ATTACHMENT III. Low Level Radwaste

MIXED WASTE CHARACTERIZATION AND PROCESSING

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ABSTRACT

Waste that is both radioactive and hazardous is regulated by both the NRC and the EPA. Since there are few treatment, storage, or disposal facilities licensed by both these agencies, mixed waste generated at Duke Power Company facilities is stored at the generation site. Processing methods for eliminating this inventory of stored mixed waste are being developed using the limited options available to facilities not possessing a hazardous waste treatment permit. In order to ensure that the above storage and processing is in compliance with EPA requirements, periodic characterization of these mixed wastes is necessary. This paper describes Duke Power Company's mixed waste characterization and processing programs and outlines the results achieved to date.

INTRODUCTION

Mixed waste is low-level radioactive waste (LLW), as defined in the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA), that also contains constituents that are either a listed hazardous waste or exhibit hazardous characteristics as described in Environmental Protection Agency (EPA) regulation 40CFR Part 261. Prior to 1985, mixed waste was generally disposed of just like LLW with the Nuclear Regulatory Commission having regulatory authority. However, during formulation of the LLRWPAA, questions arose as to which agency, the EPA or the NRC, should have regulatory authority over mixed waste. Congress directed these two agencies to administratively resolve the problem. As a result, the NRC and the EPA issued a joint guidance document that stated the NRC had jurisdiction over the radionuclide portion of the mixed waste while the EPA had authority over the hazardous constituents. With the issuance of the NRC-EPA joint guidance document, a mixed waste treatment, storage, and disposal facility (TSDF) was required to conform to both NRC and EPA regulations. EPA regulations require that a mixed waste TSDF obtain an EPA permit and that they characterize their mixed waste to ensure that it can be treated, stored, or disposed of in compliance with the storage permit and EPA regulations. Due to the projected high costs associated with TSDF permits, Duke Power Company has implemented mixed waste characterization and processing programs whose goal is to eliminate any need to maintain these permits by eliminating mixed waste inventories.

The general strategy of the mixed waste processing program is to reduce the concentration of listed hazardous constituents in a mixed waste prior to submitting a delisting petition and to eliminate the hazardous characteristics of a mixed waste (ignitability, toxicity, reactivity, or corrosivity). Testing has begun on the limited processing options available to facilities not possessing an EPA treatment permit. Since these options are not fully developed, Duke Power has obtained hazardous waste storage permits and continues to accumulate mixed wastes at its generation sites.

The characterization program ensures that the storage of mixed waste is done in compliance with the respective facility's storage permit and EPA regulations. In addition, this program provides information necessary to the proper development of the company's mixed waste processing programs.

DISCUSSION

Characterization Program

The mixed waste characterization program began with the formation of mixed waste working groups at the Catawba, McGuire, and Oconee Nuclear Stations. These three sites produce all the mixed wastes generated by Duke Power Company. Each working group was comprised of chemistry, radiation protection, and environmental personnel from the stations and the corporate office. The mixed waste working groups were assigned the responsibility for identifying all mixed waste generated at their respective facility and for implementing a characterization program that fulfilled the requirements of 40CFR Part 265.

Each working group's initial action was to identify all LLW generated at their station. Next, each LLW stream was placed into one of the following general classifications:

* LLW known to be mixed waste because it contains or has contacted a listed hazardous solvent

* LLW which could be mixed waste because it has the potential to exhibit hazardous characteristics

* LLW which is not and should never become mixed waste because there is not a reasonable potential that it will become hazardous

A Waste Analysis Plan (WAP) was then developed which outlined the procedures necessary to ensure that each known or potential mixed waste was characterized as per the requirements of 40CFR Part 265. This WAP provides the following information for each of these waste streams:

* the parameters for which the waste will be analyzed
* the rationale for the selection of these parameters
* the sampling methods which will be used to ensure a representative sample of the waste is collected
* the test methods which will be used to analyze for the selected parameters
* the frequency with which the analysis of the waste will be repeated
* the test acceptance criteria

After development of the WAP, the known or potential mixed wastes were characterized. The initial characterization results for these known or potential mixed waste streams are shown in Table I and II respectively. Table III lists the LLW which is not and should never become mixed waste.

Table I

Initial characterization results for LLW known to be mixed waste because they contain or have contacted a listed hazardous solvent

Waste Stream	Parameter (See Note 1)	Result
dry cleaner filters, paper portion	freon	200 - 2200 ppm
	ignitability	non-ignitable
	toxicity	toxic, up to 2.0 ppm Cd and 16.0 ppm Pb
dry cleaner filters, carbon portion	freon	120 - 350,000 ppm
	ignitability	non-ignitable
	toxicity	non-toxic

Table I (continued)

Waste Stream	Parameter	Result
dry cleaner bottoms	freon	58,000 - 330,000 ppm
	ignitability	non-ignitable
	toxicity	toxic, up to 5.9 ppm Pb
scintillation cocktail	See Note 2	
acetone based cleaning solutions	See Note 2	
waste oil/solvent mixtures	See Note 2	
tool decon unit filters	See Note 3	
tool decon unit bottoms	See Note 3	

Notes: 1) Waste streams were analyzed for both the concentration of the applicable listed constituent and the parameters which caused that constituent to be listed.

2) Note that analysis of most of the Table I wastes was not necessary since their characteristics were already known. Analysis was performed only on the freon related wastes because a knowledge of the actual concentration of the listed constituent in these wastes was important for process development. In addition, there was sufficient doubt as to whether the freon waste actually exhibited the characteristics that caused its hazardous constituent to be EPA listed.

3) Tool decon unit freon waste analysis has yet to be performed.

Table II

Initial characterization results for LLW which could be mixed waste because they have the potential for exhibiting hazardous characteristics

Waste Stream	Potential Characteristics	Result
paint solids	ignitability	non-ignitable
chromate analysis waste	toxicity	toxic, up to 240 ppm Cr
reactor coolant pump decon solution	toxicity	toxic, up to 3560 ppm Cr
sludge lance filters/sludge	toxicity	non-toxic
chloride analysis waste	toxicity	toxic, up to 780 ppm Hg
liquid radwaste filter (laundry system)	toxicity	non-toxic
liquid radwaste filter (floor drain system)	toxicity	non-toxic
laundry liquids	toxicity	non-toxic
	corrosivity	non-corrosive PH=7.2
floor drain liquids	toxicity	non-toxic
	corrosivity	non-corrosive PH=6.9
wet blast decon unit grit/filters	toxicity	toxic, up to 28 ppm Cd and 30 ppm Pb
lead batteries/ shielding	See Note 1	

Notes: 1) Lead batteries and shielding are decontaminated. Consequently, no analysis has been performed on this waste.

Table III

LLW which is not and should never become mixed waste because there is not a reasonable potential that it will become hazardous

primary system filters/resins	
process equipment	
tools	
unused non-solvent commercial products	
HVAC filters/carbon	
dry cell batteries	
oil/greases	
empty scintillation vials	*
empty solvent containers	*
absorbents containing solvents	**
equipment and sump sludges	

* Per EPA regulations, empty solvent containers are not subject to regulation as a hazardous waste.

** At the time of the working group's initial classification, non-soaked absorbents were classified as non-hazardous. However, because of a recently issued EPA regulation, solvent containing absorbents are now classified as hazardous. The characterization of these absorbents has yet to be performed.

After completion of the above initial characterizations, process development began for the LLW determined to be mixed waste. These processes are described in the Processing Program section of this paper. Periodic analysis continues on the LLW listed in Tables I and II at the frequency specified in [illegible] WAP.

Processing Program

The initial characterization of LLW generated at Duke Power facilities identified the mixed waste currently being generated at Duke Power facilities. Next, development began on methods to process this mixed waste using the limited techniques available to facilities not possessing an EPA treatment permit. The goal of this process program is to eliminate the need to maintain any EPA related storage permits by eliminating mixed waste inventories.

