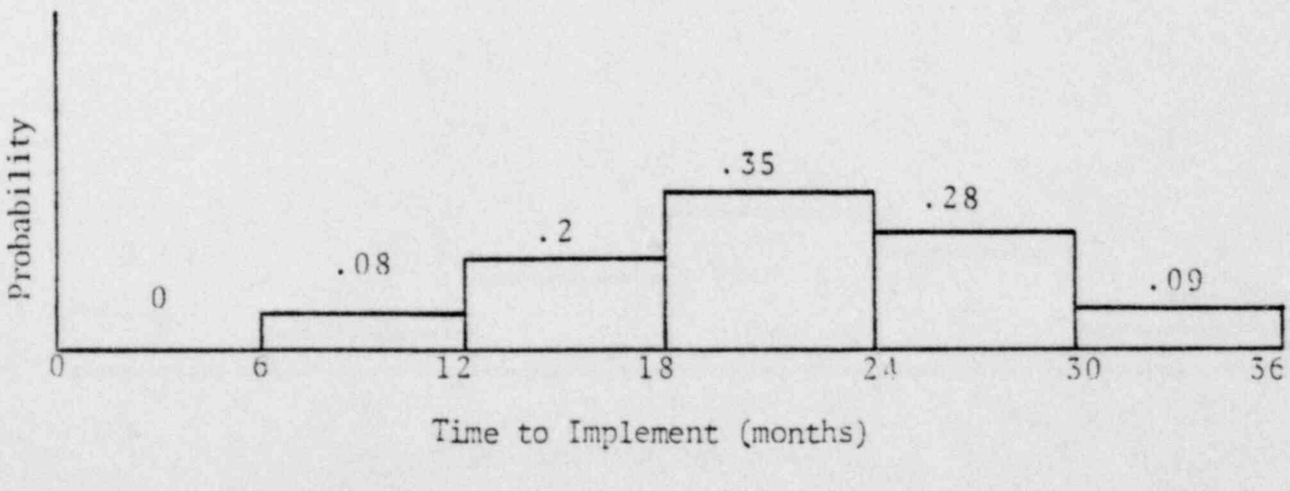
These high costs are the result of a number of considerations:

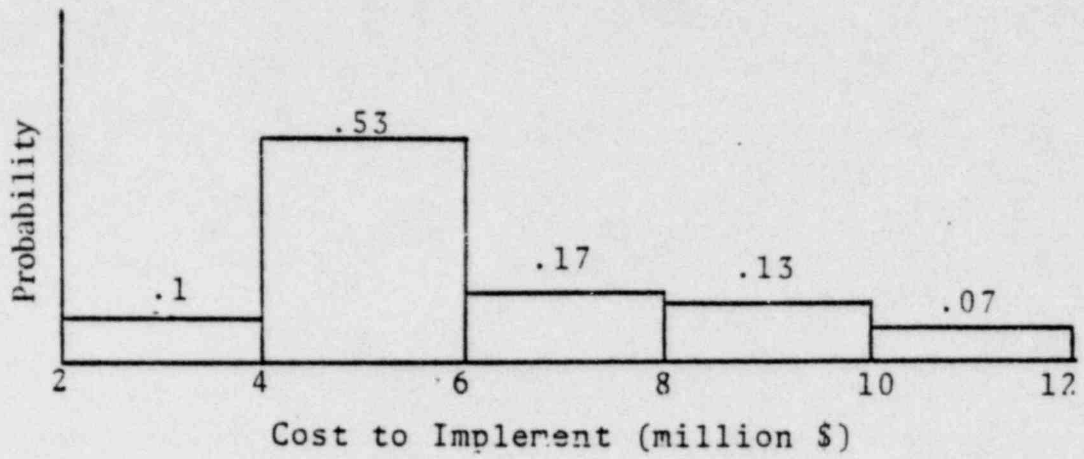
- o Status indicators would have to be added to many active safety components (valves and breakers). In cases where indicators presently exist, the indicator is used for other purposes and spare contacts may not be available.
- o The architect/engineer may have to route new cables and cable trays.
- o The panel to display the indicators would be similar to the safety state vector panel which was estimated to cost a minimum of about $2M.

It should be pointed out that if Regulatory Guide 1.47 could be endorsed in essentially its present form, e.g., allowing a combination of automatic and administrative controls, the costs could be greatly reduced, and many newer plants would qualify without additional changes.

Some evaluation histograms are shown below:







This item is judged to be Priority II.

I.D.1 Control Room Design Reviews

SCOPE STATEMENT

Condensation of NRC Description

NRC will require that licensees perform a review to identify design deficiencies. The review may identify the need to make "enhancement" changes pertaining to human factors or make physical changes (move switches and instruments).

Alternative Scope Statement

For purposes of evaluation the team segregated this item into two parts:

a. Control room review, and human factors changes which can be implemented without shutdown (e.g., color coding).

b. Changes requiring shutdowns such as having to move the physical location of devices (e.g., switches and instruments).

Physical redesign of the control room is assumed not to commence until the changes required by Regulatory Guides 1.47 and 1.97 and the safety parameter display console are defined.

PRIORITY EVALUATION

This evaluation is the result of balancing the safety enhancement expected from the item with costs and possible operating errors that are associated with changes. The changes should be implemented gradually and cautiously in operating plants and in those so close to operation that the operators have already been qualified. The reason for this is to accommodate the operator relearning process to the additional human engineering. Little risk is expected to be introduced by implementing this item if this caution is observed.

Lower costs for implementation will be required for items requiring only enhancement (color coding, painted groupings, scale changes, etc.); a higher cost will be experienced for items requiring hardware changes. The success mean probability was assessed at 0.7 but with considerable uncertainty that extended to the lower probabilities, reflecting the uncertainties of human factors enhancement. The most probable time for implementation was 22 months with a 9 month uncertainty. Enhancement changes can be implemented more expeditiously. The probable cost was \$1M with a .3 probability of being less than a million dollars; however there is a high cost tail on the distribution extending beyond \$5M.

This item is judged to be Priority II.

I.D.2 Plant Safety Parameter Display Console

SCOPE STATEMENT (Alternative)

NRC requires installation of a console in the control room to monitor essential functions ("Safety State Vectors") such as:

Radioactivity	Coolant inventory
Reactivity	Containment integrity
Heat sink	

For purposes of estimating risk reduction and costing, the evaluation team made the following assumptions:

1. Not required to be Safety Grade (but reliable).
2. No additional transmitting devices or sensors are required that are not mandated by some other requirement.
3. Will not use plant computer.
4. Display=10 parameters continuous; up to 50 parameters on callup.
5. Fault tolerant - reliable system rather than a fully redundant set of devices.
6. Have the capability for an operator to call up other supporting data.
7. Will not have either predictive capability or instructive capability.
8. Will be required for all plants.
9. Digital state-of-the-art.
10. Mini-computer based system with 400 inputs.
11. A primary function of the console will be to assist the SRO in diagnosing an on-going accident, determining plant state, and evaluating the effectiveness of corrective action because all parameters are not displayed on the panel. The SRO will use it to direct the focus of the reactor operators to specific panels and instruments for detailed readouts.

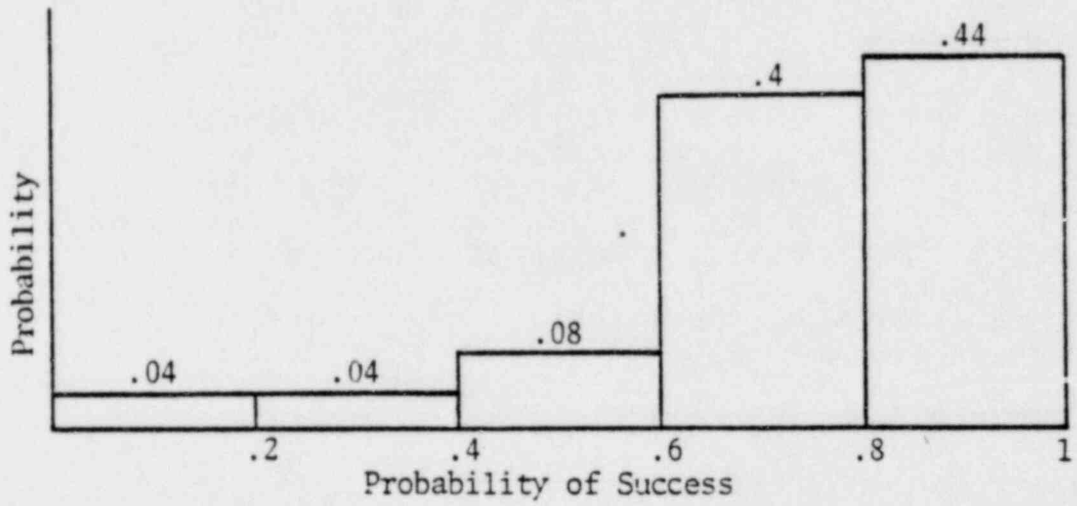
PRIORITY EVALUATION

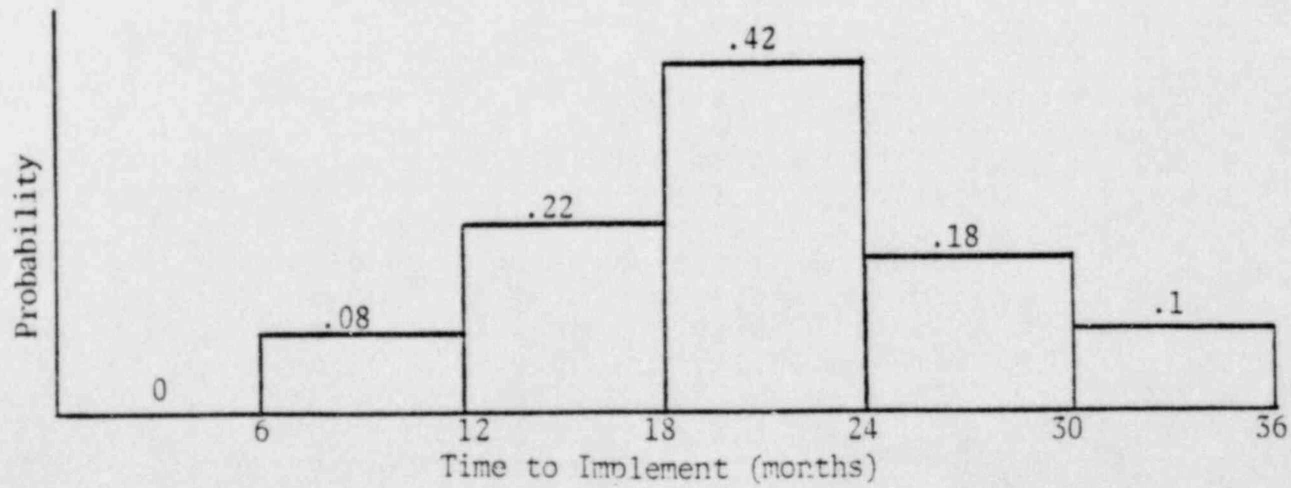
This evaluation results from balancing the advantages of a compact presentation of plant status against certain factors that tend to be disadvantageous. There may, for example, be a tendency for operators to place excessive reliance on this panel to the extent that their proficiency with the operating panels may be reduced. All or portions of this safety panel could fail, nence over-reliance should be avoided. Therefore, sufficient time must be allowed so that proper planning and reliability can be incorporated into the design.

The probability of success was assessed to be high; in fact the confidence of exceeding 0.6 is 80%. The most probable time of implementation is 25 months with 82% confidence of being between 12 and 30 months. The expected cost is $4M for a single unit plant but there is a 5% probability of exceeding $8M.

This item is judged to be Priority II.

Consensus histograms for probability of success and time to implement are shown below:





II.F.3 Instruments for Monitoring Accident Conditions (Regulatory Guide 1.97)

SCOPE STATEMENT

NRC Description

NRC will require environmentally qualified instrumentation with expanded ranges to monitor accidents which involve core damage. The design criteria, ranges, and other requirements will be delineated in Regulatory Guide 1.97, which is expected to be issued in revised form later in 1980.

Alternative Scope Statement

The evaluation team assumed that essentially the full scope of Regulatory Guide 1.97 in its present draft form would be required.

PRIORITY EVALUATION

The objective of this item is to provide instrumentation readouts that will assist the operator in mitigating an accident; this additional instrumentation will be of little value in preventing an accident, but may be helpful in keeping a transient from proceeding to a worse condition.

Further work is required to integrate the intent of this item with the goals of:

1. The technical support center
2. The control room design review (I.D.1)
3. The safety system status monitor (I.D.3)
4. The safety status panel (I.D.2)

An effort to implement Regulatory Guide 1.97 independent of these considerations could be counterproductive. In general, adequate consideration must be given to human factors.

