STEAM GENERATOR REPAIR PROGRAM

FOR

TURKEY POINT UNIT 4

FINAL RADIOLOGICAL PROGRESS REPORT - NO. 4

FOR THE PERIOD

OCTOBER 10, 1982 THROUGH MAY 16, 1983

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TABLE OF CONTENTS

TABLE OF CONTENTS

PAGE NO.

TABLES

1.0 INTRODUCTION

Radiological Progress Report No. 4 contains information pertaining to the radiological aspects of the Unit 4 Steam Generator Repair Program (SGRP) from project commencement 10 October 1982 through project completion 16 May 1983. This information includes the following:

a. An assessment and summary of the occupational exposure and labor expended for each reporting period (throughout the project).

b. An evaluation of the effectiveness of dose reduction techniques (ALARA principles).

c. An estimate of the radioactivity released in liquid and airborne effluents.

d. An estimate of the solid radioactive waste generated including volume and radioactive content.

e. A summary for those tasks where actual person-rem expended was significantly greater than the estimated values and a discussion for the higher expended exposure.

f. A discussion of the Unit 4 SGRP lower expended exposure as compared to the Unit #3 SGRP.

g. A discussion of recommended changes in techniques to be evaluated to determine their effects on further lowering exposure for steam generator replacement-channel cut method.

Significant project tasks performed during the final reporting period (31 March, 1983 through 16 May, 1983) included:

1. Installation of miscellaneous steel.

2. Installation of manipulator crane.

3. Hot functional testing.

4. Cleanup activities (removal of scaffolding and support equipment, removal of temporary shielding, etc.).

2.0 OCCUPATIONAL RADIATION EXPOSURE

2.1 General

As indicated in previous progress reports , occupational exposure to radiation may be considered the major radiological impact of the SGRP. The program developed to collect exposure information and provide accurate assessments of tasks performed was discussed in detail in Section 2.1 - 2.3 of Radiological Progress Report No. I. This program was utilized throughout the entire project. A description of the thirteen (13) major tasks is indicated in Table 1.

2.2 Description and Format of Exposure Data

Table 2 presents a summary of the occupational radiation exposure expended in person-rem and the labor expended in the radiation field in person-hours from project commencement on 10 October 1982 to project completion 16 May 1983.* Also included are the original estimated expenditures. The following comments are provided for clarification and should be considered when reviewing the data presented in Table 2.

a. Several activities performed during the repair effort which were not described in Table 1 have been appropriately placed into one of the major task categories in Table 2 and accordingly accounted for.

b. Exposures received by certain pre-identified personnel (e.g., health physics, QC/QA, etc.) performing functions not directly attributable to any one task are listed separately in Item 7.

c. Information detailing exposures reported for specific activities within a major task is contained in the data base. This information was utilized to "track" exposure for the time period of interest.

A detailed summary of the personnel exposure expended (for the entire project) for preparatory, removal, installation and post-installation activities is presented in Tables 3A, 3B, 3C and 3D respectively. This summary includes both the labor and exposure expenditures and the original estimated expenditures. These tables list a more detailed breakdown of specific job activities which have been incorporated into the appropriate major task descriptions listed in table 2. Table 4 presents a general summary of both labor and personnel exposure expended for each phase of the repair project with the original estimated expenditures.

2.3 Discussion of Exposure Results

A review of the data presented in Table 2 shows that the total occupational radiation exposure expended for all major tasks throughout the entire project was significantly below the estimated range of 1,730 - 2,480 person-rem. These exposures were recorded by computer acquisition as discussed in Progress Report No. 1. A summary for the tasks indicated in Table 2 where actual person-rem expended was significantly greater than the estimated values and a discussion for the higher expended exposure is presented in Section 2.4.

Tables 3A and 3B show that the total actual exposure expended for preparatory and removal phase activities was approximatley 51% less than the total estimated exposure for those activities.

*Self-reading pocket dosimeter (SRPD) results were used to report person-rem since exposure information was immediately available upon exit from the RCA and accordingly recorded in the computer data base. Since thermoluminescent dosimeters (TLD's) were processed primarily on a monthly basis this information was not readily incorporated into the exposure expended for each specific activity. Historically, SRPD results are higher than TLD results primarily due to drift (caused by factors such as heat and humidity, and initial charging). Therefore, the accumulated dose reported may be considered as conservative.

Table 3C shows that the total exposure accumulated for installation phase activities was approximately 563 person-rem as compared to the original exposure estimate of 644 person-rem.

Table 3D shows that the total occupational exposure accumulated for post-installation activities was approximately 117 person-rem as compared to the original total estimate of 141 person-rem. Some of these activities (items 8, 9, 10, 11, and 12 of table 3D) were not included in the original estimate. These activities resulted in an exposure of approximately 46 person-rem.

Table 4 contains summarized information for all project phases (detailed in tables 3A, 3B, 3C and 3D). The total exposure expended (by SRPD) during the final reporting period (31 March 1983 through 16 May 1983) was approximately 61 person-rem. The total exposure expended for the Unit 4 SGRP was approximately 1305 person-rem (by SRPD).

2.4 Summary of Major Tasks with Significant Expended Exposure

Both estimated and actual total labor and exposure expended for the 13 major tasks described in table 1 are shown in table 2. The following discussion presents a summary of those tasks where the person-rem expended was significantly greater than the estimated values. Tables 3A through 3D are appropriately referenced for specific detailed job activities (RWP controlled) within a major task.

1. Task #11 - Cut and Remove Old Divider Plate, Weld New Divider Plate

   The actual exposure expended for this task was approximately 62 person-rem as compared to the estimate of 29 person-rem. The following RWP controlled activities contributed significantly to this total exposure:

   a. Welding of S/G divider plates (item 4 of table 3C)

   Discussion

   The exposure expended for welding the new S/G divider plates was approximately 58 person-rem as compared to the estimate of 15 person-rem. The additional exposure is attributed to working in radiation fields higher than originally estimated and performing repairs that required more time in the higher radiation fields.

2. Task #12 - Install New Steam Generator, Weld Channel Head

   The actual exposure expended for this task was approximately 238 person-rem as compared to the estimate of 204 person-rem. The following RWP controlled activities contributed significantly to this total exposure:

   a. Weld preparation of S/G channel head remnants (item 2 of table 3C).

   b. Installation and welding of new S/G lower assemblies (item 3 of table 3C).

Discussion

The exposure expended for weld preparation of the S/G channel head remnants was approximately 13 person-rem as compared to the estimate of approximately 8 person-rem. The exposure expended for the installation and welding of the new SGLAs was approximately 214 person-rem as compared to the estimate of 192 person-rem. As discussed in Progress Report No. 3, the additional exposure for these activities is attributed to working in radiation fields higher than originally estimated (i.e. original estimate was based on general area radiation fields of 5 to 20 mR/hr in the S/G channel heads; the actual radiation fields after channel head decontamination and shielding were in the range of 50 to 200 mR/hr) and performing repairs that required more time in the higher radiation fields (i.e. approximately 29,000 actual person-hours expended as compared to the estimate of 9,500 person-hours).