Two general strategies are being employed to achieve this goal:

Strategy #1 - involves the submittal of delisting petitions for mixed waste streams that contain or have contacted a listed hazardous solvent. Prior to petition submittal, the concentration of the hazardous solvent in the mixed waste will be reduced as low as possible.

Strategy #2 - is applicable to a mixed waste that exhibits a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity). These wastes will be treated in-container to eliminate their hazardous characteristics.

Table IV lists the mixed wastes that are currently being generated at Duke Power facilities, as identified by the characterization program. In addition, their hazardous properties and the general processing strategies to be applied to these mixed wastes are provided.

Table IV

General Process Strategy For Mixed Waste Streams Currently Being Generated At Duke Power Facilities

Mixed Waste Stream	Hazardous Properties	Strategy
dry cleaner filters, paper portion	listed waste (freon), toxic (Cd,Pb)	#1 and #2 See Note 1
dry cleaner filters, carbon portion	listed waste (freon)	#1
dry cleaner bottoms	listed waste (freon), toxic (Pb)	#1 and #2
scintillation cocktail	ignitable, See Note 2	#2, See Note 3
acetone based cleaning solutions	listed waste (acetone)	#2, See Note 4
waste oil/solvent mixtures	listed waste (solvents)	#1, See Note 5
tool decon unit filters	listed waste (freon), See Note 6	#1

Table IV (continued)

Mixed Waste Stream	Hazardous Properties	Strategy
tool decon unit bottoms	listed waste (freon) See Note 6	#1
chromate analysis waste	toxic (Cr)	#2
reactor coolant pump solution	toxic (Cr)	#2
chloride analysis waste	toxic (Hg)	#2
wet blast decon unit grit/filters	toxic (Cd)	#2

Notes: 1) Strategy #1 - reduce concentration of the listed hazardous constituent and then submit a delisting petition.

Strategy #2 - render non-hazardous by eliminating hazardous characteristics.

2) The initial characterization of LLW classified scintillation cocktail as a listed mixed waste since it contains a listed hazardous solvent. However, based upon an EPA regulation, the cocktail is classified only as characteristic mixed waste (ignitability) since it is not used in a solvent application.

3) Cocktail waste containing no gamma-emitting radioactive isotopes was sent to an off site facility for disposal. The remaining cocktail waste was processed using Strategy #2.

4) The acetone based cleaning solution is a listed hazardous waste only because it is ignitable. Based upon an EPA regulation, wastes containing a solvent which is listed solely due to ignitability need only be rendered non-ignitable within 90 days of generation to be declared non-hazardous. Neither removal of the listed solvent from the waste nor a delisting petition is required.

Table IV (continued)

5) An alternative option being pursued for mixed waste comprised of oil and listed hazardous solvents is approval from the applicable regulatory agencies for a one time burn of current inventories. Afterwards, an oil and solvent segregation program should prevent the generation of additional amounts of this mixed waste.

6) The tool decon unit waste characterization has not been completed.

Application of Strategy #1 to the applicable wastes required an investigation into effective methods for reducing the listed solvent concentrations of these wastes. At this time, no testing has been performed on methods for reducing the listed solvent concentration of the waste oil/solvent mixtures. For the freon related wastes, two methods have been tested - distillation and drying using the heat cycle of the dry cleaners. Neither of these two methods of reclaiming freon require a hazardous waste treatment permit. Strategy #2 is being employed to eliminate the hazardous characteristics associated with any of the identified mixed wastes. Generally, these wastes are being solidified with a gypsum based solidification agent. Again, a treatment permit is not required as long as the solidifications are performed in the original waste container within 90 days of the waste generation date.

At this time, the only full scale application of the above process strategies has been on the scintillation cocktail and the reactor coolant pump decon solution. Full scale processing of the remaining mixed wastes was delayed pending the results of bench scale processing of these wastes. The mixed waste processing results achieved thus far are shown in Table V. Testing is in progress for the identified mixed waste streams for which no results are shown.

Table V

Current Duke Power Mixed Waste Processing Results

Mixed Waste	Process Description	Pre-processed Properties	Post-processed Properties
dry cleaner filters, paper	dried 4 hours @ 120 degrees F, then solidified	2200 ppm freon, 2 ppm Cd and 16 ppm Pb	1200 ppm freon, < 0.2 Cd and < 0.3 Pb, See Notes 1 thru 5

Table V (continued)

Mixed Waste	Process Description	Pre-processed Properties	Post-processed Properties
dry cleaner filters, carbon	dried 8 hours @ 120 degrees F	350,000 ppm freon	18,000 ppm freon, See Note 4
dry cleaner bottoms	distilled, then solidified	330,000 ppm freon, 5.9 ppm Pb	110 ppm freon, < 0.3 Pb, See Notes 2,4,5
scintillation cocktail	solidified	ignitable	non-ignitable, See Notes 4 and 5
chromate analysis waste	solidified	240 ppm Cr	1.01 ppm Cr, See Notes 2, 4, and 5
rx coolant pump decon solution	solidified	3560 ppm Cr	4.97 ppm Cr, See notes 2,4, and 5
chloride analysis waste	solidified	780 ppm Hg	0.023 ppm Hg, See Notes 2,4, and 5
wet blast grit/filters	solidified	2.3 ppm Cd, See Note 4	0.23 ppm Cd, See Notes 2,4, 5, and 6

Notes: 1) Freon analysis of dried or distilled dry cleaner wastes was performed prior to any solidification of these wastes.

2) All post-processed toxic metal results are below the allowed maximum. Consequently, these processed wastes are non-toxic.

3) No significant additional reduction was achieved in the dry cleaner filter paper freon concentration by drying the paper longer than 4 hours.

Table V (continued)

4) The scintillation cocktail and the coolant pump decon solution results were obtained from full scale processing. All other post-processed results were obtained from bench scale process testing.

5) The solidification of the reactor coolant pump decon solution was done using cement. All other waste solidifications were performed using a gypsum based solidification agent.

6) This wet blast filters/grit processing was performed on a waste batch that contained only 2.3 ppm Cd. The processing of batches containing Pb and higher levels of Cd is in progress.

SUMMARY AND CONCLUSION

The Duke Power characterization program has identified all mixed waste currently being generated at Duke Power facilities. This program provides for the periodic characterization of these wastes and ensures that they continue to be stored and processed in accordance with the requirements of 40CFR Part 265.
The Duke Power processing program has eliminated two of the identified mixed wastes from the companies hazardous waste storage permits - scintillation cocktail and reactor coolant pump decon solution. The processing of the remaining mixed waste is in progress and the preliminary results are satisfactory. Based upon these results, there is a reasonable possibility that all Duke Power mixed waste inventories and hazardous waste storage permits can be eliminated.

REFERENCES

1. Low Level Radioactive Waste Policy Amendments Act, January 1986.

2. Resource Conservation and Recovery Act of 1976, October 1976.

3. Environmental Protection Agency and U.S. Nuclear Regulatory Commission, " Guidance on the Definition and Identification of Commercial Mixed Low-Level Radioactive and Hazardous Waste and Answers to Anticipated Questions", January 8, 1987.

4. Code of Federal Regulations, Title 40, Parts 260 thru 262, and Parts 264 thru 270.

5. Environmental Protection Agency, "Treatment of Hazardous Waste Without a Permit", Federal Register, Vol.51, No. 56, pg 10168, March 24, 1986.

AQUATIC RESOURCE QUESTIONS

This request for information is designed to obtain the utility overview of its power plant's impacts on aquatic resources. It is not intended to require new surveys, data collection, or extensive new analyses of existing data. Responses can be based on existing information, for example, by summarization of information contained in monitoring reports, publications, or unpublished files. The questions should be answered separately for each site operated by the utility.

Documents that may be useful in addressing the following questions are:

- o Annual Aquatic Monitoring Report submitted to the responsible State Agency
- o Final Environmental Statement
- o Annual Non-Radiological Monitoring Report as required by Environmental Protection Plan of Technical Specifications, Appendix B
- o Section 316 (a) and (b) Demonstration Report submitted to Environmental Protection Agency

Based on our pilot study, the Aquatic Resource questions should take approximately 40 man-hours to answer.

