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OCRWM CSDP
INDEPENDENT MANAGEMENT REVIEW GROUP
(IMRG)

FIRST REPORT

August 24, 1992

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OCRWM CSDP INDEPENDENT MANAGEMENT REVIEW GROUP

August 24, 1992

Mr. Ronald A. Milner
Associate Director for Storage and Transportation, RW-40
Office of Civilian Radioactive Waste Management
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C 20585

Dear Mr. Milner:

The Independent Management Review Group herewith submits its First Report. This document includes the information presented orally to you and your staff on several occasions since the Group's inception.

This report was prepared by the IMRG to summarize its findings and recommendations as of May 7, 1992, its last fact- finding meeting. A report review meeting was held on July 30, 1992. Supplemental information, at the Group's discretion, may be published and released under separate cover.

We appreciate the opportunity to offer an independent assessment of the CSDP. As stated in the report, we will continue to support your efforts to assess the role and impacts of this program, and to provide you with constructive observations and recommendations.

Sincerely,

Reuben W. Peterson, Chairman

David M. Dawson

Robert H. Jones

Ray W. Lambert

Ronald B. Pope

John A. Vincent

INDEPENDENT MANAGEMENT REVIEW GROUP (IMRG)
FIRST REPORT

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1.0 INTRODUCTION

1.1 IMRG PURPOSE AND SCOPE

The Independent Management Review Group (IMRG or Group) was established by the DOE Office of Civilian Radioactive Waste Management (OCRWM), RW-40 [letter of August 9, 1991, R. Milner to E. J. Bentz], to provide objective assessments of RW's cask system development activities including the Cask Systems Development Program (CSDP) Initiative I cask projects, the GA 4/9 and the B&W BR-100. Topics in the Group's review scope included but were not limited to: cask system design and certification, cask system operability, cask system suitability for service, project oversight, and project compatibility with overall OCRWM schedules and objectives.

The Group's activities were principally based on the draft cask Final Design Reports (FDR) but supplemental information was provided by the DOE or was requested by the IMRG. In addition, presentations were made to the Group by the cask contractors and other organizations performing studies supporting RW-40. Initially these presentations were to supplement the draft FDRs, later they were made at the Group's request to clarify specific issues.

The IMRG work-products include verbal and written comments and recommendations. These will be offered periodically and at the end of the Group's activities. The Group's comments and recommendations should be considered as advisory in nature and should be balanced against or combined with other available information in arriving at programmatic decisions. Program direction remains with the Department of Energy.

1.2 IMRG MEMBERSHIP AND SUPPORT PERSONNEL

The IMRG consists of a limited number of individuals all of whom are knowledgeable in various aspects of spent nuclear fuel transportation. The members represent the nuclear utility industry, selected DOE/OCRWM program management contractors, and one national laboratory. No member is directly affiliated with the cask programs being reviewed. A second set of knowledgeable individuals provide technical and administrative support to the IMRG.

The IMRG and Technical Support Group personnel are as follows:

Members of the Group

Mr. Reuben W. Peterson, Chairman	E.J. Bentz & Associates
Mr. David M. Dawson	E.R. Johnson Associates
Mr. Robert H. Jones	Consultant
Mr. Ray W. Lambert	EPRI
Mr. Ronald B. Pope	Oak Ridge National Laboratory
Mr. John A. Vincent	GPU Nuclear

Technical Support to the Group

Mr. Michael S. Alissi	EEI/UWASTE
Mr. Michael H. Schwartz	Energy Resources Int'l.
Mr. Mitchell A. Waller	Energy Resources Int'l.
Dr. Edward J. Bentz, Jr.	E.J. Bentz & Associates
Ms. Carole B. Bentz	E.J. Bentz & Associates
Mr. Charles E. Williams	E.J. Bentz & Associates

1.3 IMRG PROCESS

1.3.1 Historical Discussion

As of May 7, 1992 the IMRG has met on four occasions for two days each. Meetings were held on: December 12 -13, 1991; January 29 - 30, 1992; March 12 - 13, 1992; and May 6 - 7, 1992. Between meetings individuals studied the OCRWM-provided information and communicated with one another on an as-needed basis. The principal exchanges between Group members occurred at the scheduled meetings. Meeting minutes were taken.

At the December 1991 "kickoff" meeting the IMRG charter, schedule, and Review Plan were discussed. The CSDP Initiative I program was also presented in summary form, and B&W provided a preliminary technical presentation of the BR-100 cask design.

The January 1992 meeting began with an invited technical presentation by General Atomic on the GA 4/9 casks. An expanded discussion of both the GA 4/9 and BR-100 casks was subsequently conducted based on Group members reading of the draft FDRs, distributed in early January, and the various technical presentations. Following this activity, RW-40 was given a oral briefing on the observations to date and work was begun on drafting a Preliminary Report.

For the March 1992 meeting, B&W returned to make a more comprehensive technical presentation on the BR-100 than the one given in December 1991; a group discussion followed. Also on the agenda was a discussion of the January 30, 1992 Preliminary Report to RW-40 (Draft). This document was a summary of the IMRG activities as-of the end of the second meeting. RW-40 was again briefed on the proceedings. The meeting ended with a presentation by ORNL on the LWT cask system tractor physical characteristics.