A few open questions are involved with this item. Some of these open questions involve developing new instruments, qualifying new and existing instruments on an expeditious schedule, and presenting the large amounts of data visualized in this guide to the proper accident control personnel. Because of uncertainties in the present status of this guide, the mean success probabiltity is 0.6 with a large uncertainty. The most probable time to implementation is 27 months with a low probability of implementation before 18 months. Two separate cost evaluations were performed; one for plants which may already have some of the required instruments, and the other for the older plants which will require extensive installation of instruments. The most probable cost is about $9M for the older plants with considerable probability of costs extending to $20M for a single plant. For the newer plants the most probable cost is $6M with a high probability of exceeding $14M.

Because of the uncertainties involved in this item, it was judged to be Priority II, with the understanding that the near term effort will be focused on the integration of the above four factors into this effort and not immediate installation of instruments that may not provide the desired safety goals.

I.C.9. Long-Term Program for Analysis of Transients and Accidents for Procedure Development and Upgrading, Including IE Inspection of Procedures and Lead Plant Onsite Audit

SCOPE STATEMENT (Condensation)

NRC will perform a systematic, integrated, logical review of plant procedures. A multidisciplinary review team led by NRR but with support from IE, SE and RES will study:

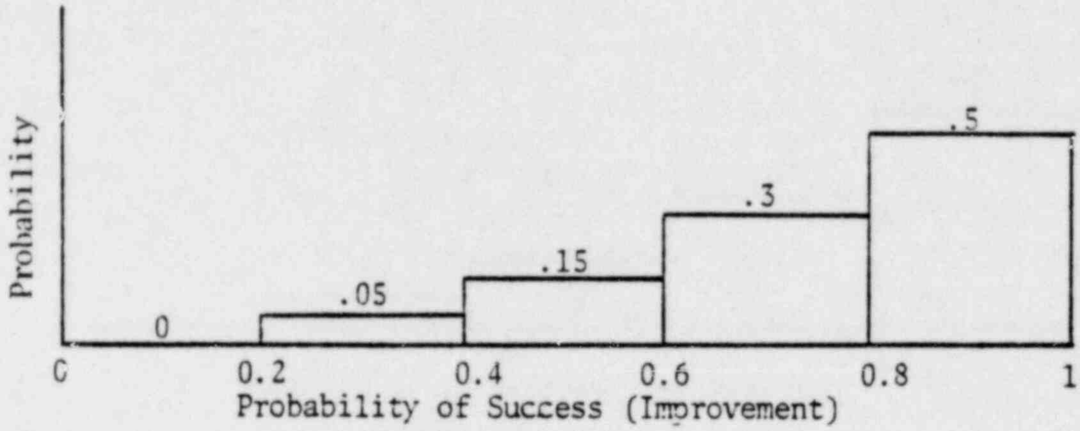
- the factors that lead to optimum procedures preparation
- criteria for verifying correct performance of operating activities and the feasibility of incorporating the various verification techniques into maintenance, test, surveillance and other operational activities
- vendor computer codes that predict plant response to accidents
- accident analysis assumptions including operator actions and errors, transients, passive failures and single and multiple active failures
- integration of the results of the IREP studies into emergency procedures

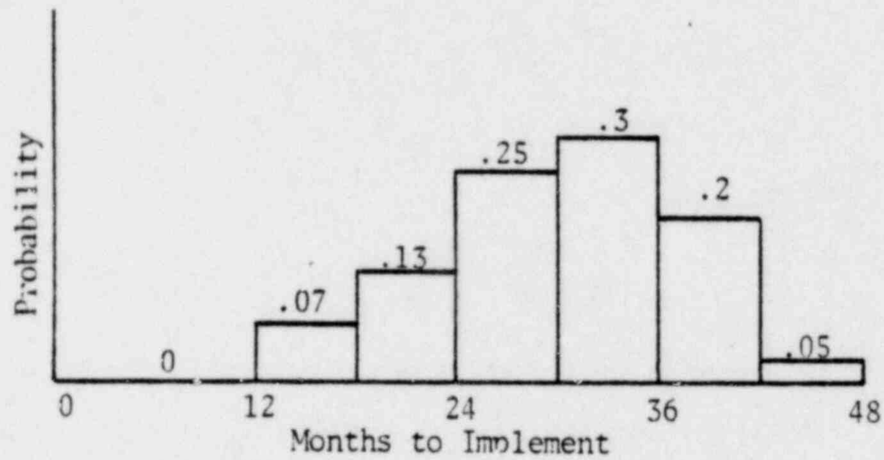
Preliminary criteria developed from this study will be applied to a lead plant's procedures, and the review of the success of the program for the lead plant will eventually result in revised regulations and regulatory guides.

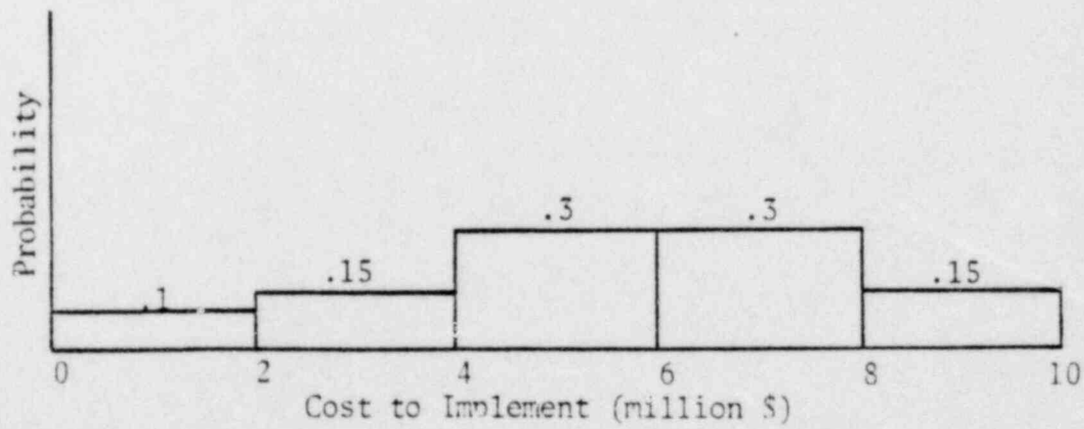
PRIORITY EVALUATION

Utility effort on this item will be limited to revising procedures and associated training programs as necessary. The NRC must complete its program before the utility effort can be completely defined.

No hazards were identified in the item as described; it could lead to some risk reduction. One positive result might be the assurance of safety that could be realized from this semi-quantitative analysis of plant operations under accident conditions. The maximum likelihood of success is 0.9 with 80% confidence of exceeding 0.6. The probable time to implement is 30 months with an uncertainty of 12 months. The expected cost is \$6M with 75% confidence of exceeding \$4M. However, most of these costs would be borne by the NRC and the cost to plant operators would be for procedural changes arising from the analyses. Evaluation histograms are shown below:







The intent of this item, to provide a more objective basis for the analysis of procedures, was endorsed by the group but with cautions regarding the magnitude and uncertainties of the undertaking. Priority III was assigned; this could be upgraded if a more definitive program is prepared and demonstrated through the lead plant. The evaluators recommended breaking the program into several components which could be analyzed separately and given appropriate priorities. For example, definition of specific tasks and objectives for procedures evaluation should be given a priority I, but action should not be taken on other items until program success can be better assured.

II.K.3 B&O Generic Review Matters - Small Break LOCAs and Loss of Feedwater Accidents

SCOPE STATEMENT (Condensation)

This Action Plan item requires licensees to complete actions originating from the generic reviews of the small-break loss-of-coolant accident and loss of feedwater events; NRC requirements are established in the following reports: NUREG-0565 (B&W),-0611 (W),-0626 (GE), and -0635 (CE). All applicants for plants and designs must resolve all applicable actions specified in NRC requirements and describe how the actions are implemented.

Schedule: OR - January 1, 1981

NTOL - To be scheduled on a case-by-case basis

PRIORITY EVALUATION

The recommendations made by the Bulletins and Orders (B&O) Task Force are as significant and extensive as the recommendations made by the Lessons Learned Task Force. Inclusion of these recommendations in the Action Plan as one item diminishes their perceived importance and obscures the level of effort required for their implementation. Individual incorporation of the B&O recommendations into the Action Plan will assure that both an appropriate level of attention is applied to the individual review/approval by the ACRS and Commission and an appropriate degree of importance will be attached to their implementation by the industry.

If the schedule for the issuance of the Action Plan does not permit this individual inclusion, then the B&O recommendations should not be included until they can be added as an addendum to the Action Plan.

There are 22 distinct items for B&W plants, 39 for Westinghouse plants, 31 for CE plants, and 34 for GE plants. These 126 items now grouped under one Action Plan line item should more properly be broken out and integrated into the appropriate parts of the Action Plan. Many of the items are identical with other items already listed separately in the Action Plan. Some generic items are listed for all vendors. A number of others are generic to all PWRs or BWRs. Finally, some are short term requirements previously completed. A catalog of the 126 items is provided in Tables I, II, and III in which the B&W, CE, GE, and W labels identify specific statements from the four NUREG documents.

Table I lists those individual recommendations from the B&O task force which should be deleted from II.K.3 because the recommended actions are already addressed by other requirements in the NRC Action Plan.

Table II contains recommendations that specify action solely by the NRC staff.

Table III contains recommendations that specify action items for the utilities and vendors for which the priorities have been evaluated. Because of the large number of specific items, the subgroup evaluating these actions could not be as thorough as the other industry team subgroups. The first nine items apply to more than one vendor and received the greatest attention. Items 10 through 17 apply to B&W plants only, and B&W has completed and submitted the required analyses. Item 18 was a curious entry -- "Review the Impact of the (Action Plan) Recommendations" -- and represented the heart of this industry team exercise. Items 19 through the end of the list apply to GE BWR plants only.

All the items in Table III have been assigned to Priorities I, II or III. The Priority I items can be accomplished without conflicting with each other. In truth, many are nearly complete or require little additional effort. Therefore, priorities within the list of Priority I items are not assigned. For those items in the Priority II category, priorities based upon costs and benefits are assigned as follows:

Priority	Item
1	5 - Instruments/procedures to verify natural circulation.
2	20 - Identify water sources prior to ADS -- GE
3	22 - Automatic restart of core spray and LPCI -- GE
4	21 - Report outage of ECC systems
5	4 - Two-phase natural circulation experiments
6	24 - Depressurization with other than ADS -- GE
7	6 - Confirmation of W anticipatory trip

Category III items were not assigned priorities. Recommendations for future consideration are stated in Table III.

TABLE I

B&O GENERIC REVIEW MATTERS
THAT SHOULD BE REMOVED FROM II.K.3 LIST

Item	Reason for Elimination
o The items on the Westinghouse and CE lists addressing auxiliary feed-water performance (i.e., the first 16 Westinghouse items - including GS-1 through GS-8, GL-1 through GL-5 and the first 14 CE items - same as W except for GS-7 and GL-5)	Either included in II.E.1 or already completed*
o Interaction of Safety and Non-Safety Systems - W	Included in II.C.1
Review of Reliability & Redundancy of Equipment - CE	
Review and upgrade rel.ability and redundancy of non-safety grade equipment upon which SBLOCA mitigation relies - B&W 2.3.2.b	
Use of non-ECC systems in analysis - GE (B.12)	
Diverse initiation signals for RCIC - (GE B.10, abbreviated title is not representative of the complete item which requires review of all cooling systems that might affect core uncover	
Modification of ADS logic - GE(A.7) (Conduct feasibility and risk assessment study, then modify equipment)	
No fuel failure requirement for anticipated transient with single failure - GE(A.14)	
Space cooling for HPCI and RCIC - GE(B.3)	

TABLE I (CONTINUED)

Item	Reason for Elimination
Effect of loss of AC power on pump seals - GE(B.4)	
Qualification of accumulators on ADS valves - GE(B.7)	
o PID Controller Modification - W	Design-specific item affecting a small number of units; low cost; should be completed, but not necessary to include in action plan
Proposed Anticipatory Trip Modifications - W	
CCI supplied PORV - W	
o Installation of Auto Isolation of PORVs - W, CE	Included in II.D.4
Automatic block valve closure system - Installed & Operational - B&W 2.1.2.a.	
Testing of Auto Isolation of PORVs - W, CE	
Testing of Automatic block valve closure system - B&W 2.1.2.a	
o Simulator Training Program - W, CE	Completed*
Minimum simulator training requirements for SBLOCAs - B&W 2.3.2a	
o Simulation of Small Break LOCA - W, CE	Included in II.A.4.2
Small-break LOCA on simulators - GE	
o Review of Procedures (NRC) - W, CE	Included in I.C.8

TABLE I (CONTINUED)

Item	Reason for Elimination
o Review of Procedures (NSSS Vendors) W, CE	Included in I.C.7
o Symptom-Based Emergency Procedures W, CE Guidelines for sympton-based emergency procedures - GE(B.8)	Included in I.C.9
o Evaluation of PORV opening probability during overpressure transient - B&W 2.1.2.b	Completed*
o Evaluation of safety valve reliability -- B&W 2.1.2d	Completed*
o Consideration of diverse decay heat removal path for Davis-Besse Unit 1 - B&W 2.5.2.a	Unit specific item - inappropriate for Action Plan; completed
o Isolation of isolation condensors on high radiation - GE(A.2) Interlock on recirculation pump loops - GE(A.8) Performance of isolation condensors with noncondensibles - GE (B.13)	Design specific (about 5 plants) - should be handled outside of Action Plan
o Loss of Service Water for Big Rock Point - GE(A.9)	Unit specific item - inappropiate for Action Plan
o Common reference low level instrument - GE(B.6)	Included in I.D.I
o Two operators in Control Room - GE(A.16)	Included in I.A.1.3

TABLE I (CONTINUED)

Item	Reason for Elimination
o Separation of HPCI and RCIC Initiation levels (to reduce the number of challenges to the HPCI) - GE(A.1)	Included in II.E.2.1
o Reduction of challenges and failures of relief valves - GE(A.4)	Included in II.D.2 and II.E.2.1

*Completed status was verified by discussion with cognizant NRC Task Manager.

