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RADIATION EXPOSURE CONTROL PROGRAM

1.0 INTRODUCTION

Vermont Yankee Nuclear Power Corporation is planning to replace IGSCC susceptible piping in the Recirculation and portions of the RHR systems at its 540 MW Nuclear Generating Station. Replacement of this piping will be the primary scope of work planned for an outage scheduled to commence in September, 1985.

Because the drywell work is of unprecedented magnitude, manpower intensive, and will be implemented under hard radiological conditions, a Radiation Exposure Control Program (RECP) has been developed to address the specific demands of the Replacement Project.

The ultimate goal of the RECP is to ensure an integrated exposure control and reduction program that will enable Vermont Yankee and contractor personnel to function as a unit. This holistic approach will ensure that occupational exposures to ionizing radiation are maintained as low as reasonably achievable in accordance with requirements of 10CFR Part 20.

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2.0 RECIRC REPLACEMENT PROJECT ORGANIZATION

Two principal organizations comprise the Vermont Yankee Recirculation Piping Replacement Project: Vermont Yankee Nuclear Power Corporation and Morrison-Knudsen Company, Inc. (referred to as contractor). Vermont Yankee Nuclear Power Corporation has established a dedicated Recirc Project Team to manage and represent the interests of Vermont Yankee with regard to the Replacement Project. The Vermont Yankee Nuclear Power Station Organization is shown in Attachment 1. The Vermont Yankee Recirc Project Team organization is depicted in Attachment 2. The Morrison-Knudsen Recirc Replacement Project Management organization is depicted in Attachment 3.

2.1 Vermont Yankee Health Physics Responsibilities

The Vermont Yankee Health Physics staff will control operational radiation protection, and has the ultimate responsibility to maintain exposure as low as reasonably achieveable. Vermont Yankee will manage health physics personnel providing radiological coverage and performing routine and RWP-related radiological surveys. Vermont Yankee Health Physics will provide all normal health physics support, including: respiratory protection equipment, protective clothing, dosimetry processing and dose tracking, radiological survey and counting instrumentation, etc.

2.2 Morrison-Knudsen Health Physics Responsibilities

The Morrison-Knudsen Health Physics staff will provide radiological engineering and ALARA support. Morrison-Knudsen Health Physics will also interface between Morrison-Knudsen work groups, Vermont Yankee Health Physics staff, and other health physics contractors.

Morrison-Knudsen's primary responsibilities prior to the outage have been to assist in the development of an integrated Radiation Exposure Control Program. Although the contractor has reviewed all major aspects of radiation protection during RECP development, major efforts have been concentrated in the areas of ALARA estimates, health physics procedures, contamination control, shielding, health physics support, pipe chemical decontamination, and disposal of the removed recirculation piping.

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3.0 PROCEDURAL CONTROLS

The Radiation Exposure Control Program is designed to use existing Vermont Yankee health physics procedures and policies whenever possible. However, if existing procedures do not adequately address the specialized requirements of the Replacement Project, supplementary procedures will be implemented. Additional procedures will be written and approved prior to the beginning of the outage whenever anticipated. If necessary, procedures will also be upgraded or developed during the outage to provide Radiation Exposure control over unexpected deviations in project.

3.1 Controlled Work Packages

The overall approach to work control will be based on an engineering work package concept. The contractor has incorporated each identified work function into a controlled engineering work package. Work packages normally consist of a Site Work Instruction, Material Data Sheets, Process Control Documents (such as Weld Data Cards), and drawings. All controlled work packages are evaluated with respect to technical, radiological, and practical construction considerations during development. All contractor work packages are reviewed and approved by Vermont Yankee. Attachment 4 depicts the typical flow path for the life cycle of the contractor's work packages. The inherent, integrated review cycle of the work packages ensures involvement of all disciplines in determining the most effective manner of executing the work so as to maintain exposures as low as reasonably achievable.

3.2 Radiation Work Permits

The contractor's controlled work package preparation process ensures incorporation of "ALARA" concerns and considerations in long range pre-planning. The Vermont Yankee RWP procedure will ensure carry through of identified long range concerns and will provide an additional, current ALARA review immediately prior to undertaking the work.

The Vermont Yankee RWP procedure requires the Health Physics Assistant preparing the RWP to review the proposed work for ALARA considerations and to note ALARA requirements on the permit.

3.3 Exposure Control Procedures

In addition to the Radiation Work Permit process, Vermont Yankee uses other health physics procedures to ensure effective control and minimization of exposure. Examples of critical areas governed by procedures include, but are not limited to:

-Criteria and guidelines for appropriate dosimetry badging of personnel as stated in AP0506; Personnel Monitoring. These guidelines ensure that the personnel monitoring requirements of 10 CRF 20 are observed.

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-Administrative exposure control limits and exposure upgrade authorization process as stated in AP0501; Radiation Protection Standards. This mechanism ensures that supervisory personnel carefully review exposure considerations when planning assigning tasks to their personnel.

-Requirements for establishing and posting of controlled areas as stated in AP0503; Establishing and Posting Controlled Areas. These requirements serve to ensure that the posting requirements of 10 CFR 20 are observed in addition to minimizing exposure to personnel.

-Requirements concerning tne selection and use of respiratory protection equipment as stated in AP0505; Respiratory Protection. These requirements serve to ensure the proper implementation and application of respiratory protection equipment when radiological conditions dictate so as to maintain potential for internal exposure to radioactive materials as low as reasonably achievable.

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4.0 ALARA

4.1 Introduction

During normal operations and routine outages Vermont Yankee successfully ensures that occupational exposure to ionizing radiation is maintained as low as reasonably achievable through worker awareness supported by an aggressive operational radiation protection program. The Vermont Yankee Radiation Exposure Control Program for the 1985 Replacement Outage provides additional administrative and engineering functions designed to estimate, track, and further reduce both individual and collective occupational radiation exposures.

4.2. Pre-project Planning

4.2.1 1984 Investigation Outage

In June 1984, Vermont Yankee shutdown for a normally scheduled refueling outage. During this shutdown, carefully planned investigation of drywell physical and radiological conditions was conducted by the contractor. The contractor's activities were governed by investigation work packages that addressed the scope of investigative work. These work packages were reviewed and approved by Vermont Yankee.

Subsequent to the outage, an Outage Report was prepared by the contractor. This report presented the contractor's data and findings in an organized manner for use in pre-planning for the Replacement Project.

4.2.2 Management Plan

Following completion of the 1984 Outage Report, a Management Plan was prepared by the contractor. The Management Plan described the contractor's detailed approach to performing the preparatory work required for an effective state of readiness for the 1985 Replacement Outage. The Management Plan was reviewed and approved by Vermont Yankee. The contractor's approved Management Plan serves as an "umbrella" document that is referenced to ensure that necessary preparations for the outage are not only accomplished, but accomplished on schedule.

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4.2.3 Historical Research

The Recirc Project Team began identifying specific areas of ALARA concern in the Fall of 1984 by actively seeking historical radiological information related to previous recirc pipe replacement projects as well as making numerous field trips to observe other pipe replacement projects in progress. Historical research is an ongoing adjuct to the outage preparation process. As information is received, it is reviewed, analyzed, and incorporated into outage preparations. This conscious effort to learn from industry experience will greatly assist Vermont Yankee in ensuring that exposures to personnel are maintained as low as reasonably achievable.