The May 1992 meeting included technical presentations by both GA and B&W. The purpose was to conceptually demonstrate how the cask designs could be altered to satisfy some of the design and operational limitations and issues previously identified by the IMRG. Also at the meeting some of the heretofore unaddressed technical/operational issues were visited to determine their importance to the IMRG findings and recommendations. RW-40 was briefed on the IMRG's findings. Lastly, the format and content of the Group's First Report, which grew out of the draft Preliminary Report, was discussed.

1.3.2 Documents Reviewed

For its deliberations the IMRG relied principally on the GA 4/9 and BR-100 draft Final Design Reports. These were supplemented with numerous documents relating to specific technical, operational, or logistical issues. Appendix A to this report contains the complete list of distributed documents.

2.0 CASK/TRANSPORT SYSTEM DESIGNS

This section addresses in summary fashion the technical, logistical/operational, and regulatory issues for each cask as developed in the IMRG review process. Fabricability and cost are included as technical issues. For each identified issue there are observations and findings that may be useful to the OCRWM. IMRG recommendations are presented in Section 2.3.

2.1 GA 4/9 CASKS AND TRANSPORT SYSTEMS

The GA 4/9 designs represent two legal weight cask types, one for PWR fuel and one for BWR fuel. The designs are very similar in most features and are treated in this report in a common subsection. Differences are noted. Findings are based on the designs as described in the draft FDRs as well as the GA-proposed design adjustments based on IMRG comments. The IMRG believes that the GA 4/9 cask designs are tantalizingly close to a near-optimum legal weight system and thus worth some extra effort to attempt to overcome any design or operational shortcomings and to reduce unit cost.

2.1.1 Technical Issues

2.1.1.1 Issue #1 - System Weight

- Observations and Findings

The system weight issue is that of keeping the loaded cask with its transport system below the over-the-road legal weight limit of 80,000 pounds. Although the draft FDR shows compliance with the weight limit, the IMRG believes that there are weight considerations not fully taken into account. Specifically, these are assumptions on PWR fuel assembly weights, tractor/trailer weights, and the overall lack of weight margins to allow for unaccounted contributions.

The IMRG finds that GA has not built a persuasive case that the legal weight limit will be met. Weight margins are uncomfortably small. Ancillary to this, the Group feels that the DOE should develop a contingency plan for acceptable hardware and operational alternatives should GA be unable to achieve the required weight reductions.

2.1.1.2 Issue #2 - Fabricability/Cost

- Observations and Findings

The GA 4/9 cask designs depart significantly from conventional materials and configurations. The solid neutron shield is a very complex assembly of compound-curved pieces that must be precisely fabricated and assembled. Heat transfer through the n-shield relies on a stainless steel-aluminum system of cylinders connecting the outer shell to the n-shielding shell.

The gamma shielding consists of machined pieces of depleted uranium metal. The inner cavity has a square cross-section with rounded corners, and in the case of the PWR configuration, the fuel support structure (or basket) keyways run the full length of each side of the cavity. The fuel support structures require numerous precise deep-hole drilling operations to accommodate boron carbide pellets for criticality control.

The IMRG finds that GA has not adequately demonstrated that certain fabrication steps and tolerances are practical, and that the configuration, once assembled, can be maintained over the cask lifetime. Further, the IMRG believes that the presented GA cost estimates are low and not representative of actual production costs.

2.1.1.3 Issue #3 - Cask Trailer

- Observations and Findings

One of the steps taken by GA to reduce transport system weight is to design a lightweight trailer. The target weight of this unit is 9,000 pounds. The IMRG agrees that the trailer is one component where weight savings may be possible, however, past attempts to design lightweight trailers have been unsuccessful resulting in premature trailer degradation.

The IMRG finds that confidence in a lightweight trailer design can only come through prototype construction and accelerated endurance testing. The IMRG further finds that the other transporter component, the tractor, should be given greater priority and should be better integrated into the overall legal weight truck cask program. The tractor objective should be one of minimum weight consistent with the operability, safety, reliability, and human factors requirements of fleet operations.

2.1.1.4 Issue #4 - Cask Model

- Observations and Findings

The GA 4/9 cask system development program includes a one- half scale cask model for drop testing to support NRC certification. This model is partially completed with 2/3's of the budgeted funds already spent. The model is not exact in that some components are simulated; for example, the neutron shield is represented by steel plates on the outer shell. Model fabrication has been halted and is awaiting a decision by the DOE to proceed.

The IMRG finds that there are some questions on the adequacy of the model in representing the final configuration of the cask. For instance, how is the proposed shortening of the BWR basket and the subsequent thickening of the inner shell accommodated in the model? One question facing OCRWM is, should the model be completed based on the current FDR configuration and set aside to await testing, or should the "hold" be continued pending programmatic decisions on the future of the GA 4/9 cask effort? The IMRG believes that the latter is the more prudent course of action.