TABLE II

II.K.3 B&O GENERIC REVIEW MATTERS:
NRC ACTION ITEMS THAT MUST BE ANALYZED FOR VALUE, IMPORTANCE, AND PRIORITY FOR INCLUSION IN THE ACTION PLAN

Item	Reason for Elimination
o Modifications to RELAP4 Heatup Calculation - W	Industry is not evaluating items with only NRC action
o Effects of Accumulator Injection on RELAP4 Calculations - W	
o Modification of RELAP4 to Represent Steam Generator Realistically - W, CE	
o Additional staff audit calculations of B&W SBLOCA analyses - B&W 2.4.2.a	

TABLE III

II K.3 B&O GENERIC REVIEW MATTERS

Industry & NRC action items that should be analyzed for value, importance, and priority for inclusion in the Action Plan.

ITEM	SCOPE AS VIEWED BY NSAC/AIF GROUP	PRIORITY	BASIS FOR PRIORITY
1. – Confirmation of small break LOCA analysis methods Appendix K – W, CE – Analysis methods for SBLOCA – B&W 2.2.2a – Revise small break LOCA model for compliance with Appendix K – GE (A.12)	Review analysis method and revise to further assure compliance with 10CFR50 Appendix K small break LOCA analysis	II	Codes already meet App. K and are conservative. Minor technical questions exist. Major efforts at this time would divert resources from items of greater potential safety impact, such as the preparation of revised operator procedures.
2. – Small break LOCA analyses – plant specific Appendix K calculations – W, CE – Plant – specific calculations to show compliance with 10CFR50.46 – B&W 2.2b – Plant – specific analysis with revised model – GE (A.13)	Apply revised methods from (1) above to each specific plant	II	Re-doing analyses for all plants would yield very little in the way of insights to equipment or procedure improvement.
3. – RCP pump trip – W – Automatic trip of RCPs – CE – Automatic trip for RCPs during SBLOCA – installed and operational – B&W 2.3.2a – Supplemental	Install an automatic trip of all RCPs on coincident reactor trip and low pressurizer pressure.	III	RCPs are an element of the principal success path for core heat removal. An automatic trip would constitute a safety hazard since it could spuriously actuate.
	Study the need for RCP trip (NRC-vendor action)	I	As discussed in the industry group's evaluation of Action Plan item II.K.1, it is important that the issue of pump operation during transient and accident response be promptly resolved. Such studies as required to resolve this issue should proceed hardware modifications.
4. – Two-phase natural circulation experiments – W, CE – Experimental verification of two-phase natural circulation – B&W 2.6.2a	Demonstrate first the continuation of natural circulation as the loop conditions change from single phase. Next demonstrate the initiation of natural circulation. Initial tests should be conducted at the LOFT facility.	II	Abundant analytical evidence implies that natural circulation can be initiated and/or continued under two-phase conditions expected for design basis events. Confirmatory experiments are desirable on a not-to-interfere basis.
5. – Instrumentation to verify natural circulation – W, CE, B&W 2.6.2b	Specify a set of instruments (new or existing)and the necessary procedures to ensure that operators can verify the effectiveness of natural circulation.	II	Instrumentation currently installed is adequate to verify natural circulation if interpreted correctly. Therefore any additional work should be done on a not-to-interfere basis.

TABLE III (Continued)

ITEM	SCOPE AS VIEWED BY NSAC/AIF GROUP	PRIORITY	BASIS FOR PRIORITY
6. – Confirmation of anticipatory trip – W	Provide verification or justification for not having anticipatory reactor trip on turbine trip at each condition (power level). [Note all W plants except Duke have this trip but each plant has a specific power level set point.]	II	Will not impact core melt accident and all plants but two have the system.
7. – Evaluation of elimination of PORV function – W, CE	Conduct a study of the potential costs, benefits, and hazards of elimination of PORV function.	III	Having PORV gives some protection against complete loss of feedwater at C-E plants with low head injection pumps. B&W and W could use PORV to avoid lifting code safety valves to deal with complete loss of feedwater.
8. – Reporting failures and challenges of PORVs and safety valves – W – Reporting future failures and challenges of PORVs and SVs – CE – Reporting of failures and challenges to the PORV – B&W 2.1.2c – Reporting of failures and challenges to safety valves – B&W 2.1.2e – Reporting of failures and challenges to SRVs – GE (B.14)	Promptly report all failures and challenges of PORVs and safety valves in accordance with NRC format, addressee, and timing requirements.	I	An adverse industry trend in the performance on challenge of these valves would have safety significance. However, since there are other possible trends which could have equivalent significance this should not be a separate reporting item. Should cover by IE6. Costs would be negligible for this item alone.
9. – Monitoring control board – W, CE	Instruct operators to coroborate indications	I	Simple, no-cost item of obvious significance (no cost sheet).
10. – Evaluation of effects of core flood tank injection on SBLOCAs – B&W 2.2.2c	Evaluate the effectiveness of core flood tank in mitigating SBLOCAs	III	The core flood tank does not mitigate the SBLOCA. B&W has already completed the analysis (no cost sheet).
11. – Analysis of plant response to a SB which is isolated, causing RCS repressurization and subsequent stuck-open PORV – B&W 2.6.2c	As stated in item description.	I	Analysis completed by B&W (no cost sheet).
12. – Analysis of plant response to a SB in the pressurizer spray line with a stuck-open spray line isolation valve – B&W 2.6.2c	As stated in item description.	I	Analysis completed by B&W (no cost sheet).
13. – Evaluation of effects of water slugs in piping caused by HPI and CFT flows – B&W 2.6.2c	As stated in item description.	I	Analysis completed by B&W (no cost sheet).
14. – Evaluation of RCP seal damage and leakage during a SBLOCA – B&W 2.6.2f	As stated in item description.	I	Analysis completed by B&W (no cost sheet).
15. – Submit predictions for LOFT Test L3-6 (RCPs running) (Schedule for performing test not finalized) – B&W 2.6.2g	Predict SBLOCA flow rates at LOFT, dependent upon operation of RCPs.	III	Analysis completed by B&W who does not feel that the tests are necessary (no cost sheet).

TABLE III (Continued)

ITEM	SCOPE AS VIEWED BY NSAC/AIF GROUP	PRIORITY	BASIS FOR PRIORITY
16. – Submit requested information on the effects of noncondensible gases: (1) justification for omission of radiolytic decomposition as a source of noncondensible gases and (2) verification of predicted condensation heat transfer degradation – B&W 2.6.2h	As stated in item description.	I	Analysis completed by B&W (no cost sheet).
17. – Evaluation of mechanical effects of slug-flow on steam generator tubes – B&W 2.6.2i	As stated in item description.	I	Analysis completed by B&W (no cost sheet).
18. – Impact of [Action Plan] recommendations – GE (B.15)	Review the impact (value, hazard, and priority) of all action items on plant safety and reliability.	I	This item is an important concern and should be completed for all NRC action plan items before an order to implement is issued (no cost sheet).
ALL OF THE FOLLOWING ITEMS APPLY TO GE ONLY *			
19. (A.3) Spurious isolation of HPCI and RCIC	Modify pipe break detection circuitry so pressure spikes resulting from HPCI and RCIC initiation will not cause isolation	I	GE has determined that a time delay of from 3 to 5 seconds will eliminate spurious isolation and yet does not degrade the safety function of the isolation signal.
20. (A.5) Identify water source prior to manual ADS	Emergency procedures should include verification that a source of cooling water such as core spray, LPCI, or feedwater be available prior to manual activation of ADS	II	Revised operator procedures already specify that low pressure ECCS should be on prior to manual ADS.
21. (A.6) Report of outage of ECC systems	Licensees should submit a report with detailed outage dates, causes, and length of outages for all ECC systems over the last five years of operation	II	Low cost.
22. (A.10) Restart of core spray and LPCI on low level	Modify core spray and LPCI logic to restart automatically after being manually stopped on loss of water level if an initiation signal is still present	II	Keeping adequate water in vessel to avoid fuel rupture is a fundamental requirement and should be assured automatically; operator should be backup. NRC proposal may not be the best way to do it and could introduce hazards by interfering with other system functions.
23. (A.11) Revised emergency procedures	All operators should, as a minimum, be required to read all emergency procedures that have been implemented or modified since their previous shift	III	Inadequate for critical procedure changes with great safety impact. Suitable training briefings could be established under I.C.2 For other changes this NRC proposal is a reasonable, common-sense approach but does not belong in the Action Plan since the effect on safety is minimal. Low cost; easy to do.
24. (A.15) Depressurization with other than ADS	Analyses are required to support depressurization modes other than full actuation of the ADS (to reduce stresses due to rapid cooldown)	II	Analyses have already been submitted for selected plants on the depressurization response of the BWR with the opening of a small number of relief valves.

*Note: Cost estimates for B&O task force BWR recommendations have been completed only for items A.12 and A.13. Cost estimates for the other recommendations are being prepared now by GE and BWR utilities and will be available by 2/22/80 through GE.

TABLE III (Continued)

ITEM	SCOPE AS VIEWED BY NSAC/AIF GROUP	PRIORITY	BASIS FOR PRIORITY
25. (A.17) Michelson concerns	GE should provide a response to the Michelson concerns as they relate to BWRs	II	Not high priority. The questions Michelson posed for PWRs are not generally applicable to BWRs.
26. (B.1) Automatic switchover of RCIC suction	Switchover of RCIC suction from the condensate storage tank to the suppression pool should be automatic on low condensate storage tank level. Until implemented, licenses should verify that clear and cogent procedures for manual switchover exist.	III	Not high priority. No credit is taken in ECCS analysis for the operation of RCIC. The current plant design for the HPCI and RCIC satisfies all current safety criteria. Little reduction in risk would be achieved.
27. (B.2) Central water level recording	All BWRs should have the capability to record vessel water level over the range from the top of the vessel dome to the lowest pressure tap. Recorders should start automatically on reactor trip signal.	II	All information needed on RPV water level following a transient or accident is adequately displayed for required operator action.
28. (B.5) Use of RHR for fuel pool cooling	Fuel pool cooling systems should be self-sufficient to avoid boiling and , hence, a steam environment for some auxiliary systems when RHR is required by safety systems. GE should perform a risk assessment.	III	Not required. The fuel pool is already equipped with a fuel pool cooling system. Use of RHR for supplemental fuel pool cooling is rarely, if every, used. Any requirements can be handled by procedures which would not reduce ultimate plant flexibility.
29. (B.9) Test program for SBLOCA model verification	Appropriate test programs should be developed for the purpose of verifying the BWR small-break LOCA models. The staff requires pretest predictions of future programs.	I	For the current SBLOCA model one test has already been performed and the remainder has been committed to be performed prior to 3/31/80. The need for model revisions has not been demonstrated.