3.0 SUMMARY OF DOSE REDUCTION TECHNIQUES (ALARA PRINCIPLES)

3.1 General

This section discusses the techniques and practices which were effective in providing exposure reduction to personnel throughout the Unit 4 SGRP. Recommended changes in techniques and methods that should be evaluated to determine their effects on further reducing personnel exposure for steam generator replacement-channel cut method are included where applicable. A discussion of the reasons for the lower expended exposure for the Unit 4 SGRP as compared to the Unit #3 SGRP is also presented. Where available data permits, the following evaluations include a quantitative assessment of the person-rem savings attributed to the techniques used.

3.2 Temporary Shielding

The use of temporary shielding in the Unit 4 SGRP was effective in reducing dose rates in high traffic and work areas. It is difficult to quantify the exposure savings realized from the use of temporary shielding but experience has shown that substantial reductions in exposure to personnel results from such practices.

The exposure expended for the installation and removal of temporary shielding for the Unit 3 and 4 SGRP was approximately 43 and 15 person-rem respectively. The lower expended exposure for the Unit 4 SGRP temporary shielding activities can be attributed to the reduced amount and type of temporary shielding installed, particularly that shielding installed for components and piping inside the biological shield wall on the 14' elevation of the reactor containment building. Observation of work activities performed during the Unit 3 SGRP indicated that shielding inside the biological shield wall could be minimized; therefore, piping such as RTD loop bypass lines were minimally shielded. Worker experience in installing the lead during the Unit 3 SGRP is also credited to the lower expended exposure during the Unit 4 SGRP.

Recommendations for Consideration

The use of free-standing shielding supports versus direct placement of shielding should be considered as an exposure reduction technique. Free-standing shielding supports can provide the following advantages:

a) Eliminate the need for seismic evaluation and load analysis of the component to be shielded.

b) Usually permits the use of additional shielding since loading of the component is not a factor.

c) Allows access to component behind the shield to conduct inspections such as ISI.

d) Usually results in lower exposure since this type support is normally installed in lower dose rate areas (i.e. further away from the radiation source).

e) Eliminates exposure associated with removing/installing insulation as usually required for direct placement of shielding.

3.3 General Containment Decontamination

The initial and on-going containment decontamination program employed during the Unit 3 & 4 SGRP is a practice which was recognized as extremely beneficial in reducing exposure (through effective control of contamination) thereby reducing the need for respiratory protection devices in most cases. It was also effective in reducing the volume of radioactive waste material generated.

The total exposure for initial and on-going decontamination during the Unit 3 and 4 SGRP was approximately 66 and 53 person-rem respectively. Although the benefit of decontamination activities, in terms of exposure savings, is difficult to quantify, the maintenance of good radiological working conditions is considered a successful ALARA technique.

3.4 Steam Generator Water Level

The exposure savings realized as a result of maintaining a high water level in the steam generator secondary side was approximately 435 and 450 person-rem during the Unit 3 and 4 SGRP respectively. A detailed listing of the activities benefiting from maintaining a high S/G secondary side water level are discussed in Radiological Progress Report #2 for the Unit 3 and 4 SGRP.

3.5 Contamination Control Envelopes and Ventilation

The use of contamination control envelopes and ventilation were extremely effective in maintaining contamination control and preventing the spread of airborne radioactivity. Details of this practice are discussed in Radiological Progress Report #1 for the Unit 3 and 4 SGRP. The benefits observed for these techniques were:

a) The use of large contamination control envelopes, such as the enclosure around the lower steam generator assembly girth cut area, largely eliminated delays and interference with work in adjacent areas.

b) The overall potential for airborne contamination in adjacent areas and the spread of contamination was minimized.

c) Airborne contamination levels were at low concentrations as a result of using an absolute filtered ventilation system in the enclosures.

d) Supervisory personnel could observe the work in progress through viewing windows installed in the enclosure thereby minimizing exposure and the use of respiratory protection devices.

3.6 Concrete Cutting Operations

The use of water-cooled concrete cutting equipment was extremely effective in minimizing airborne activity. The run-off water contained a slight amount of radioactivity and was discharged as an effluent release. The total exposure expended for concrete cutting and installation during the Unit 3 and 4 SGRP was:

Activity	Unit #3 (person-rem)	Unit #4 (person-rem)
Cherry picker concrete removal and installation	32.8	30.4
Concrete block removal 30'6" and 58' Elevation	12.7	8.5
Installation of concrete 30'6" and 58' Elevations	8.5	7.1
TOTAL	54.0	46.0

The use of this concrete cutting equipment allowed the removal of concrete block in large sections thereby minimizing time in the radiation area. In addition, the removal of blocks in large sections made survey assessments and decontamination of concrete surfaces relatively simple. Also, the concrete sections removed were initially painted during construction, thereby minimizing the depth of contamination into the concrete. This resulted in a reduced volume of contaminated material to be disposed of as radioactive waste.

3.7 Channel Head Decontamination and Shielding

The decontamination of the S/G channel head surfaces and use of channel head shielding during the Unit 3 and 4 SGRP were extremely effective in lowering the total exposure for SGLA installation. The exposure savings realized for the Unit 3 and 4 SGRP as a result of this decontamination and shielding were approximately 4400 and 5450 person-rem respectively.

The exposure expended for decontamination of the S/G channel heads (alumina grit-blast method) for the Unit 3 and 4 SGRP was approximately 155 and 91 person-rem respectively. The lower expended exposure for S/G channel head decontamination during the Unit 4 SGRP can be attributed to improved system reliability and arrangement. System improvements included: improved and higher pressure grit-blast pumps; improved electro-mechanical equipment (valves, controls, etc.); and improvements in mechanical spray arm attachment to minimize breakdowns. The major change in system arrangement for the Unit 4 SGRP was the location of the used grit mixing container and associated

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operating equipment outside the containment. This container was located in the Radwaste Building (adjacent to Unit 4 containment). Temporary hard piping runs were installed from the containment via the equipment hatch to the container in the Radwaste Building. This temporary piping was shielded to minimize exposure to personnel during transfer of the grit from the holding tank in containment. During the Unit 3 SGRP, the used grit was collected in containers located in containment thereby contributing additional exposure to personnel in the area.

Based on the experience gained from the Unit 3 S/G channel head decontamination, changes were made in an attempt to reduce exposure to personnel involved with installation of the new SGLAs. These changes included regrogramming the computer operated spray nozzle arm to decontaminate hard to reach areas (e.g. divider plate to channel head weld) and using a grit-blast nozzle adapted for decontamination of the S/G manways. Specific details relative to S/G channel head decontamination can be found in Radiological Progress Report #2 for the Unit 3 and 4 SGRP.

S/G channel head shielding (includes nozzle shielding) was utilized during the Unit 3 and 4 SGRP. This shielding was effective in reducing exposure to personnel working in the channel heads. General area dose rates as a result of channel head and nozzle shielding were reduced from ranges of approximately 0.6 R/hr - 1 R/hr to levels of 0.05 R/hr - 0.2 R/hr in the Unit 3 SGRP and 0.05 R/hr to 0.1 R/hr in the Unit 4 SGRP. As stated earlier, the estimated exposure savings for this technique is included with total exposure savings for channel head decontamination and shielding.