2.1.2 Logistical/Operational Issues

2.1.2.1 Issue #1 - At Reactor Operations

- Observations and Findings

The IMRG has concerns in a number of operational applications of the GA casks. The contact dose rates at the ends of the casks (~400 to 700 mR/hr without impact limiters) are excessive for reactor work in view of ALARA requirements. The GA-proposed routine use of temporary shielding will not be well- received at the shipping and receiving facilities. Another issue is the alignment of the cask and fuel. The cask trunnion placement is on the cavity diagonal which requires either cask rotation while on the hook or fuel rotation while on the grapple to achieve either X-Y alignment or to permit fuel insertion. Lastly, the matter of dual load path lifting vs. high safety factor lifting is a concern. The need for compatibility with a reactor's existing lifting philosophy may dictate the need for a dual load path capability. GA has adopted only the high safety factor philosophy.

The IMRG finds that GA has not adequately addressed the at reactor dose rate problem. Concerning the cask-fuel alignment issue, the relative difficulty of cask or fuel rotation is unknown. On cask lifting, GA believes that there is not a problem with the proposed method, however, the IMRG finds itself unconvinced. GA has presented several conceptual designs of dual load path systems that might satisfy the utilities and/or the NRC, but it remains committed to the original single load path philosophy. The Group believes that the GA 4/9 cask designs should be studied for the effects of a second set of lifting trunnions.

2.1.2.2 Issue #2 - Fuel Accommodation

- Observations and Findings

One objective of the CSDP should be to accommodate as wide a variety of fuel types as is reasonably achievable but this has not been adequately fulfilled. The original design basis of the GA 9 was unchannelled BWR fuel. This requirement has now changed to include channelled assemblies but the cask design still reflects the original specification. Another fuel concern is the accommodation of certain PWR assemblies that contain non-fuel assembly hardware (NFAH); some PWR fuel is still excluded from the GA 4 design. Lastly, the cask designs are overly restricted with respect to fuel age and burnup when compared to utility projections of future fuel parameters.

The IMRG finds that the newly proposed GA 9 cask BWR basket modification for channelled fuel appears to be reasonable. By shortening the basket and making other revisions, the nine assembly capacity apparently can be preserved. This design requires more work to confirm its viability. A GA-proposed four assembly basket and lid option to carry CE PWR fuel in the GA 9 has merit and should be studied further. A side benefit of this CE fuel basket is that it could also accommodate severely bowed BWR assemblies. It should be noted that there

would still be some fuel that would not be accommodated in the GA casks, e.g., WEC 17 x 17, and B&W 15 x 15 and 17 x 17, all with NFAH inserted.

With respect to fuel parameters, GA intends to examine projected combinations of age/burnup and include the results in the SARP's to increase cask user flexibility. However, the Group finds that the incentives are reduced dramatically if the GA-4 capacity falls below two assemblies or the GA-9 capacity falls below five assemblies for projected fuel. In such a case, fleet acquisition should be reconsidered in light of the Phase 1 cask procurement project, see 3.3 below.

2.1.3 Regulatory Issues

2.1.3.1 Issue #1 - NRC Certification

- Observations and Findings

There are several issues and concerns under the heading of NRC Certification. The overall schedule for NRC review and approval appears to be quite optimistic even though a number of key items have been the subject of informal GA-NRC meetings over the past several years. One of the more important of these items is the use of burnup credit. This is an unresolved generic issue that is being pursued principally by the DOE, however, it is crucial to the cask vendors' design effort, regulatory program, schedule, and strategy. Further, design margins on dose rate appear to be inadequate from both certification and field implementation perspectives. Additionally, as mentioned in 2.1.1.2 above, there are components that perform certain shielding, heat transfer, and basket support and alignment functions that may receive increased NRC scrutiny for demonstration of long-term compliance. Finally, a more flexible approach to accommodating wide variations in fuel initial enrichment/burnup/age must be included in the SARP and the certificate.

The IMRG finds that there are enough unresolved issues with the GA 4/9 cask design that proceeding with NRC certification in the near term seems unwise. When the cask designs are truly complete a realistic schedule assessment should be made that will dictate when the application and SARP should be submitted for regulatory review and approval, and when model testing should proceed.

2.2 BR-100 CASK AND TRANSPORT SYSTEM

The BR-100 design represents a railroad/barge transported cask system that can accommodate PWR or BWR fuel through the use of interchangeable baskets. The discussion in this subsection includes consideration of both the design as described in the draft FDR as well as the limited redesign studies performed as a result of IMRG comments. Based on the design contained in the draft FDR, the BR- 100 is judged to be functionally and operationally inadequate and consequently, that design activity should not proceed.

2.2.1 Technical Issues

2.2.1.1 Issue #1 - Borated Cement Neutron Shield and Thermal Switch

- Observations and Findings

The borated cement neutron shield and thermal switch design had been an IMRG concern until the second B&W technical presentation in March 1992. At that meeting it became apparent that based on European experience the concept was not as unique and untested as had been previously presented. Most Group reservations on performance were removed.

The IMRG finds the borated cement neutron shield and thermal switch technically supportable for the service intended. This increase in confidence level was provided by a verbal briefing, not by reading the draft FDR; improved technical and operational documentation of this shield/thermal switch concept is needed.