4.3 ALARA Estimate Process

An ALARA estimate consists of an assessment by radiological personnel of the expected total person-Rem that will be accrued during the performance of an activity. ALARA estimates identify those activities which will contribute most significantly to accumulated personnel radiation exposure. These activities then receive greatest attention with respect to finding and applying exposure reduction techniques.

ALARA estimates are performed and used by the contractor to assist in pre-job planning and decision-making during the pre-outage work package development process.

During the outage the current ALARA estimate will serve as a bench-mark by which exposure reduction efforts will be measured. Activities that appear to be significantly exceeding their respective estimates will be reviewed to determine whether the estimate is incorrect or exposure reduction methods are failing. Estimates will be adjusted and further exposure reduction techniques will be employed as necessary.

The overall ALARA estimate process (see Attachment 5) is based upon establishing an initial, working ALARA estimate associated with the performance of the activities on the outage baseline schedule. This initial ALARA estimate is then refined and revised through ongoing analysis at critical points in the project.

Work package preparation for the Replacement Project began in early 1985. An ALARA review has been an integral part of work package development. ALARA reviews were performed by MK health Physics supervisors, the Recirc Project ALARA Engineer and if requested, by the Plant Health Physics Supervisor. ALARA reviews focus on exposure reduction methods, indentification of major radiological concerns, and refinement of exposure estimates. As a specific work procedures take shape within a work package, more accurate assessments are made concerning worker time in area and specific area of work.

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Once the 1985 Replacement Outage begins, a review of radiation survey data and a revision to the ALARA estimate will be made based on actual drywell dose rates. Additional reviews and revisions will take place subsequent to post pipe decontamination surveys and post pipe removal surveys. Other reviews and revisions will be made as deemed necessary by outage health physics management.

ALARA estimates and estimate revisions performed by the contractor are submitted to Vermont Yankee for review and approval.

4.4 Evaluation of Drywell Radiation Fields

During the 1984 Vermont Yankee refueling outage extensive gamma radiation surveys were conducted in the drywell to obtain baseline levels for dose rate projections for the Replacement Project. Normally, radiation surveys were taken on contact and at 18" from piping/components exhibiting significant radiation levels. General area radiation dose rates were also taken. When applicable, pipe, component, and system status were documented to properly reflect the environment surrounding and contributing to radiological conditions. In an effort to estimate radiation fields after the plant has operated on an additional fuel cycle, survey results were increased by an average buildup factor based on previous fuel cycle results.

4.5 Radiation Zones and Dose Rate Projections

The Vermont Yankee drywell was divided into zones for use during dose rate projections and exposure estimates.

During the Replacement Outage, several major evolutions will occur that result in relatively predictable, significant changes in radiation levels. These changes in conditions were addressed and specific dose rates were assigned to each zone for each major change of condition.

Vermont Yankee plans to conduct an in-situ chemical decontamination of the Reactor Recirculation System piping. Therefore, it was necessary to assess the impact on projected radiation levels by the planned chemical decon.

Although component specific decontamination factors (DFs) of 100 or greater can be obtained, they are a poor means of analyzing changes in overall general area dose rates. Thus, the evaluation of DFs was restricted to general raea decontamination factors.

General area DFs historically range from a low of 2 to a high of 15. A general area DF of 5 was chosen as a reasonable, conservative figure for use in the initial ALARA estimate with respect to drywell elevations 238', 252', and 269'. A DF of 2 was applied to the nozzle regions due to historic difficulties in achieving significant dose reductions in these areas.

4.6 Initial ALARA Estimates

The initial ALARA estimate was generated based upon analysis of estimated exposure accrued per task. Total occupational radiation exposure for replacement of piping at Vermont Yankee in accordance with Morrison-Knudsen's current baseline schedule is estimated to be 1392 person-Rem. Exposure estimates by work package are summarized in Attachment 6.

This estimate represents the first milestone in an evaluation process that will be continued up to and throughout the recirc pipe replacement project. The data base established to generate this estimate will be updated as decisions are made and more information is received.

For the most part, exposure estimates were based on currently planned Morrison-Knudsen controlled work packages. When applicable, work packages were broken down into major activities. Dose was assigned based upon the specific craft/manpower resources needed to support a given activity.

Certain dose contributing functions exist that are not covered by a planned Morrison-Knudsen controlled work package. "Dummy" work package numbers have been assigned to these functions for exposure estimate and tracking purposes.

4.7 controlled Work Package ALARA Reviews

Controlled work package ALARA reviews are conducted by health physics personnel. These reviews provide the opportunity to reflect major radiological concerns within the body of a work package via health physics hold points. This facet of the work package ALARA review program is meant to supplement the use of Vermont Yankee Radiation Work Permits, not substitute for them.

Additionally, the Morrison-Knudsen controlled work package procedure requires that the applicable Discipline Engineer complete an ALARA Review Checklist for each of his assigned work packages. This requirement ensures that the engineer gives consideration to exposure concerns and exposure reduction methods in the course of work package preparation.

The ALARA Checklist is reviewed by Health Physics to ensure consistent, thorough, documented reviews. The ALARA Review Checklist reflects ALARA criteria and considerations found in Reg Guides 8.8 and 8.10 as well as other experience based concerns.

4.8 ALARA Tracking

ALARA tracking will be initiated on a daily basis during the 1985 Replacement Outage. The ALARA tracking system will compare actual exposures and time in areas to current estimates. Significant overruns of actual exposure or time in area versus current estimates will be identified and investigated. When practicable, steps will be taken to reduce overruns to within or below estimate levels.

4.9 Ongoing ALARA Reviews

ALARA reviews will take place while work is in progress. There are several aspects to ongoing ALARA reviews.

Health Physics technician input to Vermont Yankee and Morrison-Knudsen Health Physics management will be used as a continuous, inherent part of the ALARA review process.

Vermont Yankee and Morrison-Knudsen Health Physics management will periodically inspect work areas with regard to evaluating radiological control work practices and identifying additional exposure reduction methods.

ALARA reviews will be initiated to investigate anomolies identified by the ALARA tracking report. When applicable, lessons learned in the performance of an activity will be projected forward to similar activities by way of work package or RWP modifications.

4.10 Post Job ALARA Reviews

Post job ALARA reviews will be conducted on significant, dose intensive activities. These reviews will include information gathered during ongoing reviews as well as post job analysis. Lessons identified during post job reviews will also be projected forward whenever possible.

4.11 ALARA Briefings

Providing worker briefings and ensuring their understanding of radiological conditions and protective clothing requirements is a normal part of the Vermont Yankee RWP issuance process. Prior to major, dose intensive evolutions, more extensive briefings will be provided to the personnel involved. In addition to significant exposure considerations, these extended briefings will concentrate heavily on providing an overall understanding of the evolution. This will enable individuals to better understand the potential effects of their actions with respect to the activity as a whole. This will assist in mitigating unnecessary exposure to personnel due to misunderstanding and interface problems.

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5.0 ENGINEERING CONTROLS

Vermont Yankee and the contractor will be implementing various methods of engineering control to ensure that personnel exposures are maintained as low as reasonably achievable during the Replacement Project.

5.1 Pipe Chemical Decontamination

An in-situ dilute chemical decon will be performed on Vermont Yankee's Recirculation Piping System and drywell portions of Residual Heat Removal System. Reactor Water Clean Up System piping in the drywell may also be decontaminated.