1. Post-licensing modifications and/or changes in operations of intake and/or discharge systems may have altered the effects of the power plant on aquatic resources, or may have been made specifically to mitigate impacts that were not anticipated in the design of the plant. Describe any such modifications and/or operational changes to the condenser cooling water intake and discharge systems since the issuance of the Operating License.

2. Summarize and describe (or provide documentation of) any known impacts on aquatic resources (e.g., fish kills, violations of discharge permit

conditions) or National Pollutant Discharge Elimination System (NPDES) enforcement actions that have occurred since issuance of the Operating License. How have these been resolved or changed over time? (The response to this question should indicate whether impacts are ongoing or were the result of start-up problems that were subsequently resolved.)

3. Changes to the NPDES permit during operation of the [illegible] indicate whether water quality parameters were determined [illegible] impacts (and were dropped from monitoring requ[illegible] subsequently raised as a water quality issue. [illegible] of changes (and when they occurred) to the NPDES p[illegible] since issuance of the Operating License.

4. An examination of trends in the effects on aquatic r[illegible] monitoring can indicate whether impacts have increase[illegible] remained relatively stable during operation. Describe [illegible] (or provide documentation of) results of monitoring [illegible] and aquatic biota (e.g., related to NPDES permits, Environme[illegible] Technical Specifications, site-specific monitoring required by federal or state agencies). What trend are apparent over time?

5. Summarize types and numbers (or provide documentation) of organisms entrained and impinged by the condenser cooling water system since issuance of the Operating License. Describe any seasonal patterns associated with entrainment and impingement. How has entrainment and impingement changed over time?

6. Aquatic habitat enhancement or restoration efforts (e.g., anadromous fish runs) during operation may have enhanced the biological communities in the vicinity of the plant. Alternatively, degradation of habitat or water quality may have resulted in loss of biological resources near the site. Describe any changes to aquatic habitats (both enhancement and degradation) in the vicinity of the power plant since the issuance of

the Operating License including those that may have resulted in different plant impacts than those initially predicted.

7. Plant operations may have had positive, negative, or no impact on the use of aquatic resources by others. Harvest by commercial or recreational fishermen may be constrained by plant operation. Alternatively commercial harvesting may be relatively large compared with fish losses caused by the plant. Describe (or provide documentation for) other nearby uses of waters affected by cooling water systems (e.g., swimming, boating, annual harvest by commercial and recreational fisheries) and how these impacts have changed since issuance of the Operating License.

8. Describe other sources of impacts on aquatic resources (e.g., industrial discharges, other power plants, agricultural runoff) that could contribute to cumulative impacts. What are the relative contributions by percent of these sources, including the contributions due to the power plant, to overall water quality degradation and losses of aquatic biota?

9. Provide a copy of your Section 316(a) and (b) Demonstration Report required by the Clean Waste Act. What Section 316(a) and (b) determinations have been made by the regulatory authorities?

DUKE POWER COMPANY

McGUIRE NUCLEAR STATION

SOCIOECONOMIC QUESTIONNAIRE

July 3, 1990

MEMORANDUM

TO: Tami Carpenter
Design Engineering
EC09-H

FROM: Gail Addis

SUBJECT: NUMARC Socioe[illegible] Impact Questionnaire

1. Estimates of numb[illegible] workers on site for most recent year:

   Average permanent wo[illegible]
   QA
   CMD
   PSD
   NPD ≈ 1000

   Does not include K-Mac (approximately 95) or Globe (approximately 150)

2. Average permanent workers in five-year increments since plant received Operating License:

	TOTAL	NPD	CMD/SMS*	QA	PSD
1980 =	953*	~621	250	82	-
1985 =	1118*	~786	250	82	-
1990 =	1509	~1000	375	82	52

*CMD was basically SMS as far as plant maintenance support in '80 and '85.

3. Three cases, a typical planned outage, an ISI outage and the largest single outage.

   A. *Typical Planned Outage - 2EOC5

      Length: 76 days Start Date: 7/5/89 Finish Date: 9/19/89

      Cost: $20,234,000

      Total Additional Workforce (Peak): 1055

Principal Task Workforce:

Refueling	15
NC Pump Maintenance	20
Modifications	150
S/G Sludge Lance}	
S/G Sludge Leg Shot Peen}	160
S/G FOSAR}	
S/G Plug Removal}	
Routine Maintenance	710

Total Occupational Dose Received: 514 Rem

Principal Task Dose:

Refueling	26 Rem
NC Pump Maintenance	17 Rem
Modifications	65 Rem
S/G Sludge Lance	17 Rem
S/G Cold Leg Shot Peen	66 Rem
S/G FOSAR	22 Rem
S/G Plug Removal	24 Rem
Routine Maintenance	277 Rem

*All figures are actuals

B. *ISI Outage - 1EOC7

Length: 80 days Start Date: 8/91 Finish Date: 11/91

Cost: $22,000,000

Total Additional Workforce (Peak): 1025

Principal Task Workforce:

Refueling	15
NC Pump Maintenance	20
Modifications	150
S/G ECT 100%}	
S/G Sleeving}	110
ISI Hydro Testing	30
Routing Maintenance	700

Total Occupational Dose Received: 518

Principal Task Dose:

Refueling	30
NC Pump Maintenance	20
Modifications	40
S/G ECT 100%}	
S/G Sleeving}	130
ISI Hydro Testing	20
Routing Maintenance	278

*All figures are estimates

C. *Largest Single Outage - 1EOC6

Length: 132 days   Start Date: 1/8/90   Finish Date: 5/20/90

Cost: $25,000,000 (estimate all invoices not yet received)

Total Additional Workforce (Peak): 1025

Principal Task Workforce:

Refueling	15
NCP Maintenance	20
Modifications	145
S/G Sludge Lance}	
S/G Shot Peen}	
S/G Sleeving}	135
S/G Tube Pull}	
S/G Plug Removal}	
Routine Maintenance	710

Total Occupational Dose Received: 487R

Principal Task Dose:

Refueling	28
NCP maintenance	20
Modifications	16
S/G Sludge Lance	13
S/G Shot Peen	33
S/G Sleeving	40
S/G Tube Pull	37
S/G Plug Removal	16
Routine Maintenance	284

*All figures are actual except cost.

Please call if you have questions.

cc: T. L. McConnell
J. W. Boyle
W. R. Kelley

DUKE POWER COMPANY

CATAWBA NUCLEAR STATION

SOCIOECONOMIC QUESTIONNAIRE

1. To understand the importance of the plant and the degree of its socioeconomic impacts on the local region, estimate the number of permanent workers on-site for the most recent year for which data are available.

As of 7/1/90: 1157 NPD
87 Permanent Vendors
1244 Total

2. To understand the importance of the plant to the local region, and how that has changed over time, estimate the average number of permanent workers on site, in five-year increments starting with the issuance of the plant's Operating License. If possible, provide this information for each unit at a plant site.

Data For Both Units:
1/1/89 - 1,248
1/1/88 - 1,242
3/1/87 - 1,099
3/1/86 - 1,075
3/1/85 - 1,052
Total: 5,716 - 5 = 1,143 Average

3. To understand the potential impact of continued operation for an additional 20 years beyond the original licensing term, please provide for the following three cases:

A) A Typical Planned Outage:

1. Estimate of additional workers involved for entire outage:
60 I&E
588 Mechanical
138 HP
786 Total

2. Length Of Outage: 62 Days Planned
74 Days Actual

3. Months & Year In Which Work Occurred:
November 1988 to February 1989

4. Cost: Accounting information not available.

5. Occupational Doses Received By Permanent And Temporary Workers During Each Principal Task:
Total Occupational Dose 313.124 Per Rem
(See attached sheet for breakdown on exposure)

B. An ISI Outage:

1. Estimate of additional workers involved for entire outage:
   76 I&E
   670 Mechanical
   143 HP
   889 Total

2. Length Of Outage: 75 Days Planned

3. Months & Year In Which Work Occurred:
   We have not had an ISI Outage to date.

4. Cost: Cost Estimates not available.

5. Estimate Occupational Doses Received By Permanent And Temporary Workers During Each Principal Task:
   We have not had an ISI Outage to date.