Recommendations for Consideration

With regard to S/G channel head decontamination, the following recommendations are submitted:

a) Conduct visual examination of grit-blast results after necessary passes are completed to assure that all areas of interest have been adequately decontaminated. Darkened areas, particularly at hard to reach areas such as weld seams, indicate that additional grit-blast may be required. These areas can contribute to significant dose rates as localized "hot" spots.

b) Evaluate the most effective method to decontaminate the S/G manway opening to the lowest practical dose rate. The hand held grit-blast nozzle used during the Unit 4 SGRP was adequate but could be improved upon. Dose rates in the S/G manways were typically 1 R/hr and 0.2 R/hr during the Unit 3 and 4 SGRP respectively, while dose rates in the channel head after channel head and nozzle shielding were typically .05 to .2 R/hr.

c) Evaluate use of a back-flush filter system to minimize filter changes during grit-blast operations. If a back-flush filter system is not used, then a dual set of filter banks should be used to maintain sytem operation while changing out the used set of filters.

3.8 Flame and Machine Cutting Operations

The exposure expended for the S/G lower girth and divider plate cuts are as follows:

Unit	S/G	Lower Girth Cut Method	Lower Girth Cut Person-rem	Divider Plate Method	Divider Plate Person-rem
3	A	Machine	24	Flame	8.5
3	B	Flame	8	Flame	5.0
3	C	Flame	17	Flame	8.4
	Unit 3 TOTALS		49		21.9

Unit	S/G	Lower Girth Cut Method	Lower Girth Cut Person-rem	Divider Plate Method	Divider Plate Person-rem
4	A	Machine	8	Flame	2.0
4	B	Machine	7	Flame	0.3
4	C	Machine	7.5	Flame	1.3
	Unit 4 TOTALS		22.5		3.6

The lower expended exposure for the Unit 4 SGLA lower girth cuts can be attributed to improvements in the cutting machine equipment and experience gained from the Unit 3 SGRP. Additional experience was gained with both the flame and machine cutting equipment since this equipment was used to cut the channel heads from the new SGLAs to be installed.

The lower expended exposure for the Unit 4 S/G divider plate cuts is attributed to the use of remotely operated flame cutting equipment and the experience gained from using this equipment on the S/G channel heads removed from the new SGLAs.

The S/G upper girth cut was also completed using the flame cutting technique. The exposure expended during the Unit 4 SGRP for this activity was approximately 3 person-rem.

As discussed in Unit 3 SGRP Radiological Progress Report #5, flame cutting operations require detailed preparation and control of flame temperature. Channel head flame cutting operations during the Unit 3 SGRP resulted in additional exposure since more time was needed to complete weld preparation of the channel head remnants due to the removal of slag material. Such repairs were not required during the Unit 4 SGRP.

3.9 Weld Preparation of S/G Channel Head Remnants

The techniques that were beneficial in minimizing exposure to personnel conducting channel head remnant weld preparation are discussed in Radiological Progress Report #2 for the Unit 3 and 4 SGRP.

The exposure expended for S/G channel head remnant weld preparation was:

Unit	S/G	Person-rem	Unit	S/G	Person-rem
3	A	17	4	A	3.1
3	B	29	4	B	4.4
3	C	23	4	C	5.2
	TOTAL	69		TOTAL	12.7

In addition to the exposure reduction techniques previously referenced, the lower expended exposure for S/G channel head remnant weld preparation during the Unit 4 SGRP can be attributed to machining equipment improvements and to the lower radiation fields in the work area which resulted from effective grit-blast decontamination of the channel head and the use of channel head shielding.

Also, all three S/Gs were machine cut for the Unit 4 SGRP while only one S/G was machine cut for Unit 3 (the other two being flame cut). As stated earlier, machine cutting resulted in much less weld preparation time, since the removal of slag material deposited on the channel head remnants (caused by flame cutting) did not occur.

3.10 Installation of Steam Generator Lower Assemblies (SGLAs)

The techniques utilized during installation of the new SGLAs were discussed in Unit 4 SGRP Radiological Progress Report #2. These methods were effective in minimizing exposure and airborne activity as well as controlling the spread of contamination.

The exposure expended for the installation and welding of the new SGLAs (Task 12 of Table 2) was approximately 451 and 238 person-rem for the Unit 3 and 4 SGRP respectively. The exposure attributed to SGLA welding (371 and 188 person-rem for the Unit 3 and 4 SGRP respectively) are included in this total. The remaining installation exposure is mainly due to preheat and post-weld heat treatment of the lower girth weld, tube cleaning, installation and removal of tube sheet protection, installation and removal of channel head and nozzle shielding and QC inspections.

In addition to the exposure reduction techniques previously referenced, the lower expended exposure for the installation of the SGLAs in the Unit 4 SGRP can be attributed to the following:

a) The revision of S/G lower girth weld procedures to minimize occupancy time in the S/G channel heads (higher radiation fields), thereby reducing the expended exposure.

b) Lower radiation fields in the S/G channel head and manways as a result of decontamination and shielding.

c) Improved tube sheet protection which minimized tube cleaning. Approximately 24 person-rem was expended to clean and inspect tubes during the Unit 3 SGRP where approximately 8 person-rem was expended in the Unit 4 SGRP.

It should be noted that the insulation installed on the new Unit 4 S/Gs was a blanket type and not the "suitcase" type which requires detailed measured fitting. The blanket type insulation resulted in a significant exposure savings to personnel due to the significant decrease in labor hours required for installation. The exposure expended in the Unit 3 SGRP was approximately 86 person-rem as compared to approximately 4 person-rem in the Unit 4 SGRP. The exposure expended for installation of S/G insulation is included in Task 3 of Table 2.

Recommendations for Consideration

The following recommendations are submitted with regard to installation of SGLAs:

a) Review SGLA weld and installation procedures to minimize occupancy time in higher radiation fields.

b) Evaluate the number of temperature indicators needed for preheat and post-weld heat treatment operations.

c) Determine the effectiveness of the tube sheet protection used to prevent smoke penetration into the tubes.

3.11 Welding of Steam Generator Divider Plates

The techniques discussed in Radiological Progress Report #4 and #3, for the Unit 3 and 4 SGRP respectively, were beneficial in minimizing exposure to personnel. A review of the exposure expended for S/G divider plate welding indicated the following:

Unit	S/G	Person-rem	Unit	S/G	Person-rem
3	A	38	4	A	24
3	B	47	4	B	19
3	C	35	4	C	16
	TOTAL	120		TOTAL	59

In addition to the exposure reduction techniques previously referenced, the lower expended exposure for S/G divider plate welding in the Unit 4 SGRP can be attributed to the experience gained from the Unit 3 SGRP and the lower radiation fields in the S/G channel head.

3.12 Reactor Head Preparation for Hot Functional Testing

Temporary shielding was beneficial in reducing the exposure expended for reactor head work prior to and after the hot functional testing during the Unit 3 and 4 SGRP. The activities benefiting from the use of this shielding are discussed in Radiological Progress Report 3 for Unit 4 SGRP.

The exposure expended for these activities was approximately 53 and 31 person-rem for the Unit 3 and 4 SGRP respectively. Without the benefit of reactor head shielding, the exposure expended in the Unit 3 and 4 SGRP would be in the range of 90 to 120 person-rem, thus a significant savings was realized.