CATEGORY D

SCOPE STATEMENTS AND
PRIORITY EVALUATION SUMMARIES
(IN ORDER OF PRIORITY)

Number	Title
II.B.4	Degraded Core - Training
II.E.4.4	Containment Purge
II.K.1	IE Bulletins on Measures to Mitigate Small Break LOCA's and Loss of Feedwater Accidents
II.E.1.1	Auxiliary Feedwater System Reliability
II.E.2.3	Treatment of Uncertainties in ECCS Performance Predictions for Small Break LOCA's
II.B.7	Containment Inerting
II.B.9	Conceptual Designs for the Mitigation of Severe Core Accidents
II.E.4.3	Gross Containment Integrity Check
II.D.4	Automatic Closure of PORV Block Valve

II.B.4. Degraded Core—Training

SCOPE (clarification based entirely on NRC discussions)

A training program will be developed to instruct operators on the use of safety and non-safety systems to control and mitigate accidents. The program emphasis will be on recognizing symptoms and dealing with them using a selection of systems and methods rather than attempting to diagnose the transient or condition and using a single prescriptive procedure. The objective is for the operator to prevent the transient from proceeding any further, regardless of the present plant condition. The program should emphasize a total knowledge of all instruments, equipment, and systems that can be used to implement basic safety functions. The program will then be implemented.

PRIORITY EVALUATION

This task is judged to be Priority I.

The enhanced operator capability for dealing with off-normal events has the potential for affecting all accidents, thus providing additional safety margins to plant operation. The philosophy of this training program, i.e., its emphasis on recognizing symptoms and dealing with them using a selection of systems and methods rather than simply attempting to diagnose the transient or condition and using a single prescriptive procedure, will provide the operator with an additional analytical tool and should enable him to react in a more timely manner to an off-normal event. It therefore has the potential for minimizing both the duration and the consequences of all accidents. Its inclusion in the periodic retraining program will increase its potential for effectiveness.

II.E.4.4. Containment Purge

SCOPE STATEMENT (condensation of NRC description)

The NRC had previously identified some operating restrictions on the venting and purging systems of plants with operating licenses.* Operating License applicants will be required to adopt the interim NRC measures subject to continuing NRC studies on the subjects of operator versus public ALARA dose considerations and LOCA analyses with open purge valves. In particular, applicants must:

1. Restrict purging in accordance with their own evaluations of ALARA considerations (to be reviewed by NRC and compared against the NRC's analysis)

2. Provide a test and analysis program to substantiate the claim of purge valve closure against DBA pressures.

3. Implement, where necessary, NRC interim measures to assure valve operability (including blocking valves partially closed to facilitate closing against DBA pressures and assuring that all signals to close the valves cannot be simultaneously bypassed)

4. Adopt future measures that result from the NRC's study

* For some plants this has meant a reduction in allowable purge times with potential increases in radiation, temperature, and humidity levels within containment.

PRIORITY EVALUATION

This item is significant for accidents in which radioactivity could potentially be released to the containment. For these scenarios, valve operability is essential to control releases to the environs. The NRC has previously established guidelines and interim requirements for operating plants related to assuring valve operability and containment isolation, which go back as far as 1978. Because of the significance of adequate containment isolation under accident scenarios, the portions of this item related to containment integrity and valve operability are judged to be Priority I.

It is felt that the balancing of in-plant and off-site ALARA considerations with consideration of post-LOCA implications during purging is worthy of a great deal more NRC attention. It is highly undesirable to limit allowable purging durations arbitrarily based on offsite considerations alone. A major effort is required to balance (1)a realistic calculation of probable off-site doses due to purging during normal operation against (2) the radiation received by plant personnel due to only limited purging and the increased equipment failure risk and required maintainence because of the effects of continual higher pressure, temperature, and humidity inside containment.

Since interim guidance is already available, it will not be necessary to delay the issuance of plant licenses for this consideration.

Therefore, the NRC balancing evaluations should continue as a Priority I effort, but the interim guidance should be sufficient to continue operation on the assumption that the balancing study is completed during 1980.

II.K.1 IE Bulletins on Measures to Mitigate Small Break LOCAs and Loss-of-Feedwater Accidents

SCOPE STATEMENT

Condensed from NRC Statement

Near term operating license applicants will evaluate their plants' compliance to certain IE bulletins and take any necessary corrective actions prior to fuel loading.

The following statement is a condensation of the major points contained in the bulletins; the bulletins include the 79-05 series, the 79-06 series, and 79-08 (for BWRs). The actions include:

1. Assess the adequacy of the plant to safely terminate cooldown transients similar to TMI-2.
2. Ensure that PWR plant operating procedures cover actions to prevent void formation, to recognize voids if they occur, and to maintain core cooling in the presence of voids.
3. Avoid overriding engineered safeguards actions without due cause.
4. Review the status of all safety systems and radioactive fluid transfer systems to ensure they will respond properly to challenges.
5. Implement procedures to ensure proper functioning of the auxiliary feedwater system and containment isolation, and to ensure proper indication of an open PORV safety relief valve.
6. Review and modify as necessary maintenance, test, and reporting procedures to ensure adherence to all plant tech specs.
7. Evaluate the necessity for providing an automatic trip for the reactor coolant pumps during small breaks.
8. Establish an anticipatory reactor trip based on loss of main feedwater or turbine trip.

PRIORITY EVALUATION

The impact of imposing the bulletins issued soon after the TMI-2 accident on other plants that are soon to be operated appears to be positive in terms of assuring better safety system operability and better-prepared plant operators. These bulletins could affect the handling of most significant plant transients, but appear to be especially effective in helping in the recognition and handling of possible local void formation.

Caution needs to be exercised that plant operators are not overburdened with detailed procedures but that they better understand basic safety principles and how they can be applied through the proper use of installed systems. Also, reevaluation should be made of always requiring anticipatory trips based on certain secondary system upsets. Such action appears to overly and unnecessarily exercise the reactor trip system and the entire NSS with the attendant rapid thermal change.

Of most importance is the need to eliminate the confusion surrounding the issue of whether to keep the reactor coolant pumps running during certain transients. This is an example of attempting to solve a generic safety function problem by using a simplistic prescriptive directive. The need to shut down pumps (if at all) is clearly a function of the plant design and the transient condition. The instruction for the operator needs to reflect considered analysis as well as the plant design features and the transient. The present situation has caused a great deal of uncertainty and has significantly contributed to less safe conditions.

The cost of implementing these bulletins is variable depending on plant status and whether the ideas have already been incorporated under other directives, but in any case it appears not to be high.

This action is judged to be Priority I with the understanding that implementation of reactor coolant pump trip and continued use of an anticipatory trip need detailed analyses equivalent to a Priority I effort prior to any effort to further implement these items.

II.E.1.1 Auxiliary Feedwater System Reliability

SCOPE STATEMENT

Condensation of NRC Description

Each OL licensee and OL applicant will be asked to reevaluate its (PWR) auxiliary feedwater system. The evaluation will include: (1) performance of qualitative reliability analyses using event tree and fault tree logic techniques to determine potential failures under various loss of main feedwater conditions, (2) a deterministic review of the auxiliary feedwater system, and (3) a reevalution of the system flow design bases and criteria.

Clarification Based on NRC Discussion

The intent of the study is to identify potential weaknesses in the system, possible failure modes, and situations where component response is improperly dependent on other actions or conditions.

PRIORITY EVALUATION

Although not all core damage sequences are affected by the performance of the AFW system, many of the more likely transient events rely on the AFW system to provide a heat sink as an initial part of transient termination. Furthermore, a deterministic review of the system design coupled with qualitative reliability analyses should provide a system that is extremely reliable for the more common of the anticipated loss-of-feedwater events.

These advantages result in a judgment that this is a Priority I.

II.E.2.3. Treatment of Uncertainties in ECCS Performance Predictions for Small Break LOCAs

SCOPE STATEMENT (clarification based on NRC discussion)

Many conservative assumptions are used in making small break LOCA calculations that may introduce significant uncertainties or inaccuracies -- in part due to the fact that the analyses are based on models established for large breaks. An assessment will be made on how to specifically adjust an equally detailed set of methods called for in Appendix K of 10CFR50 so that an equally detailed set of methods is understood and made available for small break analyses. These methods will properly account for the assumptions so that the acceptability of ECCS performance is assured for these breaks.

The NRC will request a reevaluation of the models used to establish better assumptions. The NRC will evaluate these results and recommend changes to the NRC regulations and guidelines.

PRIORITY EVALUATION

This task is judged to be a Priority II effort.

The performance of this task is expected to result in a more precise evaluation of ECCS performance during small break LOCA events. The likelihood for it leading to significant changes in requirements of ECCS performance to mitigate these accidents is judged to be low. Its potential impact on accidents is limited to small break LOCAs and to SRV (for BWRs) and PORV (for PWRs) events. Present confidence in the conservatism of the current calculational techniques and the adequacy of ECC systems supports the need to proceed with this study on an as-available basis.

II. B.7. Containment Inerting

SCOPE STATEMENT

Condensation of NRC Description

Containment integrity needs to be ensured even in the event of a hydrogen burn during a postulated severe accident involving extensive reaction between fuel cladding and reactor coolant water. The NRC will require the inerting of BWR Mark I and Mark II containments.

Clarification Based on NRC Discussion

Other licensees will need to evaluate their containments for handling a postulated hydrogen burn--especially those with Mark III and ice condenser containments. Although all structures may not require inerting, it may be necessary to use other systems, features, and procedures to cope with hydrogen generation.

The assumptions, criteria, and source terms will be specified in part by the NRC but will mostly result from mutual agreement between the NRC and industry.

Alternative Scope Statement

An evaluation of the above scope statements led to the conclusion that it would difficult to prove a plant safety improvement through changes based on information presently available. Therefore the following evaluation is based solely on the alternative scope statement presented below:

> Containment integrity needs to be ensured. A study will be performed by the NRC to assess reasonable but postulated conditions under which to evaluate the extent of hydrogen generation, the credit to be taken for preventive features, and any containment features that may be needed to meet this goal.

PRIORITY EVALUATION

The concept of containment inerting is a mitigating factor to be available on the assumption that preventive measures to eliminate hydrogen production have failed. The requirement for studies on how to handle hydrogen production is being applied primarily to small containment structures and those of relatively low design pressure.

In considering inerting, it needs to be recognized that it would eliminate access to the containment during operation and could cut down on the available access time at each end of an outage. This loss of access would eliminate the highly desirable flexibility of the plant operators to quickly enter containment to investigate--and possibly correct--malfunctions in equipment located there. Inerting significantly increases risk to personnel even when the containment has been ventilated in preparation for personnel entry because of the possibility of incomplete purging. (At least one fatality has occurred in such a case.)

The study should include detailed consideration of aspects associated with hydrogen accumulation and coping with consequences of a rapid burn so that alternatives can be properly balanced.

This study is judged to be Priority II. Although not included in this evaluation explicitly, the order to inert Mark I and II containments is judged to be Priority III with the understanding that any consideration of inerting containment or evaluating other containment types for possible inerting will be incorporated in the rulemaking process indicated in II.B.8 of NUREG-0660 (draft 2).

II. B.9 Conceptual Designs for the Mitigation of Severe Core Accidents

SCOPE STATEMENT

Condensation of NRC Description

The NRC will determine whether each licensee having a CP or OL should provide conceptual designs for (1) a filtered vented containment, and (2) a core retention system for its plant. The NRC will select licensees to perform studies of such systems. These studies will be analyzed by the NRC to determine if safety improvements can be achieved, if additional hazards are introduced, and the validity of the design basis.

Clarification Based on NRC Discussions

Credit is expected to be given for certain types of foundations if direct air and drinking water pathways are not significantly affected. Licensees will investigate both passive and active core retention systems that either provide a significant delay in containment penetration or permanently retain core debris inside containment. The analysis will address related effects in containment, including pressure, temperature, and hydrogen and other gas concentrations. Radiological releases above and below ground will be estimated. The study will include a conceptual design for each system to the extent that sizing calculations and general arrangements are completed for at least a class of closely related plants, if not for individual plants.

Criteria, assumptions, and procedures for performing the study will be decided upon mutually between the NRC and industry. The results of this study will be used to establish design criteria and design requirements.

Alternative Scope Statement

An evaluation of the above scope statements led to the conclusion that the proposed study went well beyond what is called for at this stage. A better understanding of the whole problem and its implications for all plant systems is needed first. Therefore the evaluation of the item is based <u>solely</u> on the following scope statement:

> The NRC will have studies performed on conceptual designs for (1) a filtered, vented containment, and (2) a core retention system for one or more typical plants. These studies will be analyzed by the NRC to determine if safety improvements can be achieved, what additional hazards are introduced, and the validity of the design basis. The study will include consideration of all related preventive

features, but will not extend to the level of sizing calculations or specific arrangement drawings.