C. The Largest Single Outage (In Terms Of the Number Of Workers Involved) That Has Occurred To Date:

1. Estimate of additional workers involved for entire outage (do not have breakdown for each principal task) Additional workers involved approximately 900.

2. Length Of Outage: Planned 68 days

3. Months & Year In Which Work Occurred:
   Outage started June 1990 - Not completed (scheduled to finish August 1990)

4. Cost: Outage Not Completed

5. Estimate Occupational Doses Received By Permanent And Temporary Workers During Each Principal Task:
   Estimated Occupational Dose 278.55 Per Rem (See attached for Estimated Exposure)

3A

FUNCTION	DOSE (REM)
360 ECT & U-Bend Stress Relief (UBSR)	54.910
Platform and Playpen Set Up/Clean Up	15.645
Nozzle Dam Installation/Removal	15.535
Tube Plugging	14.540
Code Eddy Current Testing (ECT)	13.450
Manway/Diaphragm Removal and Installation	9.480
Tube Dampening	4.930
Bowl Washdown and Initial HP Survey	2.760
FOSAR	1.410
TOTAL	132.660

FUNCTION	DOSE (REM)
Valve Repair	35.380
MOVATS	8.750
Limitorque Operator PM	1.975
TOTAL	45.500

FUNCTION	DOSE (REM)
Reactor Head Removal/Assembly	13.200
ISI of piping welds/hangers	11.420
Snubber inspection/testing	8.935
General Health Physics Surveillance (RB)	7.950
SRWP dose for outage tasks	7.910
Inspect/Replace 214 pipe clamps	7.320
General Operations Surveillance (RB)	7.050
General Decontamination (RB)	6.775
Socket weld tube fittings	5.665
Miscellaneous PM/PT	5.605
Hanging valve/component labels	4.425
Refuel Cavity Decontamination	3.490
RB/Annulus General Entry	2.915
Miscellaneous Instrument Calibration	2.880
Replace S/G Snubbers	2.735
Relocate 1NV014	2.595
Inspect/Retube KC HX's 1A/1B	2.455
ECT NV Letdown HX	2.145
TOTAL	105.470
Miscellaneous Work	29.494

3 C

SIGNIFICANT JOBS

ACTIVITY	ESTIMATED EXPOSURE (Person - Rem)
Steam Generator Eddy Current Testing/ Tube Plugging	65.0
Steam Generator Nozzle Dam Installation	15.0
Sludge Lance 4 Steam Generators	7.0
FOSAR 4 Steam Generators	3.0
Reactor Head Removal/Replacement	15.0
Reactor Coolant Pump "2A", Seal Inspection/Replacement	4.0
ECT of NS Heat Exchangers	1.5
Miscellaneous Hanger Support	4.0
Snubber Inspection and Testing	8.0
Ice Basket Weighing and Replenishment	1.5
Socket Weld Tube Fittings	3.5
Incore Thermocouples/Mid Loop Operations	1.5
Pump Work	2.0
Valve Repair	37.710
Fuel Handling Operation	1.9
MOVATS (approximately 45 valves)	13.0
Rotorque Inspections	1.248
Limitorque P.M.s	2.780
E. Q. Activities	2.0
Loose Parts System Calibration	1.2
QA Inservice Inspections	10.0
Type C Leak Rate Testing	2.0

SUBTOTAL FOR SIGNIFICANT JOBS: 202.838 person - rem

3 C

ACTIVITIES HAVING ESTIMATED EXPOSURES > 1 PERSON - REM

General Outage Work
(Not Associated with a Specific Significant Job or NSM/VN)

ACTIVITY	ESTIMATED EXPOSURE (Person - Rem)
Temporary Shielding	2.5
Upper Containment General Entry	1.0
Housekeeping in Upper Containment	1.065
Upper Containment Canal Decon	5.0
Lower Containment General Entry	1.5
General Decon in Lower Containment	6.0
General R. P. Surveillance in Lower Containment	6.0
Operations Surveillance and Red Tags	6.7
Miscellaneous Work on SRWP's	15.0
Miscellaneous Instrumentation Calibration	4.0
Miscellaneous PM's and PTs	4.5

Subtotal for General Outage Work: 53.265 person - rem

NSM's/VN's

ACTIVITY	ESTIMATED EXPOSURE (Person - Rem)
CN 20330 Modify control circuitry wiring on MOV's	2.0
CN 20566 Replace inside containment BB isolation valves	5.0
CN 20582 Provide data for MOV testing	2.0
CN 20594 Delete HVAC Duct in Annulus	1.0

Subtotal for NSM's/VNs: 11.1 person - rem

Miscellaneous Work	12.455

DUKE POWER COMPANY

SOCIOECONOMIC QUESTIONNAIRE

CASE STUDY PLANTS - TAXES

B. **Taxes**

These questions are asked to validate information obtained from local government sources or to obtain information if local governments fail to provide it.

1. What types of local taxes must be paid on the plant and property?
   ad valorem property tax

2. To what jurisdictions are these taxes paid?
   see schedule

3. What types of state taxes must be paid on the plant and property?
   none

4. For each tax type, please estimate the total amount the utility paid to each relevant state and local jurisdiction in 1980, 1985 and 1989 (or the most recent year for which data are available).
   see schedule

5. Have major plant modifications or refurbishment affected the plant's taxable assessed value?
   no

6. Would an extended outage for major plant modifications or refurbishment result in a temporary cessation or reduction of tax payments to state and/or local governments?
   no

7. Would tax payments cease in the event of plant decommissioning?
   Yes

C. **Public Services**
   n/a

This question is asked to validate information obtained from local government sources or to obtain information if local governments fail to provide it.

1) Please estimate the total annual plant expenditure for each fee-paid public service (e.g., water, sewer, etc.) in five year intervals since plant operations began.

National 45-604 Eye-Ease 43-704 20/20 Buff Made in USA

[illegible]

Property Tax on Nuclear Stations as of 12-31-89

State	Plant	County	Orig Cost	Assessed Value	Tax Rate	Tax
N.C.	McGuire	Mecklenburg	$2467833347	1826023866	.66	12051758
S.C.	Oconee	Oconee	635924863	40514729	136 Mils	5510003
S.C.	Catawba	York *	267590676	17048183	083.9 Mils	1430343

* Duke 12½% ownership only.

6-14-90

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

SOCIOECONOMIC QUESTIONNAIRE

SOCIOECONOMIC QUESTIONS FOR ALL UTILITIES

1. **To understand the importance of the plant and the degree of its socioeconomic impacts on the local region, estimate the number of permanent workers on site for the most recent year for which data are available.**

   As of June 26, 1990, the Oconee Nuclear Station "ONS" has approximately 2300 permanent workers on site. The following is a listing by ONS departments/full time vendors of permanent onsite workers:

Department	Total Workers
Nuclear Production	1,022
Construction and Maintenance	899
Quality Assurance	80
Production Support	52
Transmission	8
Design Engineering	7
Corporate Communications	7
Globe Security	119
Wometco Vending	94
Babcock and Wilcox	1
Human Resources	1
Operating	5
Procurement Services and Materials	5
	2,300

2. **To understand the importance of the plant to the local region, and how that has changed over time, estimate the average number of permanent workers on site, in five year increments starting with the issuance of the plant's operating license. If possible, provide this information for each unit at a plant's site.**

   Operation of Oconee Units 1, 2 and 3 were authorized by the United States Atomic Energy Commission by issuance of operating licenses DPR-38, 47, and 55 on February 6, 1973, October 6, 1973, and July 19, 1974, respectively. Relative to all three units, the estimated permanent workforce on site in five-year increments are as follows:

Month/Year	Total Employees
September 1974	310
September 1979	625
September 1984	850

   (Effective mid-1985, Duke Power's Construction Department became permanently located on site. At this time this department's permanent work force was approximately 300. Therefore, the entire ONS site's workforce was approximately 1200 permanent employees).