2.2.1.2 Issue #2 - Cask Closure Design

- Observations and Findings

The BR-100 original closure (or lid) design is a complicated arrangement consisting of an inner shield plug, an outer shield lid, a metallic O-ring (a change from the draft FDR), and a preloaded lid bolting system. This closure was designed to prevent momentary seal relaxation during certain accident conditions. The two recent redesigned concepts presented by B&W to the Group at the May 1992 meeting were based on allowing transient seal relaxation to occur, with the result being simpler designs incorporating one piece lid construction, elastomeric seals, and conventional bolt torque values.

The IMRG finds the original design and related operating procedures unacceptable and is encouraged by the results of the redesign effort. If a more detailed review is to be conducted the new concepts must be further detailed and described.

2.2.1.3 Issue #3 - Fuel Baskets

- Observations and Findings

The original 21 PWR assembly and 52 (later 42 for channelled fuel) BWR assembly baskets are of a complicated modular design with each module composed of a multi-layered square assemblage of dissimilar materials. Each module contains heat transfer, criticality control, and structural components. Modules are assembled into an array and retained in position by surrounding structural elements. Gaps between modules are inaccessible for routine cleaning and will accumulate contamination (i.e., crud) during operation. Two redesigned concepts presented to the Group by B&W lower the fuel capacities to 16/37 and 14/32 respectively but drastically simplify the basket design and reduce the cask weight-related

problems of the original design.

The IMRG finds that the original 21/42 basket presents unreasonable design, fabrication, and operational challenges. The IMRG further finds that features of the two recent concepts appear to be a significant improvement and suggests that the non- modular design of the 14/32 arrangement be applied to the 16/37 configuration should the DOE choose to further pursue basket redesign.

2.2.1.4 Issue #4 - Fabrication Feasibility/Cost

- Observations and Findings

There were a number of issues identified relating to fabrication. As discussed in 2.2.1.3 above, the basket design will result in a complex fabrication effort and high cost; B&W estimates suggest $1.65M per basket. Much of the overall cask cost estimate is based on the BR-100 cask model and other European casks constructed by Robatel. The Group is not convinced that this cost extrapolation is valid or that the cost bases for this French company can be applied to domestic manufacturers. An ancillary concern is the transfer and application of the Robatel proprietary borated cement n-shield and thermal switch to a domestic manufacturer. Although a Robatel representative assured the Group that technology transfer had been included in the contractual arrangements with B&W, the Group remains skeptical.

The IMRG finds that many questions remain on cask and basket fabrication feasibility and cost, even with the redesigned configurations. It was stated to the Group that many costs will not be known until fabrication is underway; the Group disagrees with this philosophy. Cost control begins with the design. If it appears to be costly on paper, it will likely be even worse in practice. More effort is needed in design simplification, in detailed cost estimating, and in implementing the use of proprietary processes where competitive bidding is involved.

2.2.1.5 Issue #5 - Cask Model

- Observations and Discussion

The one-quarter scale model built by Robatel for drop testing purposes is complete. It was suggested by B&W that the model could be used even if cask downsizing was the selected option. The Group is not convinced on this point but believes that if technically justifiable, the model could be considered for future use.

The IMRG finds that the issues raised in this report are such that to proceed with model testing at this time would be inadvisable. The model should be protectively stored pending programmatic decisions by the DOE.

2.2.2 Logistical/Operational Issues

2.2.2.1 Issue #1 - At Reactor Operations

- Observations and Findings

From a reactor operations perspective, the BR-100 cask presents many problems. The draining method using dip tubes has historically been difficult to implement. The dose rates at the closure end with the outer lid removed are unacceptably high and the arguments by B&W for temporary shielding and remote operations are unrealistic. The method for outer lid sealing involves a complicated tensioning system and high preload values. This represents a significant departure from conventional cask handling and will greatly increase the complexity, occupational exposure, and turnaround time of operations.

There are requirements for a number of precise underwater or remote operations including underwater dewatering and the submerged placement and removal of a shielding ring. In addition, the weight of the cask on the reactor building crane hook as well as the system weight for shipment exceed the upper limits established as the design bases. These excessive weights will have significant operational impact at a number of utility sites. Finally, there is no provision for dual load path lifting even though the BR-100 is equipped with two pair of lifting trunnions. A dual load path yoke would exacerbate the lifting weight problem. The general characterization of the BR-100 cask by the Group is that it is user-unfriendly.

The IMRG finds the original BR-100 design and operational plans unacceptable. Although the cask as designed could be used in some nuclear facilities, its use will be significantly restricted. Further, the above cited concerns will result in inefficient cask processing in those plants where it can be used. The B&W redesigned concepts go a long way in resolving many of the operational issues and further study of these concepts should be considered. However, the drain line issue and certain ALARA and human factor considerations remain unresolved.

2.2.2.2 Issue #2 - Fuel Accommodation

- Observations and Findings

The design basis of the BR-100 cask considering fuel age, burnup, and initial enrichment is incompatible with current projections of the fuel that will be available for shipping at the time the BR-100 enters service. Although compensating strategies have been proposed in OSTP-12 (Draft), these "blending" and "derating" alternatives have not been taken into account in cask design and analysis. Indeed, some suggest that a greater issue is whether the fuel assumptions for the current design should even be the basis since higher enrichment/burnup and shorter cooled fuel will constitute the expected shipments rather than the exceptional shipments.