PRIORITY EVALUATION

Providing a filtered, vented containment system (FVCS) to vent containment atmosphere through a massive filter might reduce the likelihood of large releases of airborne radioactivity and a core retention system might reduce the likelihood of releases to the ground. The basic question here is whether such additions, if they could achieve the stated objective, are needed. WASH 1400 indicated very small risks to the public from reactor accidents; if this view is generally credible, and the group believes that it is, a value impact analysis should be performed to indicate whether such devices can be justified. NUREG 0438, containing the combined reviews of many safety experts, proposed that research be done to provide a better understanding of what could be achieved by a FVCS. The same study also found the addition of a core retention system to be must less worthy of pursuit because any expected public consequences would be very low.

It is recognized that certain political forces are being applied to make some visible changes related to the issue of core melting and the potential release of significant radioactive material for reactors in a few highly populated areas. In this intense atmosphere, care must be exercised to establish logical, coherent justification for actions to be implemented on plants in operation or in advanced construction stages. A study appears to be a reasonable step at this point to better understand the need for such systems and to identify the constraints required because of other safety requirements.

The performance of a study (as described in the alternative scope statement) is supported for both the FVCS and the core retention system. This evaluation should include feasibility analyses and related research on materials behavior to be completed before consideration is given to implementing any system. For example, extensive studies by NSAC have shown that even in the event of an assumed melt through of the core and conservative assumptions on the subsequent interaction of the melt with the base mat, penetration of the concrete is not predicted. Furthermore, even if the core were assumed to melt through, nearly all plants are sited on material that would prevent any short term paths to drinking water and should thus permit effective interdiction of water pathways. The study should place considerable emphasis on preventive features that are related to any postulated transient considered.

As indicated above, WASH-1400 indicates that the risks to the public from commercial LWRs are already very small compared to other societal hazards. An acceptable level of risk should be established. It is believed that a realistic yardstick, considering alternate methods for generating electricity, will show that current reactor designs are acceptable without major new and untested safety systems. Having established an acceptable level of risk, it would be constructive to assess alternative safety systems using a value impact analysis.

The study of these two concepts is judged to be Priority II based on the understanding that this evaluation was done for the alternate scope given above and that such studies be made a part of the rulemaking process indicated in II.B.9 of NUREG-0660 (draft 2).

II.E.4.3 Gross Containment Integrity Check

SCOPE STATEMENT

Condensation of NRC Description

The NRC will develop criteria for determining containment integrity by performing a low pressure, short duration test after each cold shutdown. The purpose of the test is to detect large openings prior to proceeding to power operation.

Clarification Based on NRC Discussion

The test would be on the containment itself and not directed at specific penetrations. If the containment has an active inerting system, no additional testing would be required. Consideration is being given to specifying a maximum permissible makeup rate equivalent to an indication of an opening one to two inches in diameter.

PRIORITY EVALUATION

The purpose in performing a gross containment integrity check is to ensure that no large openings exist in the primary containment prior to going to power operation. It is anticipated that a relatively short, low-pressure test can be used for this purpose following those outages where the more comprehensive integrated leak test is not used. The test provides assurance of reasonable leak tightness in the event radioactivity is released to the containment atmosphere.

No special test of this type needs to be performed for subatmospheric or inerted containments because these systems automatically perform the desired function.

The concept affords significant risk reduction. The actual implementation will require demonstration of its effectiveness using the containment of an operating plant. Effectiveness needs to be judged based on size of hole, time taken from the outage, pressure required, and any other adverse or delaying effect on normal operations to bring the plant back to power. It is important to keep the time required to about twelve hours and the peak pressure under 4 psi to not unnecessarily stress the containment system.

The importance of this idea dictates that a single, but thorough, feasibility study be performed, and if sucessful, carried out on one or two plants for demonstration purposes. This is judged to be Priority I. When demonstration of the method is successfully completed, implementation (which is considered as Priority III during the study and demonstration phases) should then proceed as a Priority I effort. The relatively high cost (in terms of time to perform the test and in installing the necessary systems) requires that this sequence be followed rather than hastily proceeding with the implementation phase.

II.D.4 Automatic Closure of the PORV Block Valve

SCOPE STATEMENT

Licensees will install controls to automatically close the PORV block valve upon low RCS pressure.

PRIORITY EVALUATION

This action item is judged to have both positive and negative contributions to safety, with the overall contribution being negative. Automatic closure of the block valve would be an effective preventive measure in only one specific accident sequence, but could be a detrimental measure in many accident sequences. For example, the operator may wish to quickly depressurize the system to permit operation of a lower presure injection system. In addition, automatic closure denies the operator the control of a valuable and useful operating system, and could be a very confusing and unexpected action in an off-normal or accident situation.

Inadvertent actuation of this system could be an initiator of new accident sequences. The need for this system is minimized by the requirement for positive PORV position indication, by a number of training and procedural items in the Action Plan, and by the intense awareness of the function of the PORV which has been generated in the last year.

This is judged to be a Category III item and it is recommended that this action item be deleted as being contrary to overall safe operation until the above evaluation is performed.

CATEGORY E

SCOPE STATEMENTS AND
PRIORITY EVALUATIONS
(IN ORDER OF PRIORITY)

Number	Title
III.D.1.2	Improved Vent Gas Systems
III.D.1.6	Radioiodine Adsorber Criteria
III.A.1.3	Maintain Supplies of Thyroid Blocking Agent (Potassium Iodide)
III.D.3.3	In-plant Radiation Monitoring (Partial)
III.D.1.3	Secondary Systems
III.D.1.5	Auxiliary and Radwaste Building Ventilation
III.D.2.4	Offsite Dose Measurements
III.D.3.5	Radiation Worker Exposure Data Base
III.D.3.2	Health Physics Improvements
III.D.2.3	Liquid Pathway Radiological Control
III.D.2.5	Offsite Dose Calculation Manual
III.D.2.1	Radiological Monitoring of Effluents

III.D.1.2 Improved Vent-Gas Systems

SCOPE STATEMENT

Condensation of NRC Description and Schedule

The post-accident releases from the gaseous radwaste system at TMI and the event at North Anna Unit 1 have convinced the NRC that the need exists to evaluate both the existing acceptance criteria for the design of vent-gas systems and the need for requiring leak detection systems. The NRC plans to issue additional criteria, as appropriate, by April 1980, with a draft revision of Standard Review Plan 11.3 to follow by July 1980.

In parallel, licensees will conduct initial evaluations considering provisions for over-pressure protection, flow restrictions, system and relief valve discharge points, and degree of filtration. Final review will be required after additional criteria are established by NRC. The licensees are to complete evaluations, provide system descriptions, and submit schedules for modifications by September 1980. NRC will review these in September 1980. Final modifications are to be completed by July 1981.

Alternative Scope Statement

The evaluation team examined the concerns expressed in this Action Item and the objectives of the required review and determined that this item is applicable only to PWRs.

The action discussed with NRC representatives does not consider providing a permanently installed path to vent this system to containment. Such a path should be considered by licensees in their evaluations; costs related to this modification are included in the cost estimate.

PRIORITY EVALUATION

The schedule proposed by the NRC is unrealistic since the NRC review apparantly has not yet started and it is unlikely that NRC guidance will be issued by April 1980. It is also unlikely that the NRC will be able to review all operating plant submittals in September 1980 to allow completion of modifications by July 1981. A more realistic schedule has been estimated. This schedule assumes the NRC will issue initial guidance in June 1980, evaluations by licensees will be submitted in October 1980 and modifications will be completed by September 1981.

The priority of this task was established assuming that the leak reduction program required by NUREG-0578, item 2.1.6.a and the containment isolation modifications required by NUREG-0578 item 2.1.4 have be accomplished. The probability is low that the review and potential modifications to this system would substantially reduce any further the doses from any accidents because of the reviews required by NUREG-0578. However, a detailed review of the as-built system to assure the capability to contain potential post-accident activity could result in some dose reduction where design or construction problems are found.

On some operating plants, the installation of a path to vent this system to the containment may provide additional assurance that post-accident activity will be contained and should be considered as part of the system evaluation.

The cost of the evaluation and the resulting modifications to the vent gas-systems do not appear prohibitive. Because some moderate reduction in risk could occur as a result, this task should proceed on a schedule consistent with available resources but not to interfere with those tasks required to be done on a high priority basis. This item is thus judged to be Priority II.

III.D.1.6 Radioiodine Adsorber Criteria

SCOPE STATEMENT

Clarification Based on NRC Discussion

Licensees will be required to upgrade charcoal adsorbers (at the earliest change out) and implement surveillance testing programs for all filtration systems. The impact of this item is twofold: it will require the use of TEDA or equivalent impregnated charcoal and will further require new surveillance requirements for non-ESF filtration systems. Further research by NRC on charcoal adsorber performance may impact licensees at a later date.

Discussions with NRC staff indicated:

1. TEDA availability is unclear due to potential patent concerns.

2. Availability of TEDA equivalent charcoal impregnant is unknown.

Alternative Scope Statement

The following assumptions were made to complete the scope:

1. TEDA impregnated charcoal is available at little additional cost, but its use is protected by patent and would involve unknown royalty payments (which cannot be estimated and are not included in this evaluation.)

2. Plants under construction generally have surveillance testing capability. Operating plants will need to make provisions for surveillance testing capability. Conceivably, this could involve installation of injection and sample ports, instruments, distribution vanes, temporary test rigs, sample cannisters, etc.

PRIORITY SUMMARY

The NRC schedule is unrealistic due to the time necessary to generate criteria, tech specs, etc., and install equipment.

The likelihood of success for degraded core conditions is only moderate since noble gases are not impacted, charcoal may still be degraded, and non-ESF filter trains may not impact the release path depending on the accident sequence.

Minimal new hazards are involved, primarily radiation exposures due to increased testing and surveillance.

The overall risk reduction is judged to be low as discussed above. Additional factors affecting this judgment include NRC requirements to avoid degraded core cooling, assure containment isolation, provide better plant monitoring, and reduce leakage. At TMI the iodine releases to the environment were low even though effluent adsorbers were apparently relatively ineffective since iodine tended to remain in solution and/or plate out on surfaces inside the plant.

Overall priority for this item was judged to be Priority II, based on the philosophy that systems should be properly maintained. Note that this item reinforces the requirements of Regulatory Guide 1.140.

III.A.1.3 Maintain Supplies of Thyroid Blocking Agent (Potassium Iodide)

SCOPE STATEMENT

The licensees, by March 1981, will purchase and maintain a stock of potassium iodide sufficient for staff and all response personnel on site.

PRIORITY EVALUATION

This analysis assumes that the programs required by NUREG-0578 to reduce the likelihood of a major accident and mitigate its consequences have been accomplished.

Essentially all major accident recovery sequences are likely to involve some worker exposure to airborne radioiodine, although more include exposures in excess of established dose limits. Potassium iodine use is likely to give some reduction in the thyroid dose for workers exposed to radioiodines, which would be of particular benefit in the unlikely event an uncontrolled exposure occurs. Post-accident health physics procedures minimize this possibility.

The potential hazard associated with the use of potassium iodine is that it could possibly be found to have, or claimed to have, adverse health effects; but this should be of minor concern since it has been used previously and its use will be endorsed by the appropriate governmental agencies.

Because this item could result in a slight reduction of risk, to plant workers with a very low cost, it is judged to be Priority II.

III.D.3.3 Inplant Radiation Monitoring

SCOPE STATEMENT

NRC Description

NUREG-0578, 2.1.8.c and 2.1.6.a required OL's and NTOL's to implement radioiodine sampling capability and to identify vital areas for access after a major accident. The NRC will issue requirements for area radiation monitors for vital post accident access areas, a rule change for radiation monitor calibration, and a Regulatory Guide for calibration of iodine sampling equipment. OL's and NTOL's must add area monitors for vital post accident access and provide a low background iodine sample analysis area.

Classification Based on NRC Discussion

Discussion with NRC representatives indicated the following:

a. Monitors are to be gross gamma sensitive and wide range (normal plus accidents).

b. Upper scale may be based on TID accident sources and realistic pathway analysis.

c. Remote readout is required but not necessarily in the control room.

d. Monitors are not intended to replace health physics coverage but will aid in planning post accident access.

Alternative Scope Description

It was assumed that 10 non-safety grade monitors will be required per plant. Also, it was assumed that a suitable low background counting area will be available at each plant for general chemical/health physics needs and, thus, was excluded from this scope.

PRIORITY SUMMARY

The broad range radiation monitors may be of assistance in planning post-accident access, but actual access monitoring would be controlled by normal health physics procedures.

Also, these monitors would not be part of the systems designed to monitor or control plant effluents and public radiation exposure. Therefore, their action items will have no accident sequence impact. The likelihood of success is zero, since even if implementation is successful there is no resulting impact on the health and safety of the public.

New hazards include worker doses for installation and maintenance and the potential for less "worker access caution" due to a tendency to rely excessively on permanent monitors. These hazards are judged to be minor.