3.13 Steam Generator Storage Compound

As discussed in Radiological Progress Report #3 for the Unit 4 SGRP, the Unit 4 SGLAs were placed in the storage compound with the three Unit 3 SGLAs already in place. Surveys indicate dose rates of approximately 0.1 to 0.4 mR/hr contact with the walls and approximately 25 to 35 mR/hr contact with the roof of the storage compound. The S/G storage compound is located in the RCA and is surveyed each quarter as part of the periodic surveillance requirement.

The exposure expended for transporting and storing the SGLAs in the compound was approximately 30 and 6 person-rem for the Unit 3 and 4 SGRP respectively. The lower expended exposure (Unit 4 SGRP) can be attributed to the experience gained from the Unit 3 SGRP with regard to S/G rigging and handling and to the fact that the Unit 4 SGLAs did not have to be placed in temporary storage as in the Unit 3 SGRP.

3.14 General Techniques and Practices

In addition to the specific exposure reduction techniques described thus far, the more general techniques and methods described in the Radiological Progress Reports for the Unit 3 and 4 SGRP contributed to the adequate control of personnel exposure during both projects. Experience has demonstrated that such techniques and practices contributed significantly to an effective dose reduction (ALARA) program.

3.15 Discussion of Unit 4 SGRP Lower Expended Exposure

In addition to the exposure reduction techniques previously discussed, significant factors that contributed to the lower expended exposure for the Unit 4 SGRP include the following:

a) A higher state of readiness - equipment, materials, and personnel were better prepared for the scheduled Unit 4 SGRP, thereby minimizing delays. Such was not the case for the Unit 3 SGRP where an extended outage, for reasons other than steam generator related, resulted in the start of the Unit 3 SGRP several months ahead of schedule.

b) Retention of experienced personnel - many of the supervisors and foremen who participated in the Unit 3 SGRP were involved with the Unit 4 SGRP, thus providing the benefit of experience. Also certain contractor groups utilized during the Unit 3 SGRP were recontracted for specific work during the Unit 4 SGRP (i.e. concrete cutting, channel head cutting, channel head decontamination).

c) Greatly improved planning and scheduling - many Unit 4 SGRP tasks were conducted in parallel and also scheduled so as to perform the work in lower radiation fields (e.g. certain Unit 3 SGRP activities on the 58' elevation were completed when general area dose rates were higher as a result of parallel defueling operations and reactor vessel inspection). Daily planning and shift turnover meetings were held to maintain job coordination, determine task status and resolve any problems, thus duplication of work and on-the-job delays were minimized. These meetings were attended by supervisors of all trade disciplines (including Health Physics).

d) Less equipment and piping interference - the physical arrangement of electrical equipment and piping in the Unit 4 containment is different from the Unit 3 arrangement. This difference reduced the number of interferences needed to be removed (and later reinstalled); thus a significant amount of time and exposure was saved.

e) Improved equipment operation and reliability - equipment, including flame and machine cutting equipment, grit-blast decontamination components,

remote welding apparatus, etc., were significantly improved since the Unit 3 SGRP. These improvements and modifications helped to reduce the time needed to complete various tasks thus reducing the personnel exposure expended.

f) High level of worker productivity - a high degree of supervisory interaction with the labor force together with improved planning and scheduling minimized idle time in containment which resulted in less exposure to personnel. The fact that the Unit 4 SGRP was conducted during the relative cooler months (November 1982 - April 1983) should have contributed to worker comfort, thereby improving productivity as well. A significant amount of Unit 3 SGRP activities was performed during the hotter, more humid months (June 1982 - November 1982).

g) Lower radiation fields - general area radiation levels in Unit 4 containment were typically 5-10% lower than the radiation levels experienced in the Unit 3 SGRP. In addtion, the Unit 4 S/G channel head dose rates (prior to decontamination and lower assembly removal) were approximately 25-30% less than the dose rates observed in the Unit 3 S/G channel heads. As previously discussed, dose rates in the Unit 4 S/G channel head (after decontamination and shielding - tube sheet removed) were approximately 50% lower than the dose rates observed in the Unit 3 S/G channel heads.

As stated earlier, these factors and the exposure reduction techniques previously discussed, resulted in a significant lower expended exposure for the Unit 4 SGRP (i.e. approximately 2152 and 1305 person-rem for the Unit 3 and 4 SGRP respectively). Also, the total labor expended in radiation fields was significantly lower for the Unit 4 SGRP (approximately 260,000 person-hours) as compared to the Unit 3 SGRP (approximately 320,000 person-hours). The lower expended exposure and total labor time for the Unit 4 SGRP clearly demonstrates the applications of the learning experience gained from the Unit 3 SGRP.

4.0 RADIOACTIVE EFFLUENTS AND SOLID WASTE

4.1 General

Radioactive effluents, comprised of liquid and airborne releases, and low-level solid radioactive waste produced during this reporting period and throughout the repair project to date are summarized in Tables 5 and 6 respectively.

4.2 Liquid Releases

Laundry operations were the major source of liquid releases for the Unit 4 SGRP. As shown in Table 5 the composition of radioactive isotopes detected remain relatively unchanged from those detected throughout the project. Approximately 41% of the total activity released to date (excluding tritium) was in the form of activated metals (e.g. Co-58, Co-60, Mn-54, Ag-110m). The remaining activitity (excluding tritium) included the following radionuclides: Cs-137 (21%), Cs-134 (11%), Cs-136 (0.3%) and radioiodines (27%). The total activity released (excluding tritium) was approximately 14% of the total estimated activity projected to be released for the Unit 4 SGRP (refer to Table 5.2-7 of the SGRR). The amount of tritium released from Unit 4 SGRP activities was approximately 25% of the amount estimated (Table 5.2-7 of the SGRR).

4.3 Airborne Releases

Airborne releases for this reporting period originated primarily from continuous ventilation of the containment during post-installation phase repair activities. A summary of airborne releases for the entire project is shown in Table 5 as well. As indicated in previous progress reports the particulates detected were typical of radionuclides expected as a result of an extended shutdown. The total activity released during the Unit 4 SGRP was less than 19% of the total estimated activity projected to be released (Table 5.2-3 of the SGRR).

4.4 Solid Radioactive Waste

A summary of solid low-level radioactive waste generated and shipped as a result of Unit 4 steam generator repair activities is provided in Table 6. The low-level waste shipments during this reporting period were made to both the Barnwell, South Carolina and Richland, Washington Low-Level Waste Disposal Facilities. The total volume of solid low-level radioactive waste generated as a result of the Unit 4 SGRP (excluding the steam generator lower assemblies) was approximately 52% greater than the volume estimated in the Gould Affidavit dated June 12, 1981. It should be noted that the final volume of waste shipped is less than the accumulated volume of waste generated. This can be primarily attributed to additional volume reduction techniques used prior to shipment, which are not accounted for when initially generated. The total quantity of radioactivity shipped as a result of the Unit 4 SGRP (for the volume of repair project waste generated) was approximately 66% of the activity estimated in the SGRR.