Another fuel feature not accounted for in the initial BR-100 design is the channel on

BWR assemblies. The draft FDR states a BWR fuel capacity of 52 assemblies but a verbal presentation by B&W indicated that a reduction to 42 assemblies would be required to accommodate channelled BWR assemblies.

The IMRG finds that the identification and consideration of the fuel parameters, features, and demographics that will be in affect when the cask must enter service is critical prior to proceeding with the BR-100 design effort. This concern remains high even with the recent redesigned concepts presented to the Group by B&W.

2.2.3 Regulatory Issues

2.2.3.1 Issue #1 - NRC Certification

- Observations and Findings

There are a number of concerns with respect to NRC certification of the BR-100. Several of these are shared by the GA 4/9. First, the schedule for certification appears to be unrealistically short. Despite informal meetings between the NRC and B&W on many of the more important issues, the review process is expected to be quite long principally due to the complexity of the cask. Next, the neutron shield/thermal switch, although regarded by the Group as an acceptable component, will still attract NRC scrutiny. As with the GA 4/9, burnup credit acceptance is key to cask certification and the DOE, not the vendor, has taken the responsibility for problem resolution. No resolution schedule has been presented to the IMRG. In addition, design margins on dose rate are inadequate as they leave no room for calculational accuracy or field measurement uncertainties. Finally, the approach to fuel description limits the flexibility of the cask user. Accommodation of wider variations in fuel parameters is needed in the SARP and the certificate.

The IMRG finds that the NRC certification strategy for the BR-100 needs to be reassessed. Certainly no application should be submitted to the NRC until there is resolution of the many technical and operational issues. This includes reaching some decision on the two lower-capacity concepts recently presented to the Group by B&W. Further, some analyses in the draft FDR suggest that B&W lacks experience in implementing 10 CFR 71 and its associated review process.

2.3 IMRG RECOMMENDATIONS

2.3.1 GA 4/9 Casks

Based on its review of the GA 4/9 draft FDRs, supplemented by other technical documents and presentations by the cask vendor, the IMRG makes the following recommendations:

2.3.1.1 There should be a hold on the completion of the SARP and the submittal of the application for NRC Certification pending acceptable resolution of the identified technical and operational issues.

2.3.1.2 The DOE should carefully examine the testing model to verify that it is representative of the final cask configuration. If it is, the model should be completed and put aside together with its documentation. Testing should be performed only after completion of a certification review schedule and a strategy assessment.

2.3.1.3 The lightweight trailer prototype should be constructed and subjected to endurance testing. Consideration should also be given to specifying, selecting, and acquiring a commercially available tractor. The tractor should be included, as appropriate, in the trailer qualification program. This should occur as soon as is practical.

2.3.1.4 Overall cask design completion and related analyses should be placed on hold. GA's recently proposed basket and closure head modification concepts presented to the Group at the May 1992 meeting should be pursued further to determine their viability.

2.3.1.5 The GA 4/9 cask designs should be studied to determine the effect of a second set of lifting trunnions on cask system weight and operations.

2.3.1.6 An independent fabrication feasibility and cost study should be performed to confirm or refute that done by the cask vendor.

2.3.1.7 Initial enrichment/burnup/age studies to determine cask fuel limitations should be completed and documented for design and certification use. The resultant capacity outcomes should be factored into the overall OCRWM cask acquisition strategy (e.g., Phase 1).

2.3.1.8 The cask vendor should continue to support the DOE in the resolution of the burnup credit issue.

2.3.1.9 There should be an increased utility involvement in the specification and evaluation of cask parameters with respect to reactor operations and fuel demographics.

2.3.2 BR-100 Cask

Based on its review of the BR-100 draft FDR supplemented by other technical documents and presentations by the cask vendor, the IMRG makes the following recommendations:

2.3.2.1 The current design, as represented by the BR-100 draft FDR, is inadequate and should not proceed.

2.3.2.2 Cask design options which address the aforementioned technical and operational issues and concerns may be investigated, but only after a properly defined and controlled scoping

analysis has been conducted. Such an analysis must consider: cost effectiveness considering both expenditures to date and Phase 1 cask acquisition plans; the impact of design changes on fabricability, operability and certification success; and, the effect of the option on overall program schedule. Such a determination based on scoping analysis should be fully documented prior to committing any additional program resources to the BR-100.

2.3.2.3 Initial enrichment/burnup/age studies to determine cask fuel limitations should be completed and documented for possible inclusion in the cask SARP and certificate.

2.3.2.4 There should be increased utility involvement in the specification and evaluation of cask parameters with respect to reactor operations and fuel demographics.

2.3.2.5 The cask vendor should continue to support the DOE in the resolution of the burnup credit issue.

2.3.2.6 The domestic use of the Robatel proprietary borated cement n-shield and thermal switch must be clearly defined, and any issues on its use in competitive bidding situations should be resolved.

2.3.2.7 The drop testing model should be properly stored and later studied to see if it has use in support of future cask activities such as the continuance of the BR-100 in some form or in a Phase 1 cask program.