The effectiveness of this technique in significantly reducing personnel exposures to ionizing radiation when a large amount of drywell work is necessary has been clearly demonstrated at other plants and at Vermont Yankee.

In addition to the obvious exposure reduction benefit, the chemical decon will substantially reduce the potential for airborne radioactivity problems when the "old" recirculation pipe is cut and transported.

Finally, radioactive shipping requirements for disposal of the pipe will be simpler and less expensive because of the lower activity on the pipe.

5.2 Nozzle Hydrolasing

Vermont Yankee currently plans to hydrolase the back side of the N2 nozzle thermal sleeve areas (from the reactor vessel side) prior to any significant work on the N2 nozzles. This technique was employed by Vermont Yankee in 1983 and resulted in a substantial dose reduction in the general area of the nozzles.

5.3 In-vessel Set Up Considerations

The Recirc Project Team is evaluating options associated with set up of the vessel in order to optimize overall exposure reduction. Although subject to change pending receipt of new information, the current approach is described below and is representative of the areas being considered.

5.3.1 The in-shroud water level will be maintained just below the jet pump slip joint to take advantage of the shielding.

5.3.2 The control rods will be positioned so as to minimize the impact of dose rates in the N2 nozzle region from the stellite balls.

5.3.3 The N1 nozzles will be shielded from the reactor side via installation of a shield plug.

5.3.4 The reactor vessel will be ventilated to reduce the potential for airborne radioactivity.

5.3.5 It is expected that at least one layer of cavity shielding will be replaced when the reactor vessel is drained for the pipe replacement in order to minimize dose rates on the refuel floor.

5.4 Shielding

Morrison-Knudsen is developing a program for installation of shielding in the drywell in order to reduce radiation levels from sources of radiation that are significantly contributing to exposure levels in the areas of work.

The criteria for determining use of shielding includes:

-Ensuring that the person-Rem required to install the shielding is justifiable in light of anticipated exposure savings.

-Minimizing movement/relocation of shielding once installed (i.e.; ideally shielding should only be removed upon completion of work in the area).

-Ensuring that the shielding is properly supported and does not affect the integrity of components or piping.

Areas being reviewed for application of shielding include:

-localized hot spots.

-open ends of pumps and major valves being left in the drywell.

-framework area around the N1 and N2 nozzles.

-internal N2 nozzle shielding.

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The shielding program will be conducted in accordance with Vermont Yankee's procedures. Vermont Yankee will review and approve the contractor's shielding program prior to implementation.

5.5 Ventilation

The nature of the work to be performed, as well as recirc pipe replacement history, dictates that reliable, local HEPA ventilation capability be available in the drywell. Local HEPA ventilation aids in the effective control of loose surface and airborne contamination.

Currently, it is planned to provide a nominal 16,000 SCFM local ventilation capability in the drywell. Manifolds and multiple suction lines will be used in order to maximize availability of ventilation in immediate work areas.

Existing drwyell ventilation will be used to the extent practicable to assist in providing for continuous air turn over in the drywell. This will allow movement of air from less contaminated areas to more contaminated areas.

Additional, portable HEPA units (nominally 1,000 and 2,000 SCFM capacity) will be available to support localized activities outside the drywell (eg: decon areas, contaminated equipment rework ares, etc.).

All HEPA units will be maintained, tested, and serviced in accordance with existing Vermont Yankee procedures.

5.6 Field Welds

The number of field welds required in the drywell has been kept to a minimum. The size of spool pieces being rigged into the drywell will be as large as possible in order to reduce the large amount of exposure associated with well preps and the actual welding process.

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6.0 Contamination Control

The Radiation Exposure Control Program deals with contamination control in three areas: control of contamination generation, control of drywell general area contamination levels, and control of contaminated tools and equipment. By minimizing the generation and spread of contamination, incidence of personnel contamination will be maintained as low as reasonably achievable.

6.1 Control of Contamination Generation

Morrison-Knudsen will exercise control of contamination generation through preferential use of mechanical cutting versus plasma arc whenever practicable and application of engineering controls. The entire scope of work has been evaluated to identify the activities likely to contribute significantly to loose surface and/or airborne contamination. This evaluation is used by Morrison-Knudsen engineering and construction personnel as a reference during work package development.

Radiological engineering methods that will be selectively applied to control the production of loose surface and airborne contamination include:

-localized HEPA ventilation units.

-portable HEPA vacuum cleaners.

-pre-manufactured glove bags.

-field erected containment "tents".

-local decontamination prior to work.

6.2 Control of Drywell General Area Contamination

Two concerns are being reviewed with regard to drywell general area contamination control. A method will be selected to support an overall, major drywell decon effort. Methods are also being evaluated to employ in maintaining an ongoing, daily general area drywell decon effort.

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6.3 Control of Contamination and Airborne Radioactivity

Emphasis will be placed on control of loose surface contamination and potential airborne radioactivity generating situations. Contamination and airborne control methods to be used include:

-A crew per shift available for decon work in the drywell.

-Use of general area and job specific HEPA ventilation.

-Minimization of grinding, flapping, buffing, welding, etc. on ID of contaminated piping. In most cases where this is likely to occur, a mechanical counterbore will already have been performed; thus, rendering the majority of the work surface free from high level fixed contamination. Airborne and loose surface contamination created during polishing/flapping on old pipe/valve surfaces will be controlled through use of contamination containment areas.

-Preferential use of mechanical cutting methods for pipe removal. Mechanical cuts will be supplemented with aforementioned HEPA units, catch trays for shavings, and general area drop cloths.

-Capping/covering of contaminated piping as soon as practicable after completion of cutting.

-Maintaining good housekeeping practices in the drywell and throughout applicable areas of the job site.

6.4 Contamination Containment Areas

Contamination containment areas will be used primarily in conjunction with radioactive airborne generating activities: grinding, buffing, flapping, welding, etc. on heavily contaminated piping.

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6.5 Control of Contaminated Tools and Equipment

An area will be established in the immediate proximity of the drywell for small tool decon and to serve as a contaminated tool crib. Information obtained from other replacement projects indicates that considerable time and exposure could have been saved if such areas had been established. Shielding will be provided as necessary to ensure that personnel exposure in these areas is maintained as low as reasonably achievable.

6.6 Miscellaneous Contamination Containment Areas

Containment areas will be ereted as necessary outside the drywell to accommodate tool and equipment decon, supplementary pipe cutting prior to disposal, and minor work on contaminated items removed from the drywell.

6.7 Respiratory Protection Considerations

Vermont Yankee health physics intends to conduct their respiratory protection program in accordance with existing procedures with due regard for potential effects of an outage of unusual magnitude. The respiratory protection area is being evaluated to define any areas where additional capabilities or increased efficiency may be desirable.

6.8 Alpha Contamination

Vermont Yankee health Physics has determined that a faster method of alpha contamination identification procedures be available during the outage. This decision was based on findings at other plants performing a similar project as that proposed at Vermont Yankee. The actual work associated with setting up such a program has been contracted in order to be in place prior to the start of the outage.