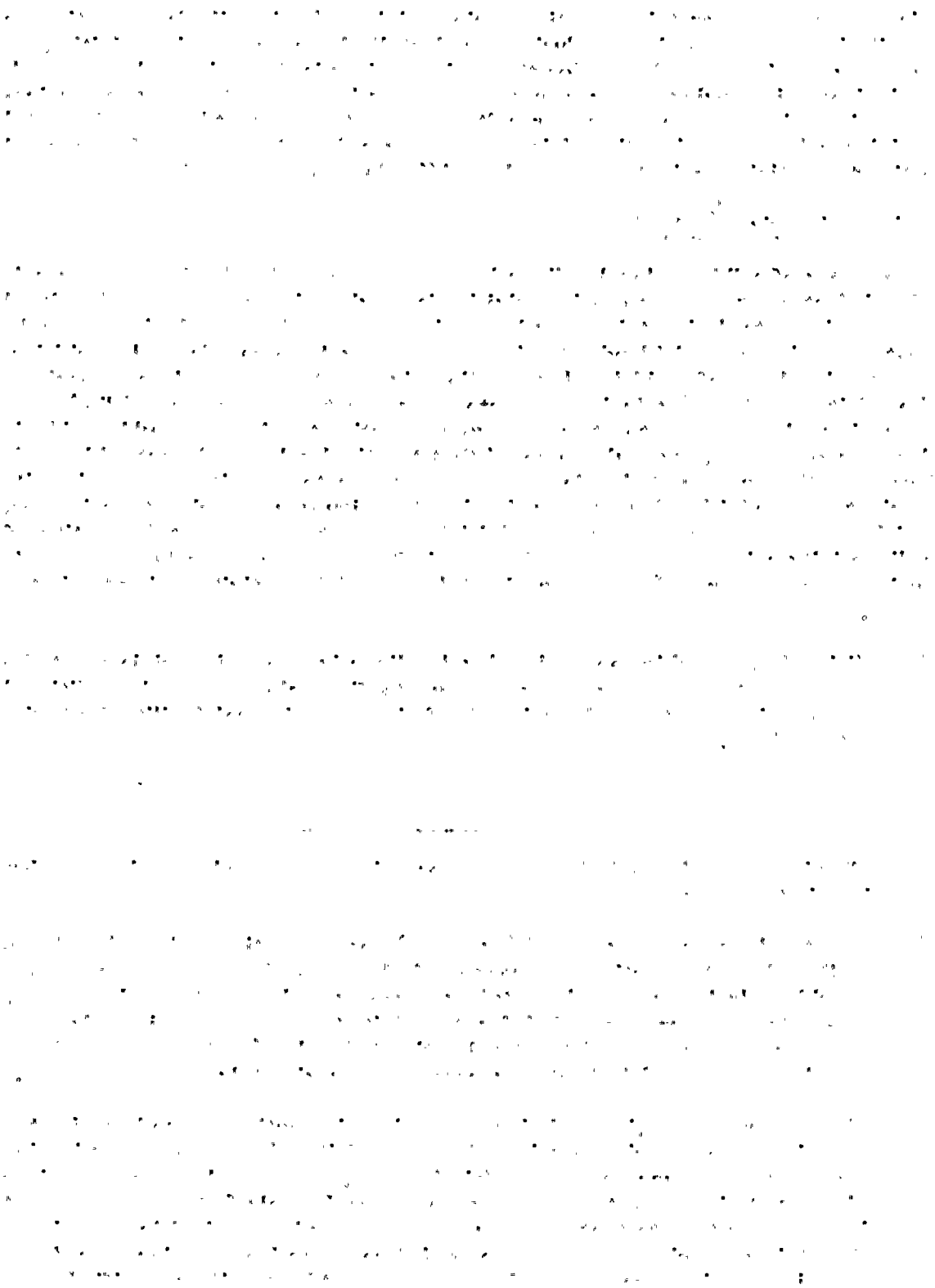
An additional 2,000 cubic feet of low-level radioactive waste is anticipated to be generated over the next several weeks due to final cleanup. This additional waste volume is expected to be shipped off-site to a disposal facility for burial by 1 October 1983.

5.0 CONCLUSIONS AND OBSERVATIONS

The following general conclusions and observations are based upon information contained in this report:

a) The total exposure expended (by SRPD) for the entire Unit 4 SGRP was well below the estimated range of 1,730 - 2,480 person-rem and considerably lower than the total exposure expended for the Unit 3 SGRP. The total exposure expended for the Unit 4 SGRP (approximately 1305 person-rem) was 63% of the total estimated value (2084 person-rem) and 40% less than the Unit 3 total exposure of approximately 2152 person-rem.

The exposure reduction techniques described in Section 3 together with the benefit of the experience gained from the Unit 3 SGRP were contributing factors to the success of the Unit 4 SGRP. The total exposure savings directly attributed to these factors was approximately 6000 person-rem. It is important to note that the actual exposure savings is significantly higher than this value since the more general dose reduction techniques used and experience gained from the Unit 3 SGRP cannot be readily quantified.



The actual labor expended for the Unit 4 SGRP (approximately 260,000 person-hours) was greater than the estimate of 208,000 person-hours but significantly less than the labor expended for the Unit 3 SGRP (approximately 319,000 person-hours). The total labor savings for the Unit 4 SGRP (approximately 59,000 person-hours) results in a conservative estimated exposure savings of approximately 295 person-rem. This value is based on the Unit 4 SGRP average exposure rate per person [i.e. total exposure expended (1305 person-rem) divided by the total labor reported (260,000 person-hours) or approximately 5 millirem per person-hour].

b) Radioactive liquid effluents released were well within the total estimate projected to be released in Table 5.2-7 of the repair report. The calculated activity (excluding tritium) was approximately 14% while the tritium activity was approximately 25% of the total estimated activity in the SGRR.

c) Airborne releases of radioactivity attributed to repair project activities were below the estimates provided in the SGRR. The majority of the reported noble gas, particulate and radioiodine activity released occurred during the initial venting of containment which was attributed to the scheduled refueling shutdown and not the SGRP.

d) Solid low-level radioactive waste generated during the Unit 4 SGRP (excluding the SGLAs) was approximately 52% greater than the estimate provided in the Gould Affidavit dated June 12, 1981. The amount of compacted dry active waste generated (approximately 28,000 cubic feet) was greater than the estimate (approximately 13,000 cubic feet) indicated in Table 1 of the Gould Affidavit. This additional volume is primarily due to the conservatism employed in assigning the volume of waste generated to the Unit 4 SGRP since some of the work was not directly related to the repair project.

e) The total quantity of radioactivity (for repair project waste shipped) was below the activity estimated in the SGRR.

The waste generated as a result of the Unit 4 SGRP was expeditiously shipped off-site, consequently, there was no significant volume of waste accumulated on-site throughout the repair project.

A small volume of low-level radioactive waste is expected to be shipped off-site after sorting the equipment and materials used during the Unit 4 SGRP. This remaining volume (approximately 2000 cubic feet) is expected to be shipped off-site to a disposal facility for burial by 1 October 1983.

The Unit 4 SGRP was completed several weeks ahead of the time scheduled for completion. This timely completion was the result of detailed job planning and coordination and effective application of experience gained from the Unit 3 SGRP.