September 1989	2000

3. To understand the potential impact of continued operation for an additional 20 years beyond the original licensing term, please provide for the following three cases; (a) a typical planned outage; (b) an ISI outage; (c) the largest single outage (in terms of the number of workers involved) that has occured to date. An estimate of additional workers involved (for the entire outage and for each principle task), length of outage, months and year in which work occured, and cost. Also, estimate occupational doses received by permanent and temporary workers during each principle task.

(a) Typical planned outage: The normal length for a typical planned outage is approximately 45 days. Outages occur at the end of a cycle length. Some power manuevering may be used to avoid summer/winter power peaks. The following is a listing of additional workers/support involved in the outage:

Workers/Support	Total
Building	20
Performance Support	3
Electrical (TSM's)	10
Equipment Operator (not Polar Crane)	4
Valve Limitorque	15
Hanger	5
Heat Exchangers	20
Material Handling (RB Move)	8
Insulation	30
Material Handling	10
Polar Crane Operator	6
Reactor Coolant Pumps	18
General Support	15
Snubber	5
Steel Work (Flagman)	6
Tool/Room Worker	15
Valves	44
Warehouse/Materials Support	8
Welding/ISI	30
TOTAL WORKERS	272

The following is a list of typical planned outage dose by tasks:

Tasks	Dose
OTSG Work	39
Valve Work	22
Head Work	19
Decon Work	15
Insulation	13
Inspecting/General Entry	10
Miscellaneous	10
I&E Work	9
RCP and Motor Work	9
ISI Activities	9
RBCUS	8
NSMS	7
Stage/Remove Equipment	7
RP Surveys	6
Scaffolding	6
Defuel/Refuel Activities	4
Shielding	4
Miscellaneous Pump Work	4
Performance Testing	2
Tendon Work	1
Turbine Building Activities	1
Snubber Work	1
Paint Basement Floor	.2
TOTAL DOSE	206.2

(b) ISI Outage: The estimated length of an ISI Outage is approximately 55 days. Such an outage would occur at the end of a cycle length. Some power manuevering may be used to avoid summer/winter power peaks. The following is a list of the additional workers/support involved in an ISI Outage:

Additional Workers/Support	Total
Building	20
Performance Support	3
Electrical (TSM's)	10
Equipment Operator (Not polar Crane)	4
Valve Limitorque	15
Hanger	5
Heat Exchangers	20
Material Handling (RB Move)	8
Insulation	30
Material Handling	10
Polar Crane Operator	6
Reactor Coolant Pumps	18
General Support	15
Snubber	5
Steel Work (Flagmen)	6
Tool/Room Workers	15
Valves	44
Warehouse/Materials Support	8
Welding/ISI Support	30
TOTAL WORKERS	272

The following is the estimated Dose received during an ISI Outage by task:

Tasks	Dose
OTSG Work	50
Valve Work	25
Head Work	20
Decon Work	15
Insulation	15
Inspecting/General Entry	10
Miscellaneous	10
I&E Work	10
RCP and Motor Work	10
ISI Activities	49
RBCUS	10
NSMS	10
Stage/Remove Equipment	10
RP Surveys	8
Scaffolding	5
Defuel/refuel Activities	4
Shielding	4
Miscellaneous Pump Work	4
Performance Testing	3
Tendon Work	2
Turbine Building Activities	
(1) Snubber Work	1
(2) Paint Basement Floor	1
TOTAL DOSE	276

(c) Largest Single Outage: The largest Oconee Outage to date by additional workers involved is not readily available; however it should not differ significantly from a typical ISI Outage. Further, we have no accounting records documenting the work incurred cost, nor are our accounting records established to provide a breakdown.

Duke

EMPLOYMENT AND EXPENDITURES

1. To understand the importance of the plant to local communities, and how that has changed over time, provide estimates of total plant expenditures, by local community, for equipment, materials, and services used in normal operations for the most recent year data are available.

   1989 Materials and Supplies/Equipment = $21,010,000
   1989 Services (Outside-Contract) = $27,884,000
   (Services are determined to be outside Contract Costs. All cost is OCONEE ONLY)

2. To understand the possible affect of the plant on the local economy, the average salary paid to plant employees, compared to average salaries for comparable jobs, if they exist in the local area: (e.g. Engineers, Secretaries, Custodial Personnel, Electronics Technicians, Maintenance Journeymen, Food Service Employees.)

Classification	Duke Power Average	Local Area Average
Storekeeper	12.00 hr.	8.00 hr.
Stockhandler	10.50 hr.	8.00 hr.
Maintenance Mech	16.50 hr.	11.00 hr.
Secretary	460.00 wk.	299.00 wk.
Word Processing	460.00 wk	304.00 wk.
Computer Operator	460.00 wk.	429.00 wk
Accounting Clerk	460.00 wk.	323.00 wk.
Personnel Clerk	460.00 wk.	394.00 wk.
Nurse	700.00 wk	476.00 wk.
I&E Technician	660.00 wk.	451.00 wk.
Janitorial	8.00 hr. (vendor)	7.00 hr.
Planner	850.00 wk.	418.00 wk.

(The aforementioned Duke Power averages are based on the average pay for experienced workers in these classifications.)

3. To understand the possible affect of the plant on the local economy, what programs has the utility sponsored in the area to improve employment opportunities such as hiring policies, job training programs, or industrial recruitment?

   In addition to supporting the employment programs listed in Duke Power Company's Affirmative Action Program, the following is a list of the specific programs/activities used by various departments at Oconee in attracting and retaining qualified employees:

   (a) Centralized Employment Application Process - Applicants can apply at one central point at the Oconee Nuclear Station to be considered for most all site/department employment opportunites rather than apply to each department.

(b) Conduct Career Day presentation to high schools in an effort to: educate students about Duke Power Company, to inform students of the types of employment opportunities within Duke Power Company and the Oconee Nuclear Station, and to inform students of what skills/qualifications are needed to be considered for the various opportunities.

(c) Conducting Career Day presentations at two-year Technical Schools, including predominately minority attended schools.

(d) Serve as company representatives on advisory councils organized in various high schools.

4. To understand the importance of the plant to specific jurisdiction near the plant, what is the current distribution, by city and county or zip code of residence of permanent workers on site?

Please see the attached printout.

CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S, OSRG, TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
ABBEVILLE	29620		2
		*	2
ALEXIS	28006		2
		*	2
ANDERSON	29621		57
	29622		4
	29624		13
	29625		18
	29825		1
		*	93
BALDWIN	30510		1
		*	1
[redacted]			
		[redacted]	
BELTON	29627		21
		*	21
BLACKSBURG	29702		1
		*	1
OILNG SPRNGS	28017		1

BOSTIC	28018	1
	*	1
BOWERSVILLE	30516	1
	*	1
BREVARD	28712	2
	*	2

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE	NUMBER OF EMPLOYEES
BUFFALO	29321	1
	*	1
CAMPOBELLO	29322	1
	*	1
CARNESVILLE	30521	2
	*	2
CASHIERS	28717	6
	*	6
CENTRAL	29630	130

[redacted]

CHESNEE	29323	3
		-----------
	*	3
CLEMSON	29631	43
	29633	9

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE	NUMBER OF EMPLOYEES
		-----------
	*	52
CLINTON	29325	[illegible]

		*	1
CLOVER	29710		2
		*	2
[redacted]			
COWPENS	29330		2
		*	2
CULLOWHEE	28723		1
		*	1
[redacted]			
DONALDS	29638		4
		*	4
DUNCAN	29334		2

CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,DSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
		*	2
E. FLAT ROCK	28726		1
		*	1
EASLEY	29640		106
	29641		3
	29642		19
		*	128
EASTANOLLEE	30538		5
		*	5
FAIR PLAY	29643		11
		*	11
FAIRPLAY	29643		2
		*	2
FOREST CITY	28043		2
		*	2
FORT HILL	29715		1
		*	1
GAFFNEY	29340		13
		*	13