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7.0 Facilities and Equipment

7.1 Facilities

7.1.1 Construction Office Building and Containment Access Building

The Construction Office Building (COB) serves as the outage planning center for the Morrison-Knudsen engineering and construction personnel and the Vermont Yankee Pipe Replacement Project personnel. This arrangement permits a fast, efficient transfer of ideas and requirements between the two groups involved in the project. The COB will also serve as the base for craft training prior to the outage. During the outage the COB will house the contractor's engineering and construction management personnel as well as Vermont Yankee Recirc Project Team personnel. This continued direct interface will facilitate production and minimize problems that could lead to unnecessary exposure to personnel. The COB will also contain project dedicated dress-out, health physics, and respirator issue areas.

The Containment Access Buidling (CAB) will connect the COB and the Reactor Building equipment airlock. This will provide a functional flow path for personnel and equipment. Mock-up training will be performed in the CAB prior to and as needed during the outage. Machining and staging of the replacement spool pieces will take place in the CAB.

7.1.2 Auxiliary Health Physics Checkpoint

The Auxiliary Health Physics Checkpoint will be located in the COB. The checkpoint will be manned by health physics personnel who are familiar with the work, radiological conditions, and radiation work permits involving the Replacement Project. The health physics personnel will answer questions concerning RWP requirements and personnel exposure control, issue special monitoring dosimetry, and monitor personnel and equipment entering and exiting the RCA. Sample counting and radiation monitoring equipment will be located at this checkpoint.

7.1.3 Dedicated Dress-Out and Respirator Issue Area

The project dress-out and respirator issue area will be located in the COB. The Dress-out area will contain all the protective clothing needed by project personnel and will be replenished on an as needed basis. The respirator issue area will contain an ongoing supply of full-face airline and negative pressure respirators. The dress-out and respirator issue area is located directly across and in direct line-of-sight from the Auxiliary Health Physics Checkpoint. The location will provide an additional check for proper dress prior to entering the reactor building.

7.1.4 Dedicated Personnel Flowpaths

The establishment of dedicated personnel flowpaths will provide for the processing of personnel in the shortest time practicable consistent with maintaining an effective exposure control program. This will increase project efficiency and reduce non-productive time spent in the RCA. Pre-planning of personnel traffic flow helps in identifying additional shielding and controls that will be required during certain evolutions in the outage in order to ensure that personnel exposures are maintained as low as reasonably achievable.

7.2 Equipment

The use of remotely operated cutting and welding equipment will ensure that personnel exposures to ionizing radiation are maintained as low as reasonably achievable.

The cutting/machining equipment is supplied with pendant controls which allow the operators to control the activities in lower radiation areas when the radiological environment and work requirements permit.

ID and OD welding will be controlled outside the drywell using remote controlled equipment and viewed using optics mounted on the welding heads.

The cutting, machining, and welding of the thermal sleeves to jet pump risers are the most critical and dose intensive activities in the project. The cutting, machining, and welding equipment to be used in this critical area mounts and operates on a stationary, self-centering, internally mounted mandrel. The mandrel allows the activities within the nozzle to be performed without any undue movement or relocation of equipment. This increases the accuracy of the activities and eliminates the need for repositioning which would be time consuming and dose intensive.

Remotely operated TV cameras with monitors located outside of the drywell will also be in use during the outage. This will allow Health Physics supervisory personnel to view work progress without having to remain in the drywell for extended periods of time.

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8.0 Additional Health Physics Support

Additional health physics support functions encompass miscellaneous areas that play an important, supplementary role in maintaining exposures as low as reasonably achievable.

8.1 Electrical Support

Lack of sufficient lighting and sources of electric power have historically presented problems during major nuclear outages. Unnecessary occupational radiation exposure is often accrued due to increased time spent in high radiation areas looking for a convenient source of electric power. Inadequate local lighting can significantly increase job performance time due to poor visibility and the effects of shadows on the work area. Such as situation inevitably results in increased personnel exposure.

In order to ensure that electrical power and lighting considerations do not unnecessarily contribute to personnel exposure, M-K health physics and electrical engineering personnel reviewed the electrical requirements for the drywell for the Replacement Project. A plan for the installation of temporary electrical support power has been generated to address these needs.

8.2 Communications

Reliable communication systems are a proven method for reducing time spent in radiation fields. Morrison-Knudsen health physics and engineering personnel are evaluating communication techniques and equipment for use during the 1985 outage. Areas and activities that would significantly benfit from the availability of field installed communication systems are being identified. Both audio and visual communication media will be employed.

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8.3 Training

8.3.1 General Employee Training (GET)

All personnel reporting to the Vermont Yakee site for work inside the Radiologically Controlled Area receive General Employee Training. GET for badged radiation workers includes instructions regarding the procedures and policies governing the safe performance of their work in a radiological environment. The concept of ALARA is stressed in this training, including the fact that it is ultimately the responsibility of each individual.

8.3.2 Mock-up Program for the Replacment Project

Extensive mock-up training of work crews is essential to efficient performance in the field. Training of both supervisory and craft personnel will ensure that everyone on the project understands the objectives, policies, and work methods. The Morrison-Knudsen training program begins when personnel start work on the project. The program covers topics such as project orientation, safety, security, project work rules, quality program indoctrination and health physics training. Additional classroom training is scheduled as deemed necessary by supervision.

Because complicated operations are to be carried out in high radiation areas, extensive mock-up training will be used in preparation for the project. The first objective is to accustom personnel to performing their assigned work under the conditions anticipated in the field. Morrison-Knudsen's approach is to perform a portion of mock-up training fully suited out in protective clothing and in the expected configurations. The second objective is to develop effective work methods. Methods will be perfected and mistakes corrected during mock-up training. This approach will minimize field problems, thus, improving the quality of the work and reducing radiation exposure. Training on full scale mock-ups will be used to obtain the following:

-Verification of the suitability of planned methods and techniques and of the ability of the equipment to perform as designed.

-Final determination of parameters to be used in the field, such as cutting speeds and weld machine settings.

-Verification that scheduled work can be completed within the projected time duration estimates.

-Familiarization of workers with expected field conditions, including interfaces and access difficulties.

-Development of worker proficiency in the operation of special tooling to reduce time spent in radiation exposure areas.

-Development of worker's abilities to perform work in full protective clothing for those operations anticipated to require it.

-Documentation of practical training by each worker to meet the requirements of the ALARA program.

-Selection of the most skilled and proficient workers for the performance of critical tasks.

Potential major mock-ups are listed below:

-Multiple nozzle mock-up for training for the installation, use, and removal of remotely operated cutting and weld preparation equipment. The cutting mock-ups will include cutting on previously welded mock-up coupons to simulate actual conditions.

-A mock-up of the riser for learning the templating method to be used.

-A mock-up to simulate the pump and valve casings for learning remotely operated cutting, weld preparation, and automatic welding.

8.3.3 General Training Program for Cutting of Piping, Safe Ends and Thermal Sleeves

Individual training records for each worker including specific work operations for which he has been trained, results of examinations and tests, as well as times to complete tasks in mock-ups will be maintained.

The following machining/cutting equipment should be available for training:

-O.D. machining (clamped on pipe)
-safe end and thermal sleeve O.D. and I.D. machining (clamped on the nozzle)
-I.D. machining (clamped on the pipe)

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The training of each individual will include familiarization with the various equipment, set up and use of the equipment to cut the piping, and specific training to cut off safe ends, prepare weld ends, and to cut and machine thermal sleeves.

For cutting, the individuals will be trained to:

-install, align, and clamp the equipment to the pipe and/or nozzle.