3.0 DEPARTMENT OF ENERGY ACTIVITIES

3.1 CASK SYSTEM DEVELOPMENT PROJECT SUPPORT

3.1.1 Technical Issues

3.1.1.1 Issue #1 - Burnup Credit

- Observations and Findings

Burnup credit is a crucial element in the design of both the GA 4/9 and the BR-100 casks. The DOE has taken the lead in obtaining the NRC's agreement on the validity of burnup credit and allowing it to be used in cask design.

The IMRG finds that although much progress has been made in the pursuit of burnup credit, NRC concurrence has yet to be obtained. The DOE should take more aggressive actions to obtain a timely closure with the NRC. Ancillary to this is the need for close cooperation between the DOE and the utilities on the demonstration and implementation of at-reactor burnup measurements as a precursor to fuel shipments in burnup credit casks.

3.1.1.2 Issue #2 - NFAH Source Term

- Observations and Findings

Localized dose rates to cask workers or transport personnel are affected by the radiation from NFAH. There are two source term approaches available to the cask contractors, one by Croff and the other by Luksic. The difference between these results in a factor of 2 - 4 difference in calculated external dose rates.

The IMRG finds that in the optimization of casks it is necessary to be conservative, but realistic. Steps should be taken to determine the correct methodology for quantifying the NFAH gamma source term and applying it to the cask designs.

3.1.2 Operational/Logistical Issues

3.1.2.1 Issue #1 - Single Failure Proof Lifting

- Observations and Findings

Both the GA 4/9 and BR-100 casks use high safety factor yokes for cask lifting rather than yokes with dual load paths. This may or may not be compatible with the philosophies of the NRC or individual utilities, particularly in those cases where the utilities have complied with NUREG-0612 through the use of a dual load path lifting system.

The IMRG finds that this uncertainty has significant effect on the number of trunnions on the GA 4/9 casks and on the hook weight and dimensional envelope of the BR-100 cask. The head room requirements for both casks are also affected. Resolution is required to permit a more precise determination of cask- facility compatibility. Also see 3.1.2.2.

3.1.2.2 Issue #2 - Cask/Facility Interface

- Observations and Findings

For the BR-100 cask, questions were raised about compatibility with the dimensions, crane capacities, pool sizes, locations, etc. of the reactors intended to be served. To a lesser extent, similar concerns apply to the GA 4/9 casks.

The IMRG finds that cask compatibility with reactor facility constraints is mandatory for efficient operations. The Group suggests that the DOE revisit existing data bases (e.g., FICA database, the NSTI database, and data from RW-859) or, if necessary, develop additional data to assure this compatibility. All cask system designs should be evaluated against this comprehensive interface database.

3.1.2.3 Issue #3 - Fuel Demographics

- Observations and Findings

It seems clear that the fuel parameters that are the current design basis of the GA 4/9 and BR-100 casks excludes significant amounts of fuel that is to be shipped at the time these casks enter service. The issue is the identification of the types and quantities of fuel that will not be compatible with the casks. Ancillary issues are the strategies that might be employed to compensate for any fuel-cask mismatch (e.g., derating or blending), and the affects of such strategies on the system logistics, cask certification, and cask loading operations at utility sites.

The IMRG finds that improved information on the fuels that are planned to be shipped at the time these casks enter service would be of great value to the DOE and to the cask designer. Further, the Group suggests that the Yates report OSTP-12 be reviewed as a basis for starting an analysis of the merits, if any, of any derating and blending strategies.

3.1.3 Regulatory Issues

3.1.3.1 Issue #1 - Regulatory Support

- Observations and Findings

The DOE has taken on a number of responsibilities with respect to the resolution of regulatory issues. These issues include: burnup credit, source term definitions for shielding and containment analyses, seal materials and types, elastic/inelastic analyses, and cask

"weeping." The objective was for the DOE to stay ahead of the cask contractors in the resolution of these issues such that the issues would not encumber cask design or certification. However, the design activities have overtaken the DOE efforts and many issues, such as burnup credit, remain unresolved.

The IMRG finds that timely closure on a number of these items is needed in order to facilitate cask design/certification activities.

3.2 PROJECT MANAGEMENT

3.2.1 OCRWM Program Schedule

3.2.1.1 Issue #1 - Fleet Delivery Schedule

- Observations and Findings

The IMRG finds that the extent and complexity of the resolution activities are such that the GA 4/9 and BR-100 cask designs may not be available for fleet acquisition in time to satisfy the 1998 scheduled need date.

The Group finds that the implementation of the newly proposed procurement initiative, called Phase 1, may have to become the reference case for providing spent fuel transportation in 1998 and for a number of years thereafter.

3.2.2 Project Administration

3.2.2.1 Issue #1 - Design Margins

- Observations and Findings

The IMRG has concluded that the designs of both cask types have left little margin for uncertainty or adjustment. Many critical values are virtually at their limits with practically no ability for retreat without jeopardizing another limit. This appears to have resulted from programmatic efforts to maximize payload capacity at the expense of other functional margins (e.g., external dose rates, transported weights). Design adjustments seem unavoidable. Thus, the Group believes that 1) the potential complexity and overall cost of adjustment activities, and 2) the potential net negative effect of such adjustments on cask payloads should become significant considerations in the CSDP decision making process.