[redacted]

GREENVILLE	29605		3
	29607		1
	29609		5
	29611		10
	29615		4
		*	23

CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
GREENWOOD	29646		1
		*	1
GREER	29650		1
	29651		5
	29652		1
		*	7
[redacted]			
HARTWELL	30643		6
		*	6
HODGES	29653		1
		*	1
HONEA PATH	29654		11

[redacted]

INMAN	29349		1
		*	1
IVA	29655		12
		*	12

[redacted]

KNOXVILLE	37921		1
		*	1
LA FRANCE	29656		2

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
		*	2
LAKE WYLIE	29710		2
		*	2
LANCASTER	29720		1
		*	1

LAURENS	29360		1
		*	1
LAVONIA	30553		5
		*	5

[redacted]

LIBERTY	29657		81
		*	81

[redacted]

LYMAN	29365		1
		*	1
MANNING	29102		1
		*	1
MARIETTA	29661		2
		*	2
MARTIN	30557		10

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CITY/COUNTY DISTRIBUTION

OCONEE NUCLEAR

CITY NAME	ZIP CODE	NUMBER OF EMPLOYEES
	*	10
[redacted]		
MAYO	29368	1
	*	1
[redacted]		
MOORE	29369	1
	*	1
MOORESBORO	28114	1
	*	1
[redacted]		
MORGANTON	28655	1
	*	1
[redacted]		
MOUNTAIN REST	29664	10
	*	10

CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
[redacted]			
NEWRY	29665		1
		*	1
NEWTON	28658		2
		*	2
NINETY SIX	29666		1
		*	1
NORRIS	29667		4
		*	4
PELZER	29669		4
		*	4
PENDELTON	29670		1

ENDLETON	29670		31
		*	31
ICKENS	29671		91
		*	91
IEDMONT	29673		7
		*	7
ICHLAND	29675		1

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

ITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
		*	1
OBBINSVILLE	28771		1
		*	1
OCK HILL	29730		12
	29732		5
		*	17
OSMAN	28772		1
		*	1
OYSTON	30662		2

		*	2
SALEM	29676		72
		*	72
SENECA	29678		519
	29679		41
		*	560
SHERRIELS FRD	28673		1
		*	1
SIMPSONVILLE	29681		2
		*	2
SIX MILE	29682		96
		*	96
SIX MILES	29682		1
		*	1
SPARTANBURG	29301		4
	29303		2
	29305		1

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE	NUMBER OF EMPLOYEES

STANLEY	28164		9
		*	9
STAR	29684		1
		*	1
STARR	29684		3
		*	3
SUNSET	29685		7
		*	7
SYLVA	28779		1
		*	1
TAMASSE	29686		1
		*	1
TAMASSEE	29686		8
		*	8
TAYLORS	29687		7
		*	7
TOCCOA	30577		11
		*	11
TOWNVILLE	29670		1
	29689		18
		*	19
TRAVLERS REST	29690		5
		*	5
UNION	29379		3

CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S, OSRG, TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
		*	3
WALHALLA	29691		157
		*	157
WALLALLA	29691		1
		*	1
WARE SHOALS	29692		2
		*	2
WATERLOO	29384		1
		*	1
WAXHAW	28173		2
		*	2
WEST PELZER	29669		2
		*	2
WEST UNION	29686		1
	29696		67
		*	68
WESTMINISTER	29693		1
		*	1
WESTMINSTER	29630		1

	29693		134
	29696		1
		*	137
WILLIAMSTON	29697		14
		*	14
WOODRUFF	29388		1

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
		*	1
YORK	29745		4
		*	4
ZIRCONIA	28790		2
		*	2
			[redacted]
		Total	2055

UTILITY Duke Power Company

SITE McGuire, Catawba, Oconee

Answers to all Questions

ENCLOSURES
1) McGuire Nuclear Station 316(a) Demonstration
2) McGuire Nuclear Station 316(b) Predictive Study of Impingement + Entertainment
3) Catawba Nuclear Station 316(a) Demonstration Two Unit Operational Report
4) Catawba Nuclear Station 316(a) Demonstration Two Unit Operational Report - Appendices -
5) Oconee Nuclear Station Environmental Summary Report 1971-1976 Vol. 2
6) Oconee Nuclear Station Environmental Summary Report 1971-1976 Vol. 1
7) Lake Norman Summary Volume I
8) Lake Norman Summary Volume II

GLENN CADA (4-7320) TOOK THE AQUATIC QUESTIONS AND ALL THE REPORTS 7/25/90

Duke Power Company

Responses to Waste Management Questions

A. Spent fuel questions:

1. Which of the following current techniques for at-reactor storage are you using and how?

   A. Re-racking of spent fuel.
   ~~B. Control rod repositioning.~~
   C. Above ground dry storage.
   D. Longer fuel burnup.
   E. Other (please identify).

Response:

Oconee: A, C, and D. Each of Oconee's two spent fuel pools has been reracked twice; the current total capacity of the pools is 2129 assemblies. A dry above ground spent fuel storage facility which utilizes the NUHOMS 24P system has recently been completed, and loading of the first canister/module is expected for late July. Higher discharge fuel burnup has occurred over time as a result of economic trends and fuel technology improvements. Equilibrium fuel burnups were expected to be around 27,000 MWD/MTU when the Oconee units began operation in the early 1970's; currently, discharge burnups are expected to be about 45,000 MWD/MTU.

McGuire: A and D. As the result of a single reracking of each of McGuire's two pools, present total capacity is 2,779 assemblies. Discharge burnups were expected to be approximately 33,000 MWD/MTU in the years before plant startup; currently, discharge burnups are expected to be about 40,000 MWD/MTU.

Catawba: E. The initial capacity of the two Catawba spent fuel pools totals 2840 fuel assemblies, which provides adequate storage until about 2008.

2. Do you plan on continuing the use of these current techniques for at-reactor storage of spent fuel during the remaining time of your operating license or do you expect to change or modify them in some way?

Response:

General comment: Significantly higher burnups are not presently anticipated for any of Duke's stations.

Oconee: Oconee's ISFSI license allows addition of enough NUHOMS modules to provide storage until the expiration of the current operating license, 2013.

5. Do you anticipate the need to acquire <u>additional land</u> for the storage of spent-fuel for the operating lifetime of the plant, including a 20-year period of license renewal? If so, how much land? When would this acquisition occur? Where? (if answer is "yes", 3-4 sentences)

Response:

<u>Oconee</u>: No.

<u>McGuire</u>: No.

<u>Catawba</u>: No.

6. Do you anticipate any <u>additional construction activity on-site, or</u> immediately adjacent to the power plant site, associated with the continued at-reactor storage of spent fuel for the operating lifetime of the plant, including a 20-year period of license renewal? (yes/no)

Response:

<u>Oconee</u>: Yes.

<u>McGuire</u>: Yes, if above ground dry storage is chosen for storage expansion.

<u>Catawba</u>: Yes, if above ground dry storage is chosen for storage expansion.

7. If you answered yes to question 6, briefly describe this construction activity (e.g., expansion of fuel storage pool, building above ground dry storage facilities)

Response:

<u>Oconee</u>: Up to the end of current licensed life, activity will involve addition of horizontal storage modules. (Of course, periodic evaluations will be made to ensure that continued use of the existing dry storage system represents our best alternative.) Should additional dry storage be required, expansion of the existing facility or construction of another on-site facility would be considered.

<u>McGuire</u>: See response to question 6.

<u>Catawba</u>: See response to question 6.

continued at-reactor storage of spent fuel for the operating lifetime of the plant, including a [illegible]-year period of license renewal? (yes/no)

7. If you answered yes to question 6, briefly describe this construction activity (e.g., expansion of fuel storage pool, building above ground dry storage facilities)

B. **Low-level radioactive waste management questions:**

1. Under the current scheme for LLRW disposal (i.e. LLRW Policy Amendments Act of 1985 and regional compacts) is there currently or will sufficient capacity for wastes generated during the license renewal period be available to your plant(s)? If so, what is the basis for this conclusion? YES, IF PRESENT PLANS FOR SOUTH EAST COMPACT ARE FULFILLED.