TABLE 1

DESCRIPTION OF MAJOR TASKS

TASK	TASK DESCRIPTION
1. Concrete and structural steel removal and placement.	1. This task includes all work associated with removal/replacement of concrete and structural steel. Removal items include: Erection of scaffolding to remove piping and electrical components, cut/removal of the concrete shield wall above EL 58' and the floor slab at EL 58', the concrete shield wall below EL 58', and removal of structural steel. Replacement items include: Installation of rebar and cadweld splices, erection of form work and shoring, concrete placement, and installation of structural steel.
2. Construction of pedestal cranes, preparation of polar crane, miscellaneous cribbing platforms, S/G transfer bridge.	2. This task includes installation/removal of the pedestal crane foundations, assembly and erection of cranes and the polar crane trolley, and disassembly and removal of cranes and the polar crane trolley.
3. Removal, modification and reinstallation of S/G upper assemblies and major piping.	3. Items included in this task are: Erection/ removal of scaffolding from El 58' to El 93', removal/installation of insulation and piping, upper assembly girth cut, cutting internal pipe and structural members inside the S/G, upper assembly modifications, and the upper assembly girth weld.
4. Construction of temporary facilities and support services.	4. The major exposure items in this task are: Routing of welding leads, installation of temporary power for small tools and lighting in the area near the S/G (most will be inside the secondary shield wall between El 14' and El 30'6"), and maintenance of temporary power and lighting for the entire outage.
5. General decontamination and disposal of contaminated materials/cleanup.	5. This task includes general area decontamination of the containment prior to commencement of major work, continuous containment decontamination for the entire outage, and removal and disposal of contaminated material for the entire outage.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] [illegible]

[illegible]

TABLE 1 (continued)

DESCRIPTION OF MAJOR TASKS

TASK		TASK DESCRIPTION	
6.	Removal and reinstallation of miscellaneous piping, equipment and insulation.	6.	This task includes removal of insulation from the steam generator and main steam and feedwater piping, installation of insulation on the new steam generators, and removal/installation of miscellaneous items.
7.	Non-manuals (e.g., QC, Engineers, HPs).	7.	The non-manual category includes health physics, quality control, and engineering personnel, visitors, and Bechtel personnel required for the entire outage.
8.	Decontamination of the channel head.	8.	Included in this task are mechanical grit blast decontamination of the channel head, and installation of inflatable plugs in the reactor coolant piping.
9.	Cut channel head and remove old S/G lower assembly.	9.	This task includes installation of tenting and temporary shielding, cutting the transition cone, and channel head, and rigging and removal of the lower assembly to the containment equipment hatch.
10.	Weld shield cover on lower assembly; a. At channel head b. At transition end	10.	The only item in this task is welding of steel plates at each end of the steam generator to provide shielding and to prevent leakage.
11.	Cut and remove old divider plate, weld new divider plate.	11.	The divider plate was detached from the tubesheet as part of Task 9. Removal and placement of the divider plate to the channel head is included in this task.
12.	Install new S/G, weld channel head.	12.	This task includes erection/removal of scaffolding, rigging and moving the new steam generator, installation/removal of hydroplugs, channel head welding and grinding, and removal of the inflatable plugs in the reactor coolant pipes.
13.	Placement of steam generator in storage.	13.	This task includes transporting of the S/G from the containment equipment hatch into the storage compound and construction of a roof once the S/G's are in the compound.

TABLE 2

PERSONNEL EXPOSURE SUMMARY - PER TASK

REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983

TURKEY POINT - UNIT 4

	TASK DESCRIPTION	LABOR EXPENDED IN RADIATION FIELD (PERSON-HOURS) ESTIMATED	ACTUAL	PERSONNEL EXPOSURE[a] (PERSON-REM) ESTIMATED	ACTUAL
1.	Concrete and structural steel removal and replacement.	13,660	22,539	88	71.49
2.	Construction of pedestal cranes, preparation of polar crane, miscellaneous cribbing platforms, and steam generator transfer bridge.	10,280	2,135	32	4.83
3.	Removal, modification and reinstallation of steam generator upper assemblies and major piping.	24,600	43,772	256	205.04
4.	Construction of temporary facilities and support services	19,120	32,425	215	104.56
5.	General decontamination and disposal of contaminated materials/cleanup.	42,310	43,874	201	180.84
6.	Removal and reinstallation of miscellaneous piping equipment and insulation.	8,850	18,284	125	100.12
7.	Non-manuals (e.g. QC, Engineers, Health Physics).	68,540	44,733	436	164.58
8.	Decontamination of the channel head.	1,840	5,554	214	90.71
9.	Cut channel head and remove old steam generator lower assembly.	3,240	4,916	166	45.59
10.	Weld shield cover on lower assembly:				
	a. at channel head	760	1,124	40	16.39
	b. at transition end	530	916	53	14.82

[illegible]

TABLE 2 (continued)

PERSONNEL EXPOSURE SUMMARY - PER TASK

REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983

TURKEY POINT - UNIT 4

	TASK DESCRIPTION.	LABOR EXPENDED IN RADIATION FIELD (PERSON-HOURS) ESTIMATED	ACTUAL	PERSONNEL EXPOSURE[a] (PERSON-REM) ESTIMATED	ACTUAL
11.	Cut and remove old divider plate, weld new divider plate.	2,640	3,065	29	62.10
12.	Install new steam generator weld channel head.	11,000	36,886	204	237.61
13	Placement of steam generator in storage.	225	200	25	6.14
	TOTAL	207,595	260,423	2,084	1,304.82
	Estimated Range			1730-2480	

[a] Actual exposures are estimated by self-reading pocket dosimeter totals.

TABLE 3A
SUMMARY OF PREPARATORY ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

	ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
1.	Initial Containment Decontamination.	4,816	3,276	45.00	0.00	18.39	C
2.	Reactor Cavity Decontamination.	0	162	0.00	0.00	1.51	C
3.	Reactor Cavity Liner Plate Inspection.	0	300	0.00	0.00	6.04	C
4.	Install S/G Transfer Bridge.	960	147	1.21	0.00	0.29	C
5.	Remove Emergency Containment Coolers.	140	78	1.68	0.00	0.24	C
6.	Remove CRDM Coolers and Fans.	67	215	0.28	0.00	1.34	C
7.	Rerate Polar Crane and Load Test.	4,571	1,481	9.49	0.00	2.97	C
8.	Disassemble Manipulator Crane and Store.	0	128	0.00	0.00	0.91	C
9.	Install Cherry Pickers.	2,430	266	6.06	0.00	1.35	C
10.	Remove Reactor Coolant Pump Motors.	0	397	0.00	0.00	2.59	C

TABLE 3A (Continued)
SUMMARY OF PREPARATORY ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

	ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
11.	Disconnect/Remove Permanent Electrical Equipment and Cables.	430	304	1.93	0.00	0.79	C
12.	Install Temporary Power, Lighting and Electrical Items.	1,148	4,458	49.50	0.00	18.55	C
13.	Remove Miscellaneous Steel.	580	3,532	6.21	0.00	8.20	C
14.	Install/Maintain S/G Temporary Containments and Ventilation.	1,008	1,013	17.63	0.00	2.92	C
15.	Install Temporary Shielding.	120	1,193	2.38	0.00	11.27	C
16.	Install Scaffolding-all levels.	1,440	5,203	3.31	0.00	34.19	C
17.	Cut and remove concrete 30'6 and 58' Elevation.	5,334	4,173	52.30	0.00	38.91	C
18.	Project non-manual support.	6,927	7,207	60.00	0.00	35.57	C
19.	On-going Decontamination Activities.	1,204	1,092	8.19	0.00	6.13	C