-install and change the various tool bits.

-operate the equipment visually as well as from the remote control station monitoring the equipment by T.V.

-disassemble and remove the equipment.

For weld preparation, the individuals will be trained to:

-install, align, and clamp the equipment to the pipe and/or nozzle.

-install and change the various tool bits.

-machine the weld prep.

-machine the inside of a pipe and/or nozzle.

After the completion of this general training program, the instructors will be in a position to decide on the makeup of the teams that will work together. Further training of the teams on mock-ups corresponding to plant conditions will then be provided. Thus, the team members will become familiar with each other, their assigned tasks, and the conditions to be expected in the drywell. The training provided will be thorough enough so that individuals and teams who complete the program will be fully qualified to perform the assigned activities efficiently, thus minimizing radiation exposure to themselves and their fellow workers.

8.4 Radioactive Waste Disposal

Morrison-Knudsen is repsonsible for arranging and overseeing the disposal of the old reactor recirculation and RHR piping being removed from the drywell.

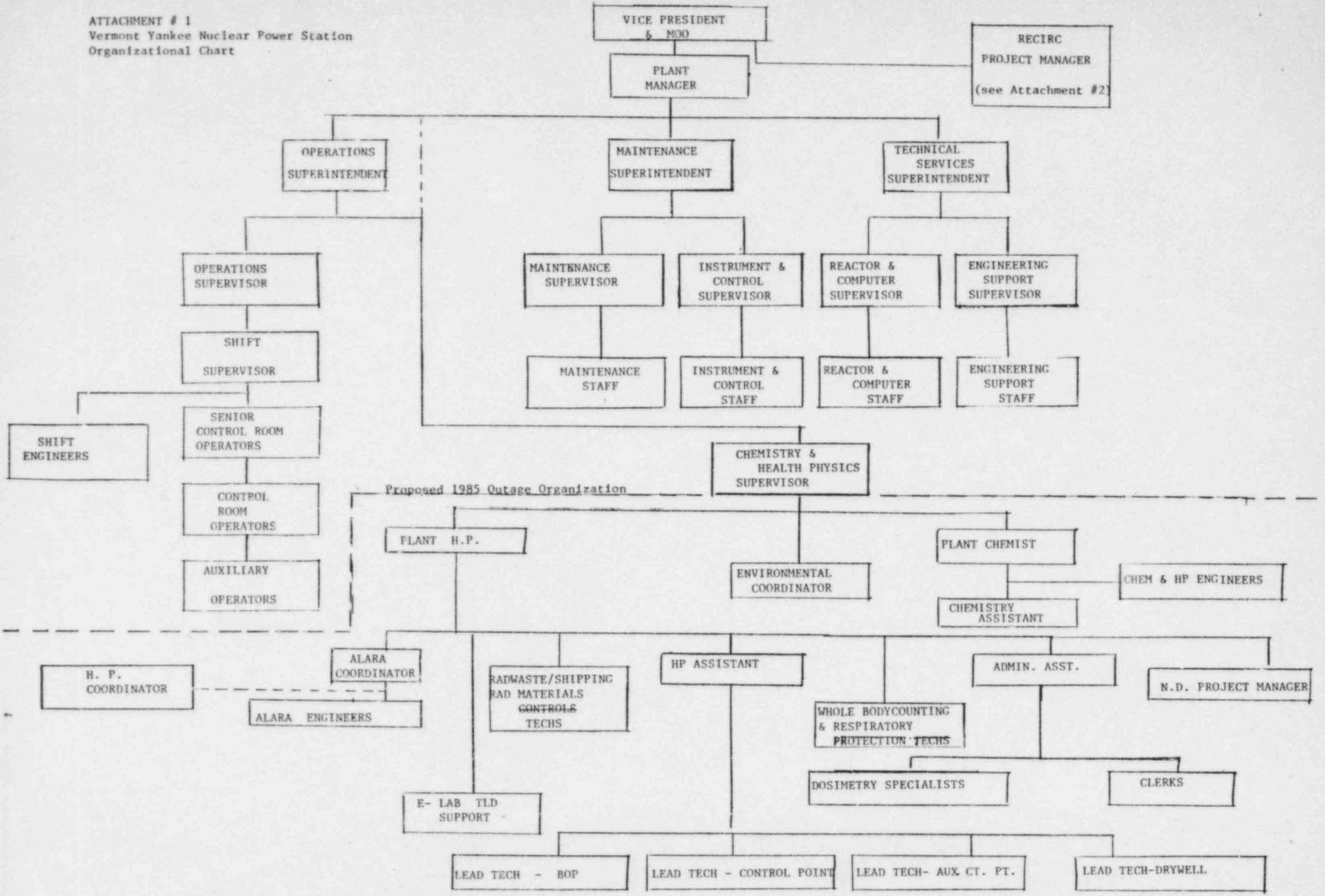
Some radioactive waste (eg: small bore piping, insulation, etc.) will be disposed of with the old recirculation pipe if feasible under the final arrangements for pipe disposal.