2. If for any reason your plant(s) is/are denied access to a licensed disposal site for a short period of time, what plans do you have for continued LLRW disposal? SEE ATTACHMENT I.

NOTE: INFO IN ATTACHMENT I. WILL BE UPDATED DURING 1990-1991

3. In a couple of pages, please describe the specific methods of LLRW management currently utilized by your plant. What percentage of your current LLRW (by volume) is managed by:

SEE ATTACHMENT II.

A. Waste compaction?________________

B. Waste segregation (through special controls or segregation at radiation check point)?________________

C. Decontamination of wastes?________________

D. Sorting of waste prior to shipment?________________

E. Other (please identify)________________

D. To provide information on future low-level waste streams which may effect workforce levels, exposure, and waste compact planning, do you anticipate any major plant modifications or refurbishment that are likely to generate unusual volumes of low-level radioactive waste prior to, or during, the relicensing period for the plant? If so, please describe these activities. Also, what types of modifications do you anticipate to be necessary to achieve license renewal operation through a 20-year license renewal term?

SEE ATTACHMENT I.

C. **Mixed low-level radioactive waste question:**

1. If your plant generates mixed LLRW, how is it currently being stored and what plans do you have for managing this waste during the license renewal period?

SEE ATTACHMENT III.

ATTACHMENT II. Lo. Level Radwaste

POWER REACTOR VOLUME REDUCTION

BY

MARY L. BIRCH
RUSSELL M. PROPST
MICHAEL S. TERRELL
DAVID L. VAUGHT
NUCLEAR PRODUCTION DEPARTMENT
DUKE POWER COMPANY
CHARLOTTE, NC

FOR

PROFESSIONAL ENRICHMENT PROGRAM
HEALTH PHYSICS SOCIETY NATIONAL MEETING
ANAHEIM, CA
JUNE 24, 1990

There is a large selection of process methods available and the choices must reflect consideration of the following factors; waste stream characteristics, site specific environmental limitations, compatibility with interfacing systems, materials handling and storage requirements, transportation limitations, state and federal regulations, burial site requirements, permanent versus transportable systems, future requirements, personnel exposure, and economics. Generally, radwaste volume reduction technologies reduce volumes by removing the non-radioactive components of the waste stream; the volume reduction processes alter only the non-radiological material content while the total radioactivity present remains the same.

This paper discusses the waste types and generation rates, the waste processing typically used by PWRs and BWRs, volume reduction, and the economics of waste disposal. The waste streams which power reactors process are gases, liquids and solids.

The basic function of the radwaste systems are to:

1. Minimize the release of gaseous radwaste to the environs through delay and filtering.

2. Minimize the release of liquid radwaste to the environs by purifying or re'`aiming plant waste water; and

3. Minimize the impact .. shallow land disposal by producing a solid waste product which is in compliance with federal criteria.

GASES

During operation, nuclear power reactors generate radioactive fission products, a portion of which will be released to the coolant when there are cladding defects. Because gases are not completely soluble within the coolant, they are available for release from process systems and ventilation pathways. Process system effluents contain radioactive materials as a result of stripping or venting gases from process streams. Ventilation pathways contain radioactive materials as a result of radioactive process fluid leakage into buildings and their ventilation systems. The sources of gaseous effluents in PWRs and BWRs are different and are listed below:

BWR

1) main condenser evacuation system
2) turbine gland seal system
3) mechanical vacuum pump exhaust

beds must be replaced when they are no longer effective for removing radioactive material from the liquid. The filters and ion exchange beds are solid by-products and, therefore, become part of the solid waste streams discussed below.

Filtration is defined as the separation of suspended, undissolved, particulate solids from a fluid mixture by passage of most of the fluid through a septum or membrane that retains the solids on or within itself. A filter's performance is measured by its ability to remove and hold solid stream contaminants, by the amounts of solid, liquid, and gaseous wastes it generates; by its ease of operation; by its maintenance requirements; and by the radiation exposures it causes during operation and maintenance. Filters used in nuclear power plants are changed most often on the basis of pressure drop across the filter, or because the radioactive dose rate of the filter reaches a predetermined upper limit. The degree of filtration required; chemical compatibility of the filter medium with the slurry being processed; the weight, volume, and particle-size distribution of the solids to be removed; and the suspended solids concentration, volume flow rate, temperature, and pressure of the stream to be processed are among the factors that should be considered in the selection of a filter. In LWR nuclear power plants, the liquid streams have various amounts of dissolved plus suspended solids and varying amounts of radioactivity associated with them, depending upon their source within the plant. Corrosion products in the coolant stream become activated in the internals of the reactor core; relatively significant fractions (about one-fourth) of the activated corrosion products tend to be present as suspended solids; fission products to be present dominantly as soluble forms.

Traditionally, BWRs have, for the most part, used pressure-pre-coat filters, while PWRs have largely used disposable-cartridge filters. However, newer types such as nonpre-coat, back-flushable filters are seeing greater application in both types of plants. Disposable cartridge filters contain from one to several replaceable elements that are discarded when they become contaminated or loaded to the extent that either the radioactive dose rate or the differential pressure across the filter reaches a preset value. In nuclear power plant applications, multiple elements are often mounted in a single removable supporting structure and, to minimize radiation exposure, the entire assembly is discarded at changeout. Disposable elements used in nuclear power plants typically have filter media of woven fabric, wound fiber (string), or pleated paper, supported on a rigid inner core of perforated stainless steel. Cotton, nylon, and epoxy-impregnated paper are among the materials commonly used in fabrication of disposable cartridges for nuclear power plants. Disposable cartridge filters perform well in removing suspended solids from the process streams of nuclear power plants. Difficulty of remote changeout is probably impurities must be solidified by mixing with cement or by mixing with a liquid plastic and, therefore, become part of the solid waste streams discussed below. It is a unit operation that has wide application in the nuclear industry for reducing waste volumes and the amount of radioactive nuclides in liquid effluents. Evaporation can be used on solutions or slurries having vastly different compositions and concentrations; however, it is most effectively used on liquid radioactive wastes having high concentrations of impurities. An evaporator is a device designed to transfer heat to a liquid that boils and to separate the vapor thus formed from the liquid. A radioactive waste evaporator system consists basically of the following building blocks: a heating element; a flash chamber; one or more deentrainment devices to separate or disengage liquid droplets from the vapor; a condenser to cool and convert the vapor back to liquid; and pumps as required to feed the system, to circulate the contents where forced circulation is employed, and to discharge the concentrated liquid (bottoms).

Liquid radioactive wastes in a BWR plant are normally segregated into four types as follows: 1) High-purity waste is a liquid of low electrical conductivity but has the potential of containing some particulate solids and dissolved oils. Major sources of high-purity waste are equipment drains from the dry well and the reactor, turbine, and radioactive waste buildings; ultrasonic resin cleaner wash; resin backwash and transfer water; filter backwash; phase separator decant liquid; and condensed radioactive evaporator overheads. 2) Low-purity waste is liquid of moderate to high conductivity and has the potential for high suspended and/or dissolved solids content. Sources of low-purity waste include floor drains from the dry well and reactor, turbine, and radioactive waste buildings; uncollected valve and pump seal leakoffs; and water resulting from dewatering of slurry wastes. 3) Chemical waste is liquid of a high conductivity and high suspended and dissolved solids content. The primary source of this waste is the regenerant solution from deep-bed ion exchange columns. 4) Detergent waste is liquid with a high suspended solids and organic chemicals content. Major sources of detergent waste are on-site laundry, personnel shower, and detergent-type decontamination wastes as well as laboratory wash water.

Liquid radioactive wastes in a PWR plant may be segregated into four types as follows: 1) Miscellaneous waste is composed of liquid having various qualities from a variety of sources which may not be readily amenable to processing and reuse as reactor coolant make-up water. The main sources of miscellaneous waste are floor drains; outdoor controlled-areas wastes; sampling station radioactive wastes; aerated systems and equipment drains; and primary system ion-exchange and filter wastes. 2) Secondary system waste is liquid of low electrical conductivity from the secondary system. Primary sources of such waste are mostly steam generator blow-down and turbine building drains. 3) Chemical

Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container (also called a High Integrity Container or HIC) or structure that provides stability after disposal.