TABLE 3A (Continued)
SUMMARY OF PREPARATORY ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
20. Containment Tool and Weld Rod Room Support.	1,232	506	7.55	0.00	0.35	C
21. Remove/dispose of contaminated materials.	900	3,009	7.41	0.00	18.64	C
22. Crane operation/maintenance.	685	3,722	1.36	0.00	7.63	C
23. Miscellaneous Activities.	1,000	7,560	1.51	0.00	11.21	C
Total - Phase I	34,992	49,422	.283	0.00	229.99	

TABLE 3B
SUMMARY OF REMOVAL ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
1. Remove insulation from A, B, & C S/G's.	3,500	6,721	77.00	0.00	63.64	C
2. Remove feedwater piping A, B, & C S/G's.	147	2,932	1.50	0.00	10.76	C
3. Remove main steam piping A, B, & C S/G's.	125	331	0.61	0.00	1.76	C
4. Remove miscellaneous piping from A, B, & C S/G cubicles.	1,410	1,370	17.62	0.00	18.11	C
5. Conduct channel head decontamination A, B, & C S/G's.	1,835	5,547	214.00	0.00	90.71	C
6. Cut A, B, & C S/G upper assemblies.	630	683	33.30	0.00	2.88	C
7. Lift A, B, & C S/G upper assemblies, invert and place in racks.	525	1,575	6.75	0.00	7.74	C
8. Cut A, B, & C S/G channel heads.	714	2,115	60.24	0.00	22.33	C
9. Install tube bundle shield covers A, B, & C S/G's.	525	916	53.00	0.00	14.82	C

TABLE 3B (Continued)
SUMMARY OF REMOVAL ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
10. Cut A, B & C S/G divider plates.	252	317	3.36	0.00	3.64	C
11. Lift A, B & C SGLA, cut and remove seismic rings.	1,089	221	77.16	0.00	3.59	C
12. Install tube sheet shield covers A, B & C S/G's.	755	1,124	40.00	0.00	16.39	C
13. Remove A, B & C SGLA's from reactor containment building and place in storage compound.	225	200	25.00	0.00	6.14	C
14. Maintain temporary power, lighting & electrical items.	2,100	2,793	55.00	0.00	5.93	C
15. Maintain, erect, and remove scaffolding.	840	7,308	8.40	0.00	31.47	C
16. On going decontamination activities.	10,900	2,540	32.76	0.00	12.74	C
17. Remove/dispose of contaminated materials.	3,600	7,617	29.62	0.00	37.65	C

TABLE 3B (Continued)
SUMMARY OF REMOVAL ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

	ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
18.	Project non-manual support.	27,725	6,410	214.72	0.00	24.58	C
19.	Containment tool and weld rod room support.	840	39	2.52	0.00	0.09	C
20.	Crane operation and maintenance.	3,015	2,334	5.44	0.00	4.05	C
21.	Miscellaneous Activities.	8,377	1,364	58.00	0.00	16.60	C
	Total - Phase II	69,129	54,457	1,016	0.00	395.62	

TABLE 3C
SUMMARY OF INSTALLATION ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
1. Remove S/G upper assembly internals and install/modify A, B and C S/G secondary internal components.	11,260	6,286	93.10	0.00	14.01	C
2. Weld preparation of A, B & C S/G channel head remnants.	840	1,757	7.71	0.00	12.69	C
3. Install/weld A, B & C SGLA's (includes post-weld heat treatment).	8,696	27,143	191.64	0.00	213.77	C
4. Install/weld A, B & C S/G divider plates.	1,554	2,760	15.10	0.00	58.46	C
5. Install/weld A, B & C S/G upper assemblies.	6,280	8,432	23.82	0.00	13.60	C
6. Installation of A, B & C S/G main steam piping.	1,250	996	5.50	0.00	2.28	C
7. Installation of A, B & C S/G feedwater piping.	1,680	1,013	6.80	0.00	1.89	C
8. Install insulation A, B & C S/G's.	3,486	2,435	29.40	0.00	4.17	C
9. Maintain temporary power, lighting and electrical items.	2,850	7,819	65.00	0.00	19.14	C

TABLE 3C (Continued)
SUMMARY OF INSTALLATION ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

	ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
10.	Maintain/erect/remove scaffolding.	2,840	17,625	20.67	0.00	58.58	C
11.	On-going decontamination activities.	10,920	5,096	32.76	0.00	14.41	C
12.	Remove/dispose of contaminated materials.	3,600	14,931	29.62	0.00	54.16	C
13.	Project non-manual support.	14,460	25,448	86.27	0.00	74.37	C
14.	Containment Tool & Weld rod room support.	840	458	2.52	0.00	0.84	C
15.	Crane operation/maintenance.	2,740	5,296	5.43	0.00	4.11	C
16.	Miscellaneous activities.	8,704	5,044	28.66	0.00	16.12	C
	Total Phase III	82,000	132,539	644	0.00	562.60	

TABLE 3D
SUMMARY OF POST-INSTALLATION ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
1. Remove temporary containments and ventilation.	970	1,129	5.97	0.00	4.10	C
2. Installation of miscellaneous steel.	600	3,348	2.33	2.23	9.61	C
3. Installation of miscellaneous piping in S/G cubicles.	350	3,817	7.58	0.00	12.37	C
4. Installation of permanent electrical cables/equipment.	580	546	5.00	1.13	2.72	C
5. Installation of concrete stop logs, concrete forms, rebar and pouring of new concrete 30'6" & 58' el.	5,490	2,539	22.08	0.00	7.10	C
6. Installation of emergency containment coolers.	210	1,122	2.52	0.01	2.25	C
7. Installation of CRDM coolers and fans.	100	64	0.42	0.00	0.28	C
8. Install manipulator crane.	0	484	0	1.14	1.63	C

TABLE 3D (Continued)
SUMMARY OF POST-INSTALLATION ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

	ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
9.	Installation of reactor coolant pump motors.	0	1,227	0	0.00	4.68	C
10.	S/G tube cleaning and inspection.	0	302	0	0.00	8.31	C
11.	Conduct S/G secondary hydrostatic testing.	0	281	0	0.00	0.59	C
12.	Reactor preparation/hot functional testing.	0	850	0	30.42	30.94	C
13.	Removal of secondary exhaust system.	140	252	3.03	0.01	1.75	C
14.	Remove temporary shielding.	84	532	2.10	0.10	4.12	C
15.	Remove scaffolding - all elevations.	830	672	7.85	1.81	1.81	C
16.	On-going decontamination activities.	2,730	370	8.20	1.56	1.56	C
17.	Remove/dispose of contaminated materials.	900	3,190	7.41	11.50	11.50	C
18.	Project non-manual support.	1,720	1,534	24.75	6.69	6.69	C

TABLE 3D (Continued)
SUMMARY OF POST-INSTALLATION ACTIVITY EXPOSURES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