VERMONT YANKEE

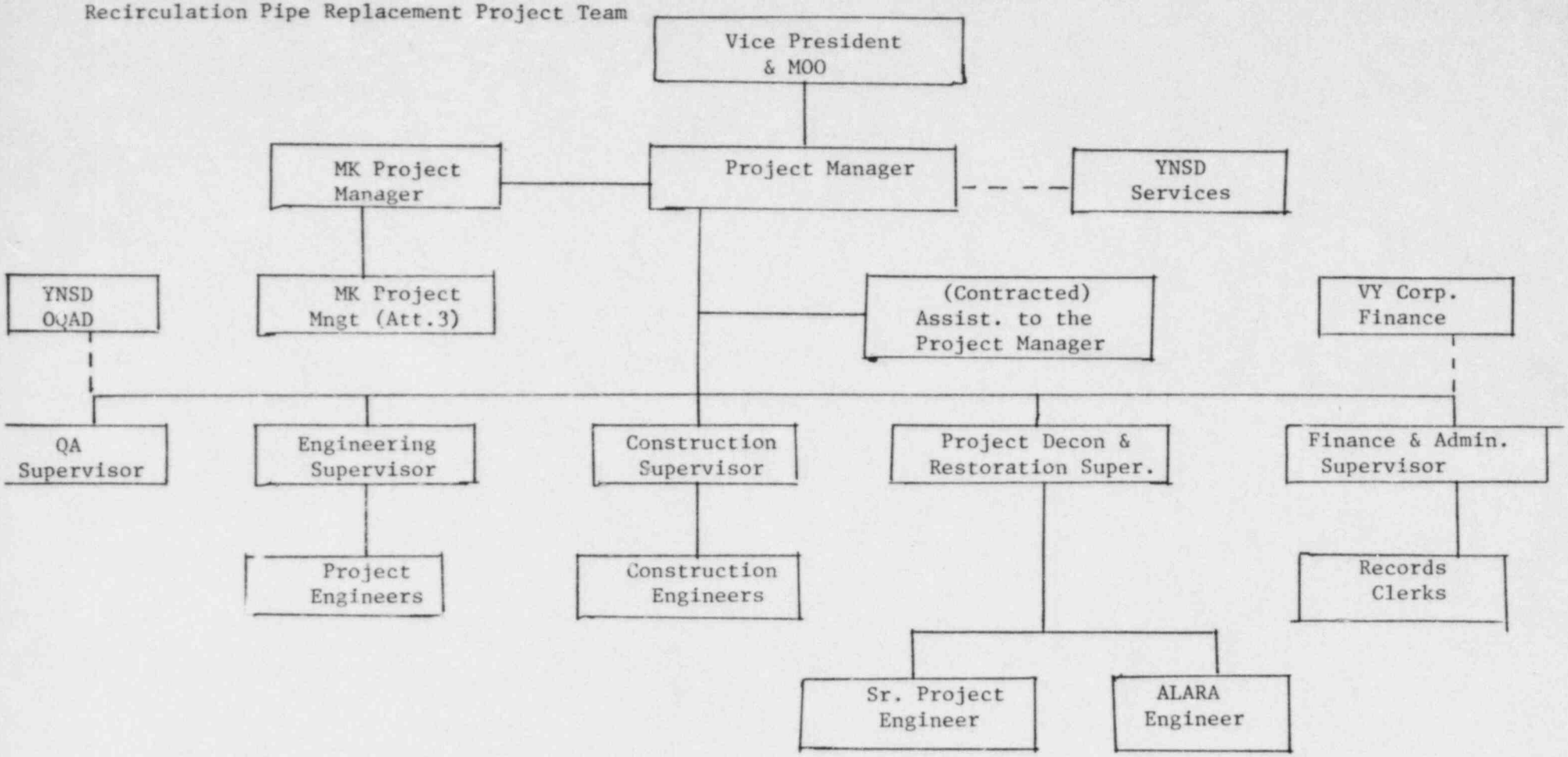
RADIATION EXPOSURE CONTROL PROGRAM

Replacement Project related compactible radioactive waste will be bagged/packaged by Morrison-Knudsen personnel under health physics direction. This waste will be processed by Vermont Yankee under existing procedures for disposition of DAW.

ATTACHMENT # 1
Vermont Yankee Nuclear Power Station
Organizational Chart



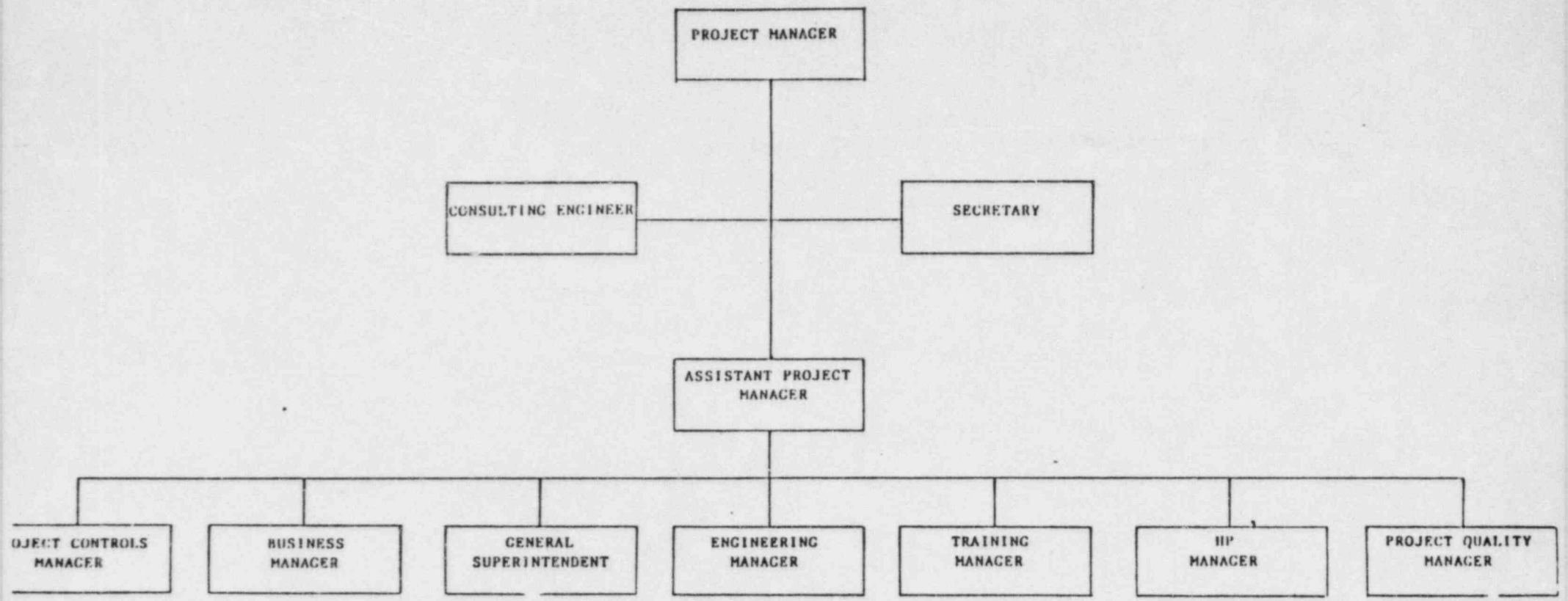
ATTACHMENT # 2
Vermont Yankee
Recirculation Pipe Replacement Project Team



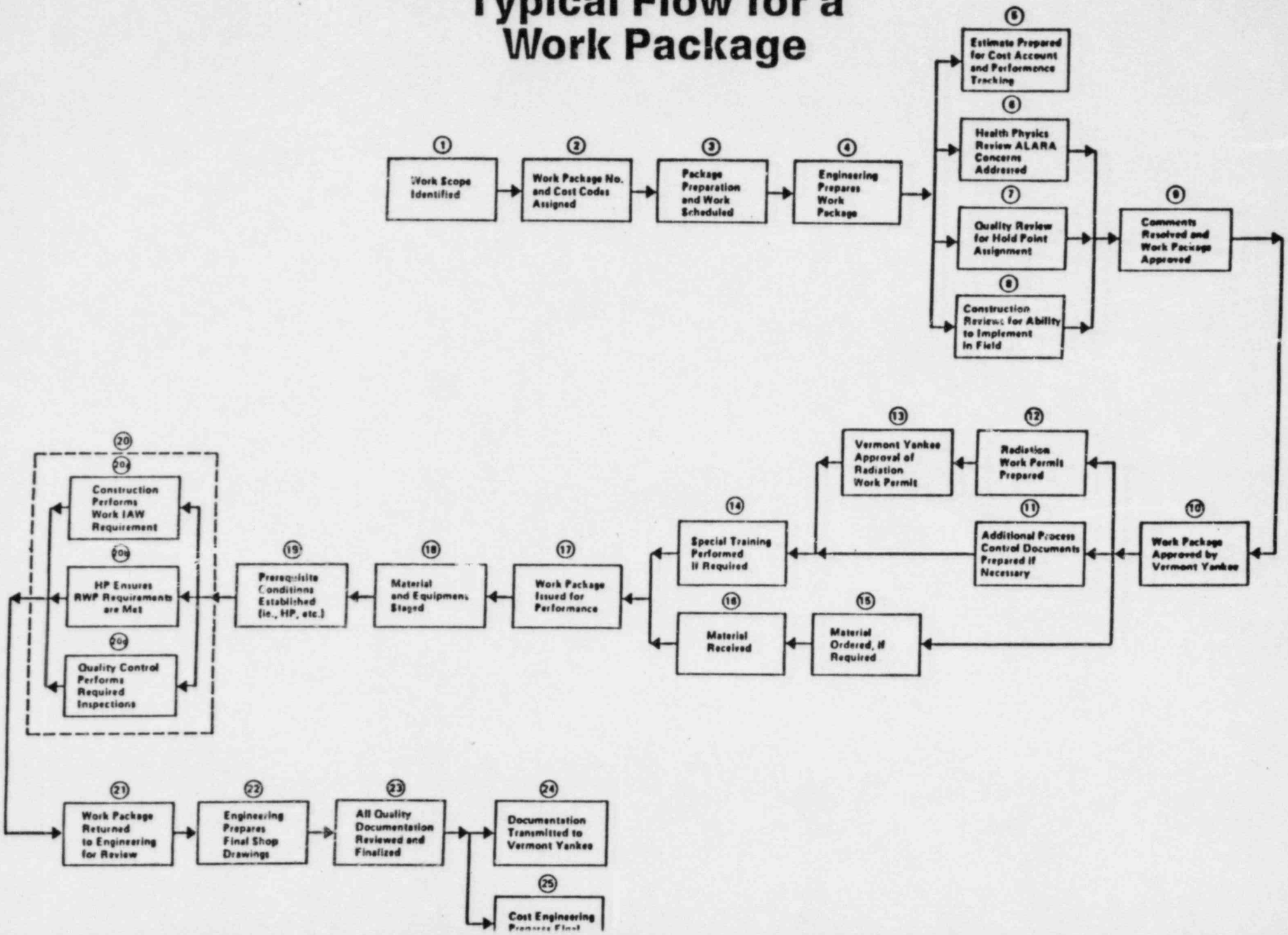
MORRISON-KNUDSEN COMPANY, INC.