The hardware is catalog equipment with 14 months for specification and delivery. Installation will require 3-9 months depending on labor and outage schedules. Overall risk reduction is zero for the public and low to moderate for workers. Licensee costs are expected to be $10k/monitor and $10k/monitor installation plus 12 man-months for engineering.

New calibration requirements for plant samplers and monitors are expected to cost $10K/yr for technician labor.

Although there is no public risk reduction, this item should be considered for implementation due to the added worker benefit, even though this is low. Other NRC requirements for post accident safety grade containment radiation monitors have burdened suppliers to the point that delivery time is approximately one year.

It was therefore judged that the requirement for access monitors should be Priority II to avoid impact on implementation of safety grade accident monitors in containments.

III.D.1.3 Secondary Systems

SCOPE STATEMENT

NRC Description

Licensees and operating license applicants with PWRs must evaluate primary-to-secondary side leakage and subsequent radioactivity leakage from the secondary system to buildings outside containment. This evaluation must include radiological hazards to workers and the public which could result from a major accident. Licensees and applicants must make modifications to reduce those hazards, as appropriate, based on the results of these evaluations.

Schedule

NRC	- Issue requirements	March 1980
	- Evaluate responses and issue regulatory position	Sept. 1980
	- IE complete inspections	Dec. 1980
	- NRR revise Standard Review Plan	July 1982
Licensee	- Evaluations complete	April 15, 1980
	- Modifications complete	July 1, 1981

PRIORITY EVALUATION

The NRC proposed schedule outlined above is not realistic in that insufficient time is provided for the NRC to establish requirements and for the licensees to perform evaluations. A more realistic schedule is for the NRC to issue requirements by July 1980, licensees complete evaluations by April 1981 (after the NRC issues its regulatory position) and licensees complete modifications by April 1982.

Related to this Action Plan item, the NRC has internally developed the following concerns:

a) Will the lack of shielding make any key equipment inaccessible?

b) Are equipment drains piped so that leakage on the floor would be minimized?

c) Do plants have the capability to pump the turbine building sump to the normal radwaste system (likely to be required by NRC)?

d) Are all gaseous and liquid discharge points monitored?

e) Is liquid radwaste capacity adequate to handle secondary side leakage?

f) Is the condensate storage tank likely to become a radiation hazard or a source of radioactive effluents?

g) Is the turbine building ventilation system adequate?

The evaluation team further assumed the following:

1) Source terms as specified in NUREG-0578 for primary side.

2) Technical specification limiting values for primary-to-secondary side leakage.

3) Realistic leak rates for secondary side systems airborne and liquid leakage.

4) The evaluation is not intended to be a detailed analysis, but rather an evaluation of primary-to-secondary leakage impacts on plant access and releases.

Despite these clarifying concerns and assumptions the total scope of this task remains vague, and a broad range of potential modifications are possible. The probable required modification is to provide a path from the turbine building symp system to the radwaste system. A less likely requirement is to install air ejector filters. These modifications are included in the uncertainty in the cost estimate. More extreme modifications are possible but not considered likely enough to include in the estimates.

The experience at TMI-2 demonstrated that secondary side radiological sources were not a major contributor to public doses despite the fact that the secondary system was used to cool the primary system for a protracted period.

The intent of this task is to cause design modifications in oper-operating and OL stage plants to reduce post-accident worker and public design base dose levels below established limits, i.e., to apply post-accident ALARA design considerations. Although the concept may be valid, the degree of reduction and the criteria for evaluation are not defined. Before meaningful evaluations and cost-effective modifications can be accomplished, the NRC must establish clear regulatory guidance for post-accident conditions in an analogous manner to the guidance provided in Regulatory Guide 8.8 for routine operation.

This task should be deferred until the goals are more specifically defined and is, therefore, judged to be Priority III.

III.D.1.5 Auxiliary and Radwaste Building Ventilation

SCOPE STATEMENT

NRC Description

Licensees and operating license applicants with PWRs must perform studies and make modifications based on these studies to improve the control of airborne radioactive leakage within the auxiliary and radwaste buildings and provide for the collection and processing of airborne radioactive particulates and radioiodines prior to release to the environment.

Clarification Based on NRC Discussion

Discussions with NRC staff indicated:

(1) Impregnated charcoal adsorbers must be provided for treatment of exhaust air from those portions of the auxiliary building postulated to contain highly radioactive fluids. The exhaust air from the entire auxiliary building need not be filtered.
(2) The filtration is only required under accident conditions (e.g., diverson of air flow on a high radiation signal as opposed to continuous filtration during normal operation is acceptable).
(3) Filtration systems need not be safety grade.

Alternative Scope Statement

Based on the above, the following assumptions were made to complete the scope:

(1) Systems containing radioactive fluid are as defined in licensee January, 1980 submittals (NUREG-0578 - 2.1.6.a).
(2) Realistic leakage rates are to be used based on the leakage rate reduction program (NUREG-0578 - 2.1.6.a).
(3) Plants without charcoal adsorption capability in the Auxiliary Building would have to backfit systems of 50,000 - 100,000 cfm capacity. This would include an estimated 80% of the operating and near term PWR's.

Schedule

NRR will issue requirements by 3/80. Operating PWR's must identify improvements by 8/1/80 and implement by 7/1/81. OL applicants must submit plans for implementation before full-power operation.

PRIORITY EVALUATION

NRC implementation schedule is unrealistic for plants which must backfit systems. Most backfit systems would not be operational until the first half of 1982.

The likelihood of success is high for minor release scenarios but only moderate for degraded core conditions since noble gases are not impacted and the charcoal may be degraded even with regular surveillance testing. New potential hazards are always a possibility in modifying existing ventilation systems, particularly imbalancing of plant HVAC and causing inadequate control of airborne radioactive materials in some plant areas.

The overall incremental risk reduction due to this action item is judged to be low due to the above and previous actions to avoid degraded core cooling, isolate containment, provide better plant monitoring, reduce leakage, etc. At TMI the iodine releases were low even though there was substantial iodine in solution and the installed effluent adsorbers were degraded. Iodine tended to remain in solution and plate out on surfaces.

This item is judged to be Priority III.

III. D.2.4 Offsite Dose Measurements

SCOPE STATEMENT

NRC Description

The NRC plans to evaluate the feasibility, desirability and necessity for environmental monitors capable of measuring real-time rates of exposures to noble gases and radioiodiens for transmission to control room. If feasible the NRC will also prepare model technical specifications. In addition, the NRC (RES) will study the feasibility of transmitting offsite dose and dose rate information directly to NRC operations center. Finally, the NRC plans to place 50 TLDs around each site and submit reports to NRC, State and Federal organizations on a quarterly bsis or at appropriate intervals in the event of an accident.

Clarification Based on NRC Discussion

Discussion with NRC representatives indicated that transmission of real time data could be to the Technical Support Center or the Control Room or both. It was unresolved as to whether licensees or NRC will provide quarterly reports from TLD data.

Alternative Scope Statement

The AIF review group assumed that:

1. Licensees will provide quarterly reports to NRC, State and Federal organizations.
2. Cost of potential data link to NRC would be borne by the utilities and NRC would pay for data link terminal.
3. Twenty real time dose monitors would be located off the plant site.

PRIORITY EVALUATION

This item would require TLDs around each plant and potentially require real time dose monitors, if they were found feasibile.

Although additional offsite dose information may be helpful in future public evacuation decisions (and, therefore, impacts several accident sequences), the real time monitors appear to be of questionable added significance considering the presence of upgraded emergency mobile measurement capability, upgraded effluent monitors, extensive TLD use, and on-site dose monitors.

No significant new hazards are associated with this action item.

Since the incremental value of the real time monitors is believed to be small, and the feasibility is yet to be determined by NRC studies, the overall risk reduction must be viewed as low and this item judged to be priority III.

III.D.3.5 Radiation Worker Exposure Data Base

SCOPE STATEMENT

NRC Description

NRC will expand the requirements for nuclear facility radiation worker records to permit later epidemiologic studies of worker health. Licensees must develop procedures to collect and transmit the required data to NRC. Data includes external and internal doses, medical radiation exposures, health data and exposure to non-radioactive carcinogens.

Alternative Scope Statement

It was assumed that licensees would implement a computerized data system.

Schedule

Legislative action and revision of 10CFR20 to require licensees to collect data is scheduled for completion October, 1982. Implementation by OL's is set for March 31, 1983, and other applicants prior to OL issuance.

PRIORITY SUMMARY

This action has no impact on accident sequences since it merely involves personnel data. Therefore, the likelihood of successful impact is zero. The likelihood of successful implementation is judged as only moderate since some data is substantially subjective (e.g., worker health) or impossible to obtain completely (e.g., exposure to non-radioactive carcinogens).

This action appears to introduce no new hazards.

It was estimated that implementation could be complete in 6 to 12 months after requirement issuance. This would include programming and procedures (1 man-year) and procurement of a minicomputer or additional capacity for an existing computer ($25K). Continuing support for this action is estimated to be 0.5 man-year/year for clerical work. The overall reduction in risk is zero since there is no accident impact.

This item was judged to be Priority III and it is recommended that all data other than in-plant worker exposure data be dropped from further consideration in this item, since licensees have no control over such non-occupational data and no legal right to obtain much of it.

III.D.3.2 Health Physics Improvements

SCOPE STATEMENT

NRC Description

This item will require future rule changes and regulatory guide issuances. The intent of these changes is to require licensees to have dosimetry processing done by a nationally certified processor (10CFR20 proposed change), use audible alarm dosimeters (proposed regulatory guide), and only use NRC approved radiaiton survey instruments (a standard to be developed via NRC/ANSI efforts).

Clarification Based on NRC Discussion

The requirement to have dosimetry processing conducted by a nationally certified processor is not intended to preclude a utility from obtaining such certification itself.

PRIORITY EVALUATION

This task is unrelated to reduction of public risk; however, implementation of these recommendations may aid a utility somewhat in administering its health physics program. The major benefit to be derivedmay be an increased probability of not violating technical specifications on worker exposure.

Because the health physics (HP) program itself (i.e., the quality of the program and the dedication of the HP staff) will tend to overshadow the incremental improvements to be derived from this task, likelihood of success in reducing tech spec violations is viewed as only moderate.

There is a slight potential for hazard introduction via the use of audible alarm dosimeters, although it is difficult to gauge the net effect. It may be human nature for workers to begin to depend on hearing the dosimeter alarm before realizing that they may be exceeding their allowable dose. Under such circumstances, individual allowable dose may be exceeded. It is expected that such would be the exception, not the rule, so that net effect of audible alarms should be positive.

Overall reduction in risk to the public is zero and is expected to be minimal to the workers because the risk to workers is more a function of the overall HP program which would only be slightly affected by the proposed action.

III.D.2.3 Liquid Pathway Radiological Control

SCOPE STATEMENT

NRC Description

This item concerns methods and provisions to assess, control, mitigate, and monitor accidental radioactivity releases via the liquid pathway. NRR will develop procedures and site comparisons and categorize plants based on the "Liquid Pathway Generic Study" (NUREG-0440) population doses. All licensees and applicants must provide supporting information (12/80) and identify specific state-of-the-art procedures and equipment, timing of installation, and interfaces with other existing monitoring programs. Category I (unfavorable relative to LPGS) sites require prompt interdiction and mitigation programs. Category II (favorable) sites may implement programs on an expanded schedule. Pre-release monitoring equipment must be in place at operating reactors by December, 1980.

Clarification Based on NRC Discussion

Discussions with the NRC representatives indicate that:

1. Category I sites have fast liquid transport pathways, e.g., on the order of hours rather than days. Relatively few sites will be Category I.

2. The only distinction between Category I and II in Draft 2 is the schedule for implementation. However, only Category I plants would have to implement non-procedural modifications such as monitoring wells.

3. Primary concern is class 9 accidents, e.g., containment melt-through as opposed to design basis accidents such as liquid radwaste system failures.

4. "Pre-release" monitoring is not defined and NRC representatives could not provide clarification despite the fact that implementation is scheduled for 12/80.

Alternative Scope Statement

Based on the above the following assumptions were made to complete the scope:

1. The only additional hardware required is monitoring wells, and then only for Category I sites. Grab samples using existing equipment for analyses are sufficient.

2. Pre-release monitoring equipment is already provided via existing plant sampling and monitoring systems.

3. Engineered interdictive measures (as opposed to simple notification of potential users on the liquid pathway), will not be mandated due to prohibitively high cost and low probability of success.