The IMRG finds that the emphasis on payload has compromised the functional adequacy and performance of the casks. Measures must be taken to provide better balance between capacity and operational margins. Alternative actions must be evaluated in terms of overall transportation system plans and objectives (i.e., performance assessment).

3.2.2.2 Issue #2 - Program Management

- Observations and Findings

The Group has noted that many of the concerns raised in this report have been previously brought to the attention of OCRWM through other review mechanisms without adequate resolution occurring (i.e., no resultant design adjustments). The IMRG finds that many of these previously-raised issues have involved utility reactor-site operations and handling, and overall system integration (e.g., LWT system weight).

With particular regard to the handling of the Technical Review Group (TRG) comments on the BR-100 draft Final Design, the IMRG notes a sense of frustration on the part of the TRG reviewers during their Final Design review over the lack of response to the same comments made by the TRG in the 70% Design Review activity.

Clearly there has been a lapse in the integration of the design functions and the independent review functions. Such integration is a program management responsibility.

Based on the issues cited in this report and the extent of their potential impacts on the program, the IMRG finds an underlying uncertainty in the ability of program management to take those timely corrective actions that could have produced a more successful outcome.

The Group also finds that it is critical to the DOE's civilian transportation program that the newly proposed Phase 1 cask procurement initiative be given different design priorities and a different management oversight and decision-making structure.

3.3 PHASE 1 CASK ACQUISITION

IMRG members were given draft copies of the Phase 1 cask Technical Specifications for review and comment. Group comments are not offered herein, rather, individual comments have been forwarded to the appropriate project personnel. The Group internally discussed the review to informally share perspectives.

It bears repeating that the DOE should carefully review the Initiative I procurement activities to assure that the problems identified will not be encountered in the Phase 1 cask acquisition program. The specification of "current technology" will go a long way in eliminating many of the technical issues and concerns raised. However, a reexamination of how the program will be managed and executed is of equal importance if the objective is cask fleet delivery to meet a 1998 need date.

Although this procurement program is based on demonstrated technology, the Group remains skeptical about the ability to comply with a 1998 shipping date. The limiting factor remains the administrative processes which underlie any government acquisition. Without some

"fast track" approach this procurement may be no more certain than that of Initiative I with respect to 1998 use. Past relevant experience suggests that a minimum of five years is required from cask concept to first-unit delivery which means that Phase 1 is already behind schedule.

3.4 PRE-CERTIFICATION CONSTRUCTION OF A GA 4 CASK

In two of its meetings the IMRG discussed a utility suggestion which was offered for DOE consideration. This suggestion was the construction of a GA 4 cask system after the design is finalized but before the commencement of the NRC certification review process. The purpose of this would be to address as early as possible the issues of system weight, system cost, and fabricability. Additional benefits of the suggestion would include: a cask acquisition activity that would allow the DOE and the M&O to define the organization and infrastructure needed to successfully pursue such a project; a prototype cask for training and display purposes; and, a cask that might be integrated into a public acceptance program, possibly involving testing.

The IMRG finds that the pre-certification construction of a GA 4 cask system has merit and adds its voice to those of the utility proposers in suggesting that OCRWM consider such a plan.

3.5 IMRG RECOMMENDATIONS ON DOE ACTIVITIES

The IMRG offers the following recommendations to the DOE/OCRWM with respect to the Initiative I casks and related activities:

3.5.1 Resolve the outstanding generic NRC regulatory issues identified above, with burnup credit being the highest priority.

3.5.2 Revisit the cask-facility interface data bases to confirm the compatibility matrix. Resolve the cask lifting system issue and related headroom, pool size, cask uprighting, and operational constraints.

3.5.3 Develop the fuel demographics for the time when the Initiative I cask systems enter service, and complete the analysis of alternative strategies for coping with fuel assemblies that exceed the cask design basis envelopes.

3.5.4 Develop a program, including management strategies, for the completion and/or disposition of the GA and B&W cask projects. This program should include resolution of the LWT cask system weight issues, see 2.1.1.1., as well as performance assessments of any proposed cask redesigns. It also must take into account the Phase 1 acquisition plans.

3.5.5 Examine the Initiative I cask program and derive a set of "lessons learned" that can be applied to the Phase 1 acquisition to give greater assurance of success. Implement the results

with an emphasis on program management and schedule control.

3.5.6 Work more effectively with the utility industry on all cask initiatives, as reasonable, to benefit from their reactor operations experience related to packaging and transportation.

3.5.7 Consider the utility suggestion of constructing a GA 4 cask prior to applying for a NRC Certificate of Compliance.

3.5.8 For future cask system activities, the formal review processes that exist within the OCRWM organization should be used to assure that all reasonable comments are addressed. Past comments on the GA 4/9 and BR-100 cask system designs need not be retroactively incorporated into the review process. However, a limited, informal review of past TRG comments may be useful to the current cask contractors.

4.0 IMRG FUTURE ACTIVITIES

4.1 GA/B&W CASK PROJECTS

With the recognition that there are resource constraints on participation, the IMRG membership remains committed to assisting the DOE in its direction of the GA and B&W cask projects. It is assumed that future work will be conducted on a basis similar to that to date (i.e., periodic meetings for review and comment).