ATTACHMENT # 3

Project Management



Typical Flow for a Work Package

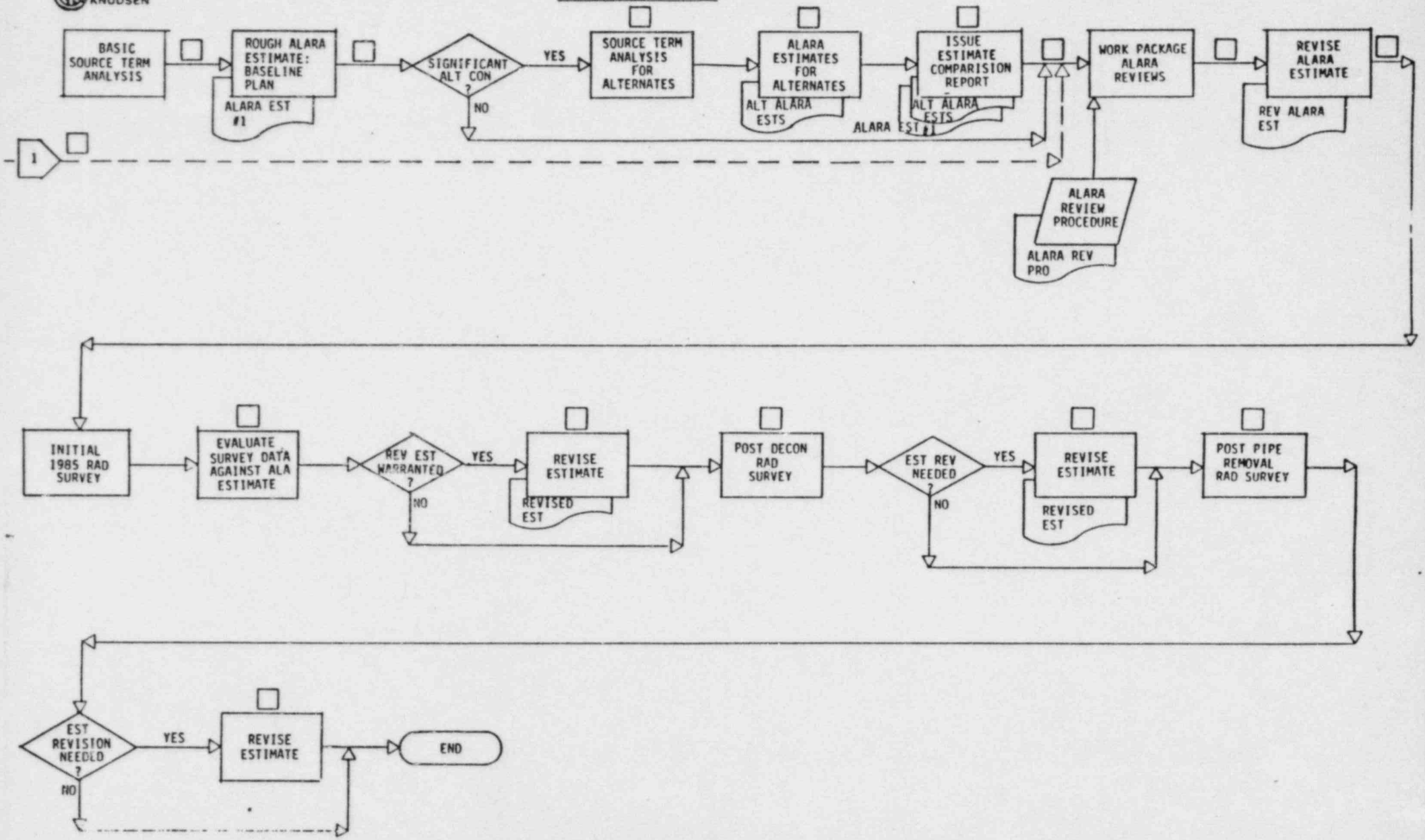


ATTACHMENT # 5

MORRISON KNUDSEN

RADIATION EXPOSURE CONTROL PROGRAM

ALARA ESTIMATE PROCESS



ATTACHMENT #6

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 1111	
RMV WHIP RSTNT RCR SIDE A	
** Subtotal **	11130.0
** WORK PACKAGE NO. 1112	
RMV WHIP RSTNT RCR SIDE B	
** Subtotal **	11130.0
** WORK PACKAGE NO. 1121	
INSTALL WHIP RSTNTS - A RECIRC	
** Subtotal **	7673.6
** WORK PACKAGE NO. 1122	
INSTALL WHIP RSTNTS - B RECIRC	
** Subtotal **	7673.6
** WORK PACKAGE NO. 1211	
RMV SUCT PIPE SIDE A	
** Subtotal **	37065.0
** WORK PACKAGE NO. 1212	
RMV SUCT PIPE - SIDE B	
** Subtotal **	29927.9
** WORK PACKAGE NO. 1213	
RMV DISCH PIPE - SIDE A	
** Subtotal **	54546.4
** WORK PACKAGE NO. 1214	
RMV DISCH PIPE - SIDE B	
** Subtotal **	42328.0
** WORK PACKAGE NO. 1221	
INSTALL RECIRC SUCT PIPE SD A	
** Subtotal **	66270.4
** WORK PACKAGE NO. 1222	
INSTALL RECIRC SUCT PIPE SD B	56230.6