PRIORITY SUMMARY

Likelihood of success is increased to 50-75% for sites with a pre-planned liquid pathway control program involving monitoring procedures and notification of potential users. Likelihood of success for engineered interdictive measures is very low and the cost would be prohibitive. The overall risk reduction is low due to preventive measures already implemented to avoid degraded cores, provide better plant monitoring, reduce leakage, etc. In addition, the hypothetical containment melt through sequences evolve slowly relative to a liquid pathway threat at most sites, and the affected potential user population would likely have already evacuated. Therefore, this item is judged to be Priority III.

III.D.2.5 Offsite Dose Calculational Manual

SCOPE STATEMENT

NRC Defined Scope

NRC will proceed to develop a manual to provide a standard manual calculational method for estimating individual and population doses during an accident. Plant manuals/procedures to be revised accordingly.

Additional Information from Discussions with NRC

The calculational methodology is expected to be realistic based more on R.G. 1.109 methodology than R.G. 1.3/1.4 methods/assumptions.

Schedule

NRR Complete Draft Manual -- 12/80
NRR Complete Final Manual -- 3/81
Licensee Revise Procedures
- -Operating Plants -- 6/81
- -NTOL -- Prior to Startup

Industry Assumptions

None

PRIORITY SUMMARY STATEMENT

Although there is no major objection to standardization of calculational methods, the incremental benefit of such actions is not substantial, i.e., methods currently exist to do this function.

Because no real benefit is perceived, likelihood of success affecting (reducing) the consequences of accident sequences 1-4 is low or non-existent. No hazards are expected to be introduced by adopting this methodology.

Implementation schedule appears reasonable.

There is no doubt that good data fed into a quick response calculational methodology has the potential to reduce risk by accurately portraying/projecting realistic population dose. Because a standardized calculational tool is not necessary to accomplish the preceding, no reduction in risk is anticipated. Accordingly, this task is graded a III.

III.D.2.1 Radiological Monitoring of Effluents

SCOPE STATEMENT

NRC Description and Schedule

NRC will issue backfit requirements for PWR steam dump radiation monitors by August, 1980. These monitors will monitor and sample noble gases and radioiodines released to the atmosphere during a PWR steam dump.

NRC will evaluate the feasibilty and perform value impact analyses of accident effluent radiation monitors that go beyond current revisions of Regulatory Guide 1.97 and NUREG-0578, 2.1.8.b. These studies would involve systems beyond the current state-of-the-art.Factors to be included in the NRC evaluation are: (a) establishment of a requirement for a background-compensating monitoring system, (b) establishment of a requirement for direct quantification of individual radioisotopes in the effluent stream, (c) the effectiveness of various radioiodine adsorbers in sampling systems, (d) establishing a requirement for locating monitors in an area which will have a low background area during accident conditions, (e) establishment of a requirement for certain monitors to meet engineered safety feature (ESF) criteria, (f) quality assurance and control requirements and (g) real time radioiodine monitors. NRC will issue revised Regulatory Guides for comment and complete the study of real time radiodine monitors by March, 1981. No dates have been projected for formal NRC issuance of Regulatory Guides or requirements.

Licensees will implement new systems by December, 1981 or as soon as practical if upgraded systems are not available from vendors for implementation by December, 1981.

Alternative Scope Statement

The evaluation team made the following scoping assumptions:

1. PWR's will be required to provide a monitor for noble gas and iodine releases to the atmosphere during a steam dump. Monitoring at four dump valves upstream of the stream line isolation valves will be required.

2. Real time isotopic analysis of effluents will be required at four locations. This will involve on-line computerized spectral analysis with background compensation using equipment qualified for the accident environment.

PRIORITY EVALUATION

The evaluation team discussed this action with NRC representatives but were unable to obtain any further definition of scope. It was confirmed that this action is generally beyond the current state-of-the-art and will require extensive development programs. The NRC representatives acknowledged that the schedule for implementation is very unrealistic.

This action could impact core melt/damage sequences by providing information to estimate public doses and aid in decisions to activate evacuation plans.

The likelihood of success is estimated at only 50% since studies of the added degree of protection provided by this action have not been performed. Furthermore, they cannot be performed until the feasibility of advancing the state-of-the-art is determined.

The introduction of new hazards is moderate, based on the fact that "new technology" monitors could be less reliable and could cause false alarm and evacuation as well as require extensive plant worker time in radiation areas for operation and maintenance.

The overall reduction in risk was judged to be small in view of the likelihood of success, possible new hazards and the fact that extensive upgrade of sampling and monitoring is already underway via Regulatory Guide 1.97 and NUREG-0578 (2.1.8).

This action involves new state-of-the-art equipment. It is estimated that 2-3 years will be required for development, design and qualification by vendors. Licensee specification, procurement, and plant application design would require 12-18 months. Plant installation would take 6-12 months. Overall, the schedule is 3-1/2 to 5-1/2 years.

Costs are estimated to be:

1. Effluent monitors at 4 locations:

Hardware	-- $1M
Plant Application Engineering	-- 1 man-year
Installation	-- $500K
Operations/Maintenance	-- 0.5 man-year/year

2. PWR steam dump monitors:

Hardware	-- $200K
Plant Application Engineering	-- 0.5 man-year
Installation	-- $100K
Operations/Maintenance	-- 0.25 man-year/year

Because of the high cost, low benefit and lack of definitive scope, this item was judged to be Prioroity III.

Appendix B

DESCRIPTION OF METHODOLOGY FOR PRIORITY EVALUATION[1]

I. INTRODUCTION

A multi-attribute value-impact assessment methodology has been developed for assigning overall priorities to competing regulatory actions. The method is based upon the state-of knowledge concept in which all available information, both qualitative and quantitative, is brought to bear on the decision process. It is a cost-benefit methodology that seeks to evaluate the costs and the changes in risk to workers and the general public as a result of specific regulatory actions.

The first step is to assess the type and importance of accident sequences that could be impacted by a proposed action. Next, the likelihood that the proposed action succeeds in achieving the desired end is evaluated. Then the proposed action is examined carefully to determine if unanticipated hazards may result from its implementation. Finally the cost and time to implement the action are considered. The methodology can accommodate both data accumulated from experience and the judgment of competent engineers.

In this process each proposed action cannot be considered alone but must be evaluated as an integral part of all existing instrumentation, procedures, people, and requirements. Thus the advisibility of these actions is contingent or conditional upon the completion of other actions in the plan.

II. GENERAL APPROACH

First, system (equipment) failure event trees are considered for accident and transient sequences leading to core melt, as in WASH-1400. Then an expanded set of event trees is envisioned that branch to restricted core damage as well as core melt but that include the possibility of operator intervention. This expanded set of event trees provides the basis for the following health and safety risk-oriented ranking scheme for proposed actions:

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[1]"Demonstration of Prioritization Methodology", Pickard, Lowe and Garrick, Inc. for the Nuclear Safety Analysis Center; Attachment to letter from E. L. Zebroski, NSAC, to Byron Lee, Jr., AIF Policy Committee on TMI Follow up, dated February 5, 1980.

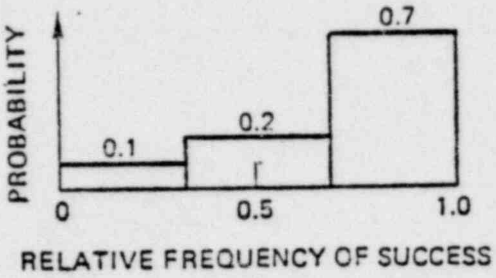
TABLE I
IMPACT* OF PROPOSED ACTION

1. Impacts dominant core melt/damage sequences or many less likely sequences.
2. Impacts many core damage sequences.
3. Impacts a few core melt/damage sequences.
4. Impacts a few core damage sequences.
5. Impacts minor release sequences.
6. Impacts plant availability, but not release sequences.
7. Impacts equipment availability.
8. Impacts Technical Specification Violations (no dollar cost or release sequence impact).
9. No Impact

*Impact ⟹ changes probabilities of events along sequences.

These categories include both risks to health and safety and risk of dollar losses. The first four categories are most serious in both respects because in addition to posing a radiological threat, core damage brings longer outages than any other equipment failure and can affect operation of plants not involved for political reasons. Because these expanded event trees have not been developed formally for any plant and because there exist substantial differences among all operating plants, assigning proposed actions to the impact categories of Table 1 requires careful use of engineering judgment. An evaluation must be made of how many and which kinds of sequences are affected in plants of different design. The priority evaluation process can be performed generically or for any individual plant; in the latter case it is likely that some change will occur in the results due to the specific situation and features of the plant studied.

The next step is to evaluate the likelihood that the proposed action would succeed in mitigating those sequences to which it applies. Here several questions arise which again require substantial engineering judgment. First, if the proposed action were carried out perfectly, what is the probability it would succeed in mitigating the affected sequences? Second, how likely is perfect implementation? For design changes, a reliability analysis of the proposed design is required. For operator aids an evaluation must be made on how likely improved operator response is, given successful performance of the new aid. Recognizing that uncertainty surrounds this evaluation the evaluator is encouraged to express his uncertainty clearly. For example, if he views the likelihood of success of a particular action as probably very high but with some change of moderate likelihood of success and a small chance of low likelihood of success, a histogram like this



conveys additional information on his true state-of-knowledge beyond that provided by a single point estimate.

The third step is an evaluation of any hazard introduced by the proposed action. Here the evaluator must look for direct physical interactions with other systems, the possibility of misinterpretatio of new indications, effects on the operator's ability to control people and equipment, and effects on the operator's morale and performance. Agai an evaluation should be made of the likelihood o each hazard using analysis and judgment.

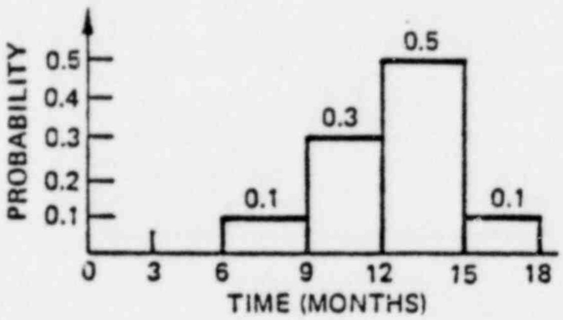
Table 2 presents a ranked list that characterizes hazard categories considered in the evaulations contained in Appendix A.

TABLE 2
Potential Hazards Introduced By Proposed Action

1. Clear and present danger to public.
2. Clear and present danger to plant personnel.
3. May increase chance of major accident.*
4. May increase chance of minor accident.*
5. May decrease plant availability.
6. None

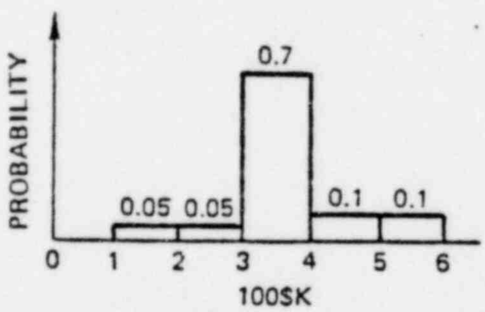
*Directly or by confusing the operator

The final factor affecting risk is the time required (or allowed) t implement the proposed action. Actions rushed too soon to the fiel have reduced likelihood of success and can introduce unexpected hazards. Actions requiring many years to implement suffer from a discounting effect analogous to economic present-worth discounting: people are exposed to existing risks for the interim time period and the benefits are long delayed. The time required for proper implementation is then estimated to aid in the ranking process. Again, the histogram approach helps display the full range of uncertainty. As an example, the time to implement an action effectively might lie between six months and 18 months, as shown:



Now, the reduction in overall risk is expressed. This is a quantitative or descriptive synthesis of the four basic inputs: sequence impact, likelihood of success, hazard introduced, and time to implement.

In the estimates of dollar cost per plant to implement a proposed action, all pertinent factors, such as required shutdown and development costs are considered. These estimates, too, can be shown as histograms. The sources of uncertainty (evaluated by engineerng judgment) include uncertainty in the exact nature of some actions, date for implementation, number of devices required, etc. The following is a description of the state-of-knowledge concerning costs. It conveys more of the available information than a single estimate of $350K could.



Ranking the proposed actions requires a scheme for mixing the reduction in overall risk with the cost of implementation. Such a scheme naturally depends on the personal value structure of the person doing the ranking and is always subject to attack by those holding different values. Therefore, it is prefered that an algorithm for distinguishing among close competitors not be developed: it is bound to be highly personal and can even change for an individual on a day-to-day basis. In contrast, the effects on risk and cost should be evaluated so as to rank the proposed actions in a less formal manner. Some will clearly be better than others for all evalutors once it is agreed on the risk and cost attributes. For those cases where the ranking is not clear, we prefer not to distinguish among the actions. That is, these are considered to be equally desirable (or undesirable) and it is urged that those involved with implementing the items to distinguish among them solely on the basis of convenience.