	ACTIVITY DESCRIPTION	ESTIMATED LABOR (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO DATE (PERSON-HOURS)	ESTIMATED EXPOSURE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTIVITY STATUS (C-COMPLETE) (I-IN PROGRESS)
19.	Containment tool and weld rod room support.	210	89	0.63	0.14	0.14	C
20.	Crane operation and maintenance.	685	160	1.36	0.14	0.14	C
21.	Miscellaneous.	5,875.	1,497	39.77	3.90	4.32	C
	Total Phase IV	21,474	24,005	141	60.78	116.61	

TABLE 4
PERSONNEL EXPOSURE SUMMARY PER PHASE
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

PHASE DESCRIPTION	ESTIMATED LABOR EXPENDED TO-DATE (PERSON-HOURS)	ACTUAL LABOR EXPENDED TO-DATE (PERSON-HOURS)	TOTAL ESTIMATED EXPOSURE (PERSON-REM)	ESTIMATED EXPOSURE EXPENDED TO-DATE (PERSON-REM)	ACTUAL EXPOSURE FOR REPORTING PERIOD (PERSON-REM)	ACTUAL EXPOSURE EXPENDED TO-DATE (PERSON-REM)	PHASE STATUS (C-COMPLETE) (I-IN PROGRESS) (NS-NOT STARTED)
Preparation	34,992	49,422	283	283	0.00	229.99	C
Removal	69,129	54,457	1,016	1,016	0.00	395.62	C
Installation	82,000	132,539	644	644	0.00	562.60	C
Miscellaneous[a]	21,474	24,005	141	141	60.78	116.61	C
Project totals	207,595	260,423	2,084	2,084	60.78	1,304.82	

[a]Miscellaneous (post-installation) - includes cleanup, storage and miscellaneous preparations prior to start-up.

TABLE 5
SUMMARY OF RADIOACTIVE EFFLUENT RELEASES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

1983

I. LIQUID EFFLUENT RELEASES	RADIOACTIVITY RELEASED IN LIQUID EFFLUENTS (CURIES)			
RADIONUCLIDE	APRIL 3/31 - 4/27	MAY 4/28 - 5/16	TOTAL ACTIVITY RELEASED THIS REPORTING PERIOD	TOTAL RELEASED DURING S/G REPAIR TO DATE
Ag-110m	2.88E-04	*	2.88E-04	5.97E-04
Co-58	5.47E-04	8.26E-05	6.30E-04	1.27E-02
Co-60	1.53E-03	2.32E-04	1.76E-03	1.85E-02
Cs-134	3.46E-04	4.35E-05	3.90E-04	8.75E-03
Cs-136	*	*	*	1.90E-04
Cs-137	7.02E-04	8.36E-05	7.86E-04	1.63E-02
I-131	*	*	*	1.79E-02
I-133	*	*	*	2.50E-03
I-135	*	*	*	2.60E-04
Mn-54	4.47E-05	3.20E-06	4.79E-05	2.42E-04
Nb-95	*	*	*	8.53E-05
TOTAL	3.46E-03	4.45E-04	3.90E-03	7.80E-02
Tritium Released (Curies)	0.0	0.0	0.0	4.7E+01
			VOLUME RELEASED THIS REPORTING PERIOD	VOLUME RELEASED DURING S/G REPAIR TO DATE
Liquid Effluent Volume Released (Liters)	9.38E+05	3.40E+05	1.28E+06	9.79E+06

*Not detectable

TABLE 5 (Continued)
SUMMARY OF RADIOACTIVE EFFLUENT RELEASES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

1983

I. AIRBORNE RELEASES	RADIOACTIVITY RELEASED IN AIRBORNE EFFLUENTS (CURIES)			
A. NOBLE GASES RADIONUCLIDE	APRIL 3/31 - 4/27	MAY 4/28 - 5/16	TOTAL ACTIVITY RELEASED THIS REPORTING PERIOD	TOTAL RELEASED DURING S/G REPAIR TO DATE
Ar-41	*	*	*	3.52E-01
Kr-85	*	*	*	4.09E-01
Kr-85m	*	*	*	2.23E-01
Kr-88	*	*	*	1.39E-01
Xe-131m	*	*	*	1.37E+00
Xe-133	*	*	*	8.62E+02
Xe-133m	*	*	*	3.89E+00
Xe-135	*	*	*	6.59E+00
TOTAL	*	*	*	8.75E+02
TRITIUM	*	*	*	2.65E-02
B. HALOGENS				
Br-82	*	*	*	1.90E-04
I-131	*	*	*	3.30E-02
I-133	*	*	*	5.62E-03
TOTAL	*	*	*	3.88E-02

*Not Detectable

TABLE 5 (Continued)
SUMMARY OF RADIOACTIVE EFFLUENT RELEASES
REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983
TURKEY POINT - UNIT 4

1983

I. AIRBORNE RELEASES	RADIOACTIVITY RELEASED IN AIRBORNE EFFLUENTS (CURIES)			
C. PARTICULATES RADIONUCLIDE	APRIL 3/21 - 4/27	MAY 4/28 - 5/16	TOTAL ACTIVITY RELEASED THIS REPORTING PERIOD	TOTAL RELEASED DURING S/G REPAIR TO DATE
Ba-140	*	*	*	2.00E-05
Co-57	*	*	*	3.50E-07
Co-58	1.10E-05	3.60E-06	1.46E-05	3.79E-04
Co-60	2.40E-05	1.20E-05	3.60E-05	2.82E-04
Cr-51	*	*	*	1.20E-05
Cs-134	4.00E-06	1.80E-06	5.80E-06	1.13E-04
Cs-136	*	*	*	3.54E-05
Cs-137	1.10E-05	4.70E-06	1.57E-05	2.32E-04
I-131	*	*	*	1.04E-04
La-140	*	*	*	1.40E-05
Mn-54	3.70E-06	7.90E-07	4.49E-06	2.50E-05
Nb-93	*	*	*	3.10E-06
Ru-103	*	*	*	3.80E-06
TOTAL	5.37E-05	2.29E-05	7.66E-05	1.22E-03

*Not Detectable

TABLE 6

SUMMARY OF SOLID LOW-LEVEL RADIOACTIVE WASTE

REPORTING PERIOD 31 MARCH 1983 TO 16 MAY 1983

TURKEY POINT - UNIT 4

I. SOLID LOW-LEVEL RADIOACTIVE WASTE GENERATED FROM U-4 S/G REPAIR

WASTE FORM	VOLUME LLW[a] IN CU-FT FOR REPORTING PERIOD	VOLUME LLW IN CU-FT TO DATE
Compacted Dry Active Waste	5,250	27,992
Non-Compacted Dry Active Waste	500	3,700
Resin and Filter Media	100	1,594
Channel Head Decontamination Waste	0	595
Miscellaneous	0	0
Totals	5,850	33,881

II. SOLID LOW-LEVEL REPAIR ACTIVITY WASTE SHIPPED

REPORTING PERIOD DATES	VOLUME LLW[a] SHIPPED IN CU-FT	ESTIMATED ACTIVITY[b] CURIES
10 October 82 - 2 December 82	7,191	0.332
3 December 82 - 2 February 83	8,217	120.250
3 February 83 - 30 March 83	8,591	7.458
31 March 83 - 16 May 83	5,016	45.239
Totals	29,015	173.279

a LLW Low-level (radioactive) waste.

b Predominant radionuclides ^{137}Cs, ^{60}Co, ^{58}Co.