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 1223	
INSTALL DISCH PIPE - A	
** Subtotal **	58038.5
** WORK PACKAGE NO. 1224	
INSTALL DISCH PIPE - B	
** Subtotal **	48333.6
** WORK PACKAGE NO. 1312	
RMV SPRING HGRS RCR SYS	
** Subtotal **	7208.0
** WORK PACKAGE NO. 1332	
INSTALL SPRING HGRS RCR SYS	
** Subtotal **	5170.0
** WORK PACKAGE NO. 1410	
MACH SLVS & SE - A (N-2-F)	
** Subtotal **	6044.0
** WORK PACKAGE NO. 1411	
MACH SLVS & SE - A (N-2-G)	
** Subtotal **	6044.0
** WORK PACKAGE NO. 1412	
MACH SLVS & SE - A (N-2-H)	
** Subtotal **	6044.0
** WORK PACKAGE NO. 1413	
MACH SLVS & SE - A (N-2-J)	
** Subtotal **	6050.0
** WORK PACKAGE NO. 1414	
MACH SLVS & SE - A (N-2-K)	6050.0

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 1415	
MACH SLVS & SE - B (N-2-A)	
** Subtotal **	6039.5
** WORK PACKAGE NO. 1416	
MACH SLVS & SE - B (N-2-B)	
** Subtotal **	6039.5
** WORK PACKAGE NO. 1417	
MACH SLVS & SE - B (N-2-C)	
** Subtotal **	6129.5
** WORK PACKAGE NO. 1418	
MACH SLVS & SE - B (N-2-D)	
** Subtotal **	6039.5
** WORK PACKAGE NO. 1419	
MACH SLVS & SE - B (N-2-E)	
** Subtotal **	6039.5
** WORK PACKAGE NO. 1420	
INSTALL SLV & SE - A (N-2-F)	
** Subtotal **	8475.5
** WORK PACKAGE NO. 1421	
INSTALL SLV & SE - A (N-2-G)	
** Subtotal **	8475.5
** WORK PACKAGE NO. 1422	
INSTALL SLV & SE - A (N-2-H)	
** Subtotal **	8255.0
** WORK PACKAGE NO. 1423	
INSTALL SLV & SE - A (N-2-J)	9037.5

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 1424	
INSTALL SLV & SE - A (N-2-K)	
** Subtotal **	9037.5
** WORK PACKAGE NO. 1425	
INSTALL SLV & SE - B (N-2-A)	
** Subtotal **	7809.0
** WORK PACKAGE NO. 1426	
INSTALL SLV & SE - B (N-2-B)	
** Subtotal **	7809.0
** WORK PACKAGE NO. 1427	
INSTALL SLV & SE - B (N-2-C)	
** Subtotal **	7931.5
** WORK PACKAGE NO. 1428	
INSTALL SLV & SE - B (N-2-D)	
** Subtotal **	8029.5
** WORK PACKAGE NO. 1429	
INSTALL SLV & SE - B (N-2-E)	
** Subtotal **	8029.5
** WORK PACKAGE NO. 1430	
MACH A - SUCT NOZZLE (N1)	
** Subtotal **	14352.0
** WORK PACKAGE NO. 1431	
MACH B - SUCT NOZZLE (N1)	
** Subtotal **	14232.0
** WORK PACKAGE NO. 1510	
MACH RECIRC PUMP P-1B-1A	2695.0

ATTACHMENT #6

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 1520 MACH RECIRC PUMP P-18-1B ** Subtotal **	1727.4
** WORK PACKAGE NO. 1602 MACH VLV V2-43-A ** Subtotal **	2501.0
** WORK PACKAGE NO. 1604 MACH VLV V2-43-B ** Subtotal **	2908.0
** WORK PACKAGE NO. 1606 MACH VLV V2-53-A ** Subtotal **	2123.0
** WORK PACKAGE NO. 1608 MACH VLV V2-53-B ** Subtotal **	1718.6
** WORK PACKAGE NO. 1610 MACH VLV V10-81-A ** Subtotal **	3036.0
** WORK PACKAGE NO. 1612 MACH VLV V10-81-B ** Subtotal **	1892.0
** WORK PACKAGE NO. 1614 MACH VLV V10-46-A ** Subtotal **	2791.0
** WORK PACKAGE NO. 1616 MACH VLV V10-46-B	3222.0

ATTACHMENT #6

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 1618	
MACH VLV V10-18	
** Subtotal **	2244.0
** WORK PACKAGE NO. 1620	
MACH VLV V10-88	
** Subtotal **	3294.0
** WORK PACKAGE NO. 2215	
RMV RHR 30	
** Subtotal **	11830.9
** WORK PACKAGE NO. 2216	
RMV RHR-31	
** Subtotal **	5589.5
** WORK PACKAGE NO. 2217	
RMV RHR-32	
** Subtotal **	8796.0
** WORK PACKAGE NO. 2225	
INSTALL RHR-30	
** Subtotal **	12541.4
** WORK PACKAGE NO. 2226	
INSTALL RHR-31	
** Subtotal **	9458.8
** WORK PACKAGE NO. 2227	
INSTALL RHR-32	
** Subtotal **	14922.9
** WORK PACKAGE NO. 2230	
MACH EXISTING RHR-30	4782.5

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 2231 MACH EXISTING RHR-31 ** Subtotal **	2567.0
** WORK PACKAGE NO. 2331 INSTALL SPRING HGRS RHR SYS ** Subtotal **	19063.0
** WORK PACKAGE NO. 4110 REMOVE PIPING INSULATION ** Subtotal **	34185.0
** WORK PACKAGE NO. 4120 INSTALL PIPING INSULATION ** Subtotal **	27740.2
** WORK PACKAGE NO. 4300 DRYWELL SHIELDING ** Subtotal **	14632.0
** WORK PACKAGE NO. 4910 ESTABLISH DRYWELL ACCESS ** Subtotal **	5087.0
** WORK PACKAGE NO. 5000 INTERFERENCE REMOVAL ** Subtotal **	58955.3
** WORK PACKAGE NO. 5100 CHEMICAL DECON OF PIPE ** Subtotal **	7179.5
** WORK PACKAGE NO. 5110 DRYWELL DECON AND CLEAN UP	109598.8

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 5200 PIPE DISPOSAL ** Subtotal **	49610.0
** WORK PACKAGE NO. 5300 SYSTEM HYDRO ** Subtotal **	376.0
** WORK PACKAGE NO. 5400 CLEARANCE INSPECTION ** Subtotal **	811.6
** WORK PACKAGE NO. 5500 IHSI ** Subtotal **	48905.0
** WORK PACKAGE NO. 5600 DEMOBILIZATION ** Subtotal **	14418.0
** WORK PACKAGE NO. 8000 ELEC/COMMUNICATION MAINTENANCE ** Subtotal **	28800.0
** WORK PACKAGE NO. 9000 GEN INSPECTION/SUPERVISION ** Subtotal **	127620.0
** WORK PACKAGE NO. 9100 HP INSPECTION/CONTROL POINT ** Subtotal **	46000.0
** WORK PACKAGE NO. 9200 DRYWELL SECURITY	7200.0

ATTACHMENT #6

MORRISON KNUDSEN
VERMONT YANKEE RECIRC PIPING REPLACEMENT
EXPOSURE ESTIMATE BY WORK PACKAGE

WORK PACKAGE DESCRIPTION	TOTAL ESTIMATED WORK PACKAGE EXPOSURE (TOTAL mR)
** WORK PACKAGE NO. 9300	
FIRE WATCH/INSPECTION	74400.0
** Subtotal **	74400.0
*** Total ***	1791941.0