This method of evaluating the component factors and combingin them to arrive at a relative priority is of value to a single evaluator. However a greater payoff, in terms of understanding the factors that bear on the decision and arriving in an optimum decision, can be obtained using multiple inputs from several individuals knowledgable on the items in question. First, each participant individually expresses his prior views on the component factors (accident sequences impacted, likelihood of success, hazards introduced, cost, and time to implement). The participants should then convene to discuss their individual inputs, identify points of difference, and work toward resolving them. Where warranted, effort can be directed at obtaining additional information in areas of major disagreement. Finally a consensus set of input is arrived at for each item. A major strength in the use of this multiple-input, iterative process is that it clearly and efficiently identifies points of agreement and disagreement, and focuses energies on resolving these differences.

III.APPLICATION

The basic methodology for laying out the separable values and impacts was used by all the evaluation teams involved in the working group activity.

Depending on the specific actions considered and the personal characteristics of each subgroup and the item in question the analyses varied over a range from primarily quantitative to quite descriptive. Some groups combined several component factors (e.g., accident sequence importance and likelihood of success) while some separated them even further. The exact steps through the process are not as important as the structured thinking backing up those steps.

APPENDIX C

DESCRIPTION OF COST & SCHEDULE ESTIMATION METHODOLOGY

The following parameters, assumptions and logic apply to the development of cost and schedule estimates:

A. All costs were developed in terms of current (February, 1980) dollars.

B. The scope descriptions were compiled by each of the five work groups and were utilized as a starting point for assessing the cost and schedule impact of each line item. Where possible and appropriate, more refined and detailed requirements were established, such as quantities of materials, equipment and installation labor. A substantial effort was made to define and document the scope (assumed, if necessary) to the extent required to produce cost and schedule estimates. Time and information constraints were limiting factors in many cases.

C. Each line item was assessed utilizing the most appropriate "common denominator", examples of which are:

1. Cost per plant site (single or multiple units);
2. Cost per operating unit;
3. Cost per unit under construction;
4. Cost per BWR;
5. Cost per PWR;
6. Cost per industry or owner group study.

D. Exhibit A shows the generating unit figures which were used for development of Total Industry costs. The source for this data, in large part, was the February 1980 issue of "Nuclear News". It was assumed that, on the average, there are two generating units on each plant site. The 63 units which are less than 25% complete were not explicitly considered in this study. However, it is estimated that inclusion of these 63 units would result in an increase in the capital cost estimate of $ 1 billion. This figure assumes that the implementation cost per unit for these 63 units would be 75% of the unit cost of those which are now operational or more than 25% complete.

E. It was assumed that each line item would be started and completed as if it was the only activity under consideration. That is, schedules and costs were developed assuming virtually unlimited resources and the absence of competition for those resources among line items.

F. It was assumed unless otherwise noted, that all work on operating plants could be performed during planned outages; and that no extension or supplementation of those outages would be required.

G. Near Term Operating License (NTOL) Units
Since a large number of the line items are not required to be implemented on NTOL's prior to receiving an operating license, it was necessary to consider NTOL's as both "Units Under Construction" and "Operating Units" depending on the particular line item being considered. NTOL's were treated as operating units (i.e., implementation of action items not required prior to issuance of an operating license) except for the following ten line items: I.C.5, I.B.1.2, I.B.1.1, II.K.3, III.D.3.4, I.C.7, I.C.8, I.G, I.B.1.2, II.B.4. For these items, it was assumed that operating license issuance would be restrained by implementation of the items.

H. For the 47 units under construction (see Exhibit A), it was assumed that 23 of these would implement each line item on the same schedule as operating units; while the remaining 24 would not implement until after 1982. The logic behind the treatment of these 24 units was that the relatively incomplete status of engineering would not permit earlier implementation.

I. The following guidelines were used for the cost evaluation of each item:

- o One man-year of engineering time costs $100,000, which includes all indirect costs such as office overhead. It was assumed that persons of relatively high skills and experience levels would be required for implementation of the items.
- o One man-year of utility operator/technician/supervisory time costs $50,000 including indirects.
- o One man-hour of craft labor is worth $30, including indirect costs such as field non-manual, construction tools and equipment, and temporary facilities.

J. Exhibit B is the form which was used by each work group to report cost and schedule data on a consistent basis for each line item.

K. The term "Direct Capital Costs" as used on the cost summaries encompasses all expenditures (1) required to implement the line item and (2) which will be capitalized and depreciated as assets. It excludes operating and maintenance expenditures, and "Allowance for Funds Used During Construction" and "Owner's" costs.

L. Allowance for Funds Used During Construction (AFUDC)
AFUDC was calculated on capital costs at the rate of 11%/annum for each applicable line item. AFUDC was applied over the period of "Start Engineering" to "Complete Construction". It was assumed that the "center-of gravity" of the capital costs was halfway between start and finish of the line item. The following table depicts the assumptions which were made to develop the 11% figure:

Source of Funds	Percent of Capitalization (1)	Cost of Money (2)	Weighted Cost of Money (1) x (2) (3)
Long-Term Debt	50.0%	9.0%	4.500%
Preferred Stock	15.0	9.5	1.425
Common Equity	35.0	14.0	4.900
Total	100.0%		10.825%

AFUDC was calculated on the sum of "Direct Capital Costs" and "Owner's" costs.

M. Owner's Costs
Owner's costs were calculated at the rate of 5% of total capital costs (excluding AFUDC). The assumptions used for the determination of the 5% figure are shown in the following table:

Item	Percentage Contribution
1. Training of Personnel	0.2%
2. Environmental studies, personnel health protection and public relations	0.3
3. Corporate headquarters costs - cost of personnel and services at headquarters office	1.5
4. Insurance - loss or damage to property during construction	0.2
5. Start-up Costs	1.8
6. Miscellaneous costs, other than those mentioned above	1.0
TOTAL	5.0%

Owner's operation and maintenance costs were calculated separately for each line item and are not included above.

N. Construction Schedule Delay Costs
Consideration was given to the cost effects of delays in the issuance of operating licenses; those delays arising from the NRC requirement to implement the action items prior to issuance of operating licenses for plants under construction. The following logic was employed for determination of such costs:

1. The five work groups estimated the time required to implement each line item from "Start Engineering" to "Complete Construction". If this time was less than one year, no schedule delay cost was calculated, since it was assumed that some method would be developed for accomplishing the work without impacting the operating license issue date (a conservative approach). If the implementation schedule was more than one year, then the remaining steps were completed.

2. Exhibit C was compiled using data obtained from an NRC document entitled, "Methodology for Estimating Fuel Load Dates for Reactors Under Construction". Exhibit C shows the relationship between "percent complete" and "months to fuel load".

3. Using the February 1980 issue of "Nuclear News", it was determined which units (based on their indicated percent complete, converted to months using Exhibit C) could not complete implementation of the action item prior to the scheduled construction completion date; that is, plants for which commercial operation would be delayed because of the action item.

4. The industry-wide impact of the schedule delay associated with applicable action items was then calculated in accordance with the following formula:

$$X = \{Z - \Sigma_1^n \text{ (Months to complete)} \div n\} \times \$700{,}000 \times n \times 30 \text{ days/month}$$

Where:

X = Cost impact of the Action item for the entire industry

Z = Estimated time to implement the Action Item (in months)

n = Number of plants as determined in Step (3)

Months to Complete = Scheduled months to-go for each affected plant as determined in Step (3)

\$700,000 = Estimated cost per day for a delay in commercial operation (see Step (5) for further details)

5. The \$700,000 per day cost is made up of two components: \$400,000 for replacement power costs and \$300,000 for AFUDC.

The \$400,000 component was developed as follows:

a) Generation charge for incremental energy using nuclear fuel: 8,760 hrs/yr x .75 CF x 10,350 Btu/khw x \$1.30/Million Btu = \$88.40/yr/kw

b) Generation charge for incremental energy using fossil fuel: 8,760 hrs/yr x .75 CF x 9,500 Btu/kwh x \$3.13/Million Btu = \$195.40/yr/kw

c) Generation charge for replacement energy: 195.40-88.40 = \$107/yr/kw

d) The fixed charge component of replacement power was estimated to be \$110/yr/kw; and it was further assumed that this charge would be in effect approximately 40% of the time during which replacement energy was being purchased.

e) Therefore, the cost for a one-day delay in the commercial operation date for a 1000 MW unit would be:

{(\$107/yr/kw + 40% x \$110/yr/kw) x 1,000,000 kw unit} ÷

365 days/yr = \$414,000 (say \$400,000).

The \$300,000 cost represents the additional AFUDC accumulated each day on a unit in which one billion dollars have been invested (at completion of construction). It was calculated as follows:

\$1,000,000,000/unit x 11%/yr ÷ 365 days/yr = \$330,000 (say \$300,000).

O. Outage Costs

For each line item for which the requirement for an "extended" or "special" outage was foreseen (in order to implement the line item on an operating plant), the cost of replacing this "lost" power during the outage was calculated. A cost of \$300,000 per day per plant was used. It was developed in the following manner:

1. The average capacity of 70 operating plants (excluding Shippingport-1 and TMI-2) was calculated to be 730 MW.

2. The \$400,000 per day figure developed in Section N was based on a 1,000 MW average plant under construction. The \$400,000 cost was adjusted in the following way to account for the relatively smaller capacity of operating units:

$\frac{730 \text{ MW}}{1,000 \text{ MW}}$ x \$400,000 = \$292,000 (say \$300,000) per day per unit

P. Evaluation of Differential Implementation Costs

In certain instances, the nature of the line items required that special consideration be given to the following factors:

1. "Old" versus "new" units (old units being generally defined as those in commercial operation prior to 1970, new being all others);

2. "Operating" units versus "units under construction";

3. PWR's versus BWR's.

In those cases where it was determined that there would be a substantial difference in implementation costs for the situations listed above, such differential costs were calculated and the rationale for the differences noted.

Q. For purposes of this study, income tax considerations have been ignored as they relate to utility financial matters.

R. If the costs for a particular Priority Group/Category were zero or negligible, that Group/Category was excluded from the cost tabulations (Attachment 3).

Exhibit A

Number of Nuclear Generating Units in the United States

	Total	PWR	BWR
Operating	70	44	26
Under Construction (25%-99% complete)	47	31	16
NTOL	6	6	0
Subtotal	123	81	42
Under Construction w/ Construction Permit (0-25% complete)	36		
Number of Units w/o Construction Permit	27		
Subtotal	63		
Grand Total	186		

Exhibit B

Cost & Schedule Evaluation Form
for
"TMI Action Plan Priorities & Resources"

I. Item Number: ____________________

II. Title: ____

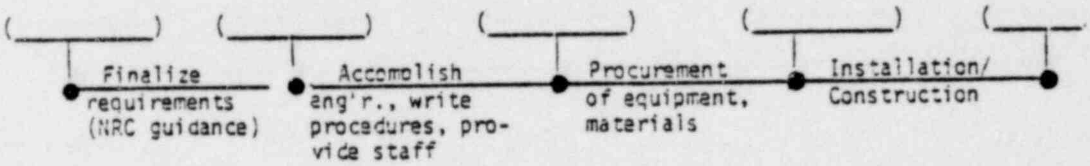
III. This is a Category I, II, III item.

IV. Is there a significant difference in implementation costs between "old" and "new" plants? If yes, which is this sheet for: old or new

V. Is there significant difference in implementation costs between an "operating or NTCL" plant and a plant "under construction"? If yes, which is this sheet for: operating or under construction

VI. Attach complete Scope Description including significant NRC comments received and bases for estimates/schedules.

VII. Implementation Schedule:



VIII. Capital Costs and Man-Years:

	Eng'r. Man-Years	Total Capital Expenditures
1980	______	______
1981	______	______
1982	______	______
Beyond 1982	______	______
Grand Total	______	______

IX. Recurring Annual Operation and Maintenance:

- $________ per year
- Beginning in 19____
- Operations staff man-years per year ________

X. Is an extended refueling (planned) outage (i.e., in excess of two months) required to implement? YES or NO
If yes, how many days in addition to the two months will be required? ________

Is it felt that a "special" unplanned outage will be required; or that the work cannot be performed in parallel with planned outage activities?
If yes, state durations in days: ____________

XI. Indicate below any significant considerations which could materially affect the above costs. State what that possibility (possibilities) is (are) and indicate potential cost impact.

____

____

____

____

(Continue on reverse side if necessary)

Exhibit C

% Complete	Months to Fuel Load
0	76
5	68
10	62
15	58
20	55
25	52
30	49
35	46
40	44
45	41
50	38
55	36
60	33
65	29
70	27
75	25
80	21
85	18
90	13
95	10
100	0