As of mid-year 1992, the Group feels that it has given the DOE sufficient information to permit the formulation of plans and schedules, and to direct the cask vendors as necessary. Until more work on the part of the vendors and the DOE is accomplished, the Group anticipates a lower level of activity.

4.2 CONTINUING SUPPORT

The IMRG has offered to assist the DOE in areas related to spent fuel packaging and transportation. The DOE's long-term plans for the IMRG should be clarified to allow Group resources to be preserved.

4.2.1 Technology Development

The IMRG could serve as a review/advisory source to the DOE to facilitate closure of the technology development issues and certain system performance issues identified in this report.

4.2.2 Phase 1 Cask Acquisition

The IMRG has offered comments on a draft version of the Phase 1 Technical Specifications. Of interest to the Group is the strategy with respect to acquisition and project management. Specifically, the IMRG would like the opportunity to review the RFP itself to understand how it characterizes the procurement objectives and the hardware to be purchased. The IMRG remains committed to providing advisory services on this specific project.

APPENDIX A
REFERENCE DOCUMENT LIST

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(Documentation Provided by DOE to the IMRG
as of August 24, 1992)

- CSDP/B & W Handouts, 12/13/91 Meeting
- GA Handout Booklet, 1/29/92 Meeting
- B & W Handout Booklet, 3/12/92 Meeting
- ORNL Handout Booklet, 3/13/92 Meeting (Tractor/Trailer Options)
- GA/B&W Handouts, 5/6/92 Meeting
- "Description of Ongoing Reviews of CSDP," 1/29/92
- "Impact of Hold on FY '92 CSDP Funding," 1/29/92
- "Feasibility of Accommodating BWR Fuel Assemblies with Channels in the GA-9 LWT Cask," 2/92
- "Comparison of BR-100 and IF-300 Cask Handling Characteristics," (Memo) 4/92
- draft Final Design Reports (FDR's), GA-4 and BR-100 Casks
- Design Drawings - Incomplete on Ancillary Equipment
- Trailer/Railcar Design Reports and Drawings
- Specific References for Gamma-Neutron Source Terms used in Shielding Design (included in draft FDR's)
- NRC's Minutes of Meetings That Have Been Held with GA and B & W (Incomplete; 1988 - 1990 Only)
- TRG 70% Design Review Comments - Both GA 4/9 and BR-100
- TRG 100% Design Review Comments - BR-100 Only
- Initiative 1 Cask Specification Study: Spent Fuel Cooling Time and Burnup, OTSP-TM-12, 9/90

- EPRI BWR Fuel Channel Dimensions Report, 11/91
- Phase 1 Cask Systems Request for Proposal Appendices A, C, and D, 6/8/92 draft
- Transportation Business Plan, RW-0046

From ORNL:

- Transportation Operations Considerations Impacting an Operationally Feasible Start-Up Rate for the Federal Waste Management System
- Ability of From-Reactor Casks to Accommodate Spent Nuclear Fuel with Varying Burnup Combinations
- Facility Constraints to Shipping Spent Fuel and Cask Handling
- An Assessment of Various Hardware Options for Possible Inclusion on the OCRWM Legal Weight Tractor
- Purpose, Scope and Planning for Operational Testing for Civilian Radioactive Waste Management Program Transportation Cask Systems
- Impact Assessment of Proposed ANSI Standard Fluence-to-Dose Factor and Neutron Quality Factor Changes on B & W and GA Shipping Cask Designs
- Issues and Recommendations Arising from Operational Reviews of OCRWM Initiative I Preliminary Cask Designs
- Cask Maintenance Facility (CMF) Preconceptual Design Studies - An Assessment of Issues which will Impact the CMF Design and Operations
- An Assessment of the Transportation Cost Impacts of Shipping Non-Fuel Assembly Hardware Within the FWMS
- Evaluation of the Flexibility of Selected From-Reactor Casks to Accommodate Spent BWR Nuclear Fuel Assemblies
- Evaluation of the Flexibility of Selected From-Reactor Casks to Accommodate Spent PWR Nuclear Fuel Assemblies and Non-Fuel Assembly Hardware
- An Assessment of the Physical Recovery of Spent Nuclear Fuel Shipping Casks Following an Accident
- The following SPDs:

- Big Rock Point
- Nine Mile 1

- Site Modal Summary and Data Matrix
- Facility Interface Capability Assessment Project Report - June 91 Draft Only
- Transportation Operations System Cask Maintenance Facility: System Requirements and Description
- Preliminary Operating Strategies, Radiological Review and Cost Assessment for Operating a Legal Weight Truck System With No Sleeper Berth
- Systems Impacts of Using a Permitted Marginal Overweight Vehicle for the Highway Transport of Spent Nuclear Fuel
- Research Plan to Study the Effects of Snow and Ice Buildup and Variances in Weight Sales on Legal Weight Highway Transportation of Spent Nuclear Fuel
- A Plan for a Vehicle Selection Program for Legal Weight Truck Casks
- Draft Tractor Specifications for the Legal Weight Highway Transport of Spent Nuclear Fuel
- An Overview of Human Factors Issues Related to Highway Transportation of Spent Nuclear Fuel
- Implications of the Regulatory Environment on the Operations of the OCRWM Legal Weight Highway Transport System