A Process Control Program (PCP) is a systematic procedure for providing reasonable assurance that the solidified product will have no detectable free liquid. It consists of two parts. The first part is a set of bounding values for system and waste parameters within which satisfactory solidification can be expected to occur with a high degree of confidence. The second part of the PCP is a systematic procedure using appropriate controls and instrumentation, properly documented, to demonstrate that the solidification system has operated within the specified boundaries.

The complexity of radwaste treatment systems is increased when each waste stream requires different processing. Typical radwaste treatment systems are shown in Figures 2, 3, and 4 for PWRs and BWRs with two different reactor cleanup systems.

Some of the waste processing techniques previously discussed are also volume reduction techniques. Duke Power Company has chosen volume reduction techniques based on our studies of each waste source. Several volume reduction techniques are applied to each waste stream.

The Volume Reduction (VR) techniques used for each waste type are listed in the Table. The techniques can be summarized as follows:

A) Source Control is exerted by a carefully designed system of administrative controls, administrative procedures and practices, and operating procedures to limit the waste being generated. The program is extensive and complex, since it requires awareness and procedure adherence by up to 2500 people working on a given reactor site. The system of controls is outlined in two papers presented by Duke Power personnel at the Waste Management '85 Meeting held in Tucson, Arizona; the papers describe "Liquid Waste Minimization Efforts" and "Solid Waste Minimization Efforts" at Duke Power Company. The papers are attached. Each station and contractor employee must be aware of his responsibility for minimizing the generation of waste. The program includes employee training programs, supervisor accountability, waste source control at each generating point or location, waste segregation, manual sorting, leak detection surveillance, leak isolation and repair, and routing of each waste to the proper waste system collection vessel.

   One example of source volume control is in the issuance of warehouse supplies. Packing materials such as crates or

D) Large compactors are used for compressing paper, plastic, and similar materials into metal boxes for shipment and disposal. This process follows the sorting and segregation processes in the source control process described above. DAW volume reduction of 50 percent at Oconee produced the disposal volumes for this waste type as listed in the Table. Labor costs were reduced by a factor of five by eliminating the time-consuming use of 55-gallon drums. Further volume reduction can be achieved by supercompaction. It is not cost effective to install this equipment at each reactor site so a service facility is used to provide supercompaction. In 1988, this facility accepted approximately 300,000 ft^3 of waste for supercompaction and shipped 150,000 ft^3 after processing.

E) Combustible wastes are generally large volumes with low bulk densities, and with relatively low specific activities. They are chemically neither inert nor stable, and are susceptible to organic decomposition, oxidation, and degradation by the effect of elements. These combustible wastes can be processed by incineration.

Incineration converts combustible wastes into radioactive ashes and residues that are nonflammable, chemically inert, and much more homogeneous than the intital waste. Since ashes are dispersable in the air, immobilization or encapsulation is normally required for their safe transportation and disposal.

The principal objectives in the design of an incineration system for processing of radioactive wastes are: complete combustion of the waste; appropriate off-gas cleaning; and radiological protection. The radioactive waste incinerator must be radiologically safe and positively contain radioactivity within the incineration system.

An incineration system for processing of radioactive wastes consists basically of: waste feed preparation and loading facilities; a combustion chamber(s); an off-gas treatment system including induced draft fan(s) and a stack; ash unloading equipment; and necessary instrumentation and controls. Ash transfer and/or immobilization equipment normally interfaces with the ash unloading equipment.

F) Evaporators are used to process pure reactor liquids such that both the concentrate and water can be reused in the reactor systems. Tritium and boric acid discharges from the station are reduced as a result of such reuse.

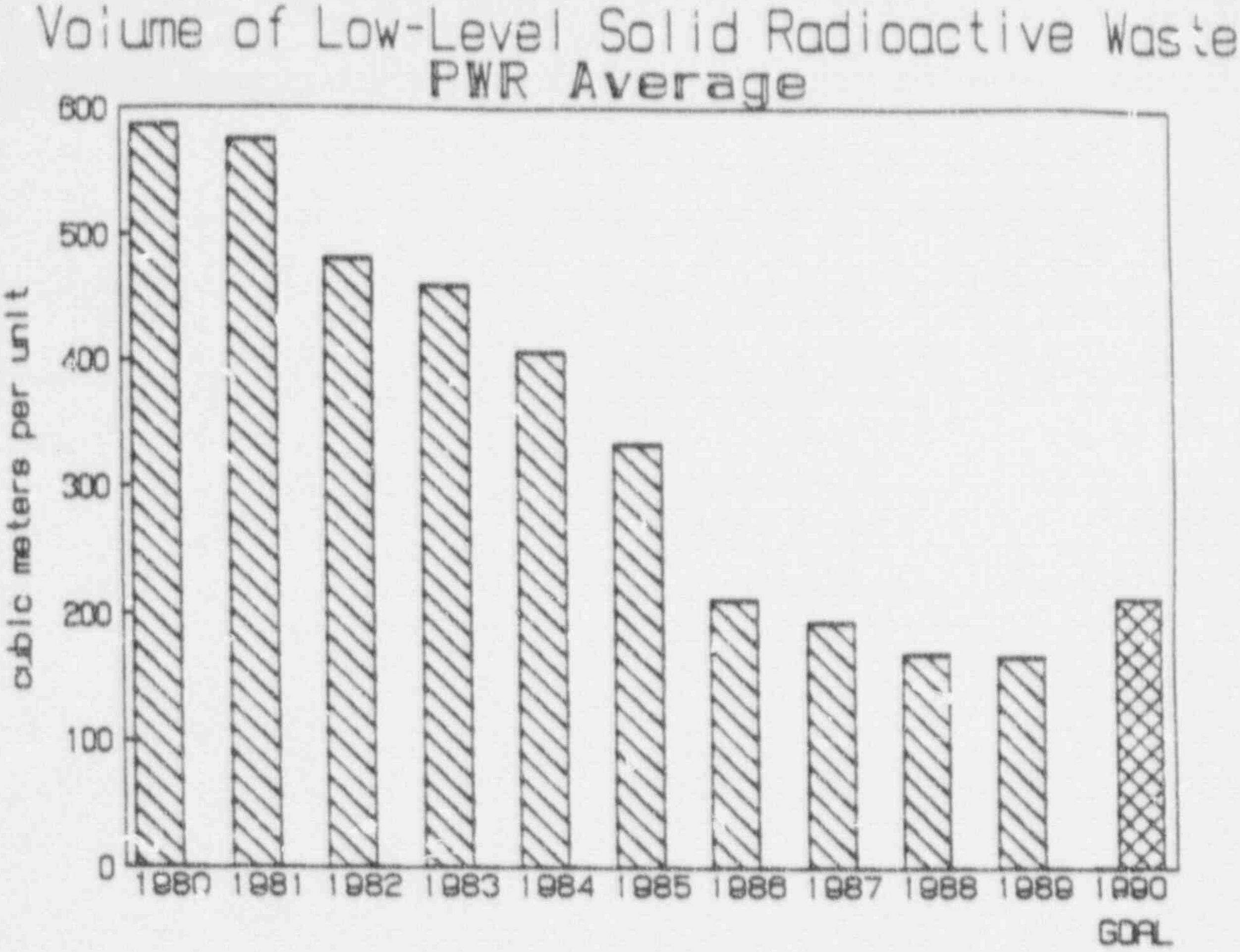
G) Equipment and floor drainage liquids are processed for radioactivity removal and released from the station using filtration and ion exchange resin. This technology has such as contaminated trash, settling basin solids, fuel racks, and insulation. The establishment of BRC levels for these type materials will eliminate approximately 20 percent of the waste we are currently disposing of with no additional risk to public health and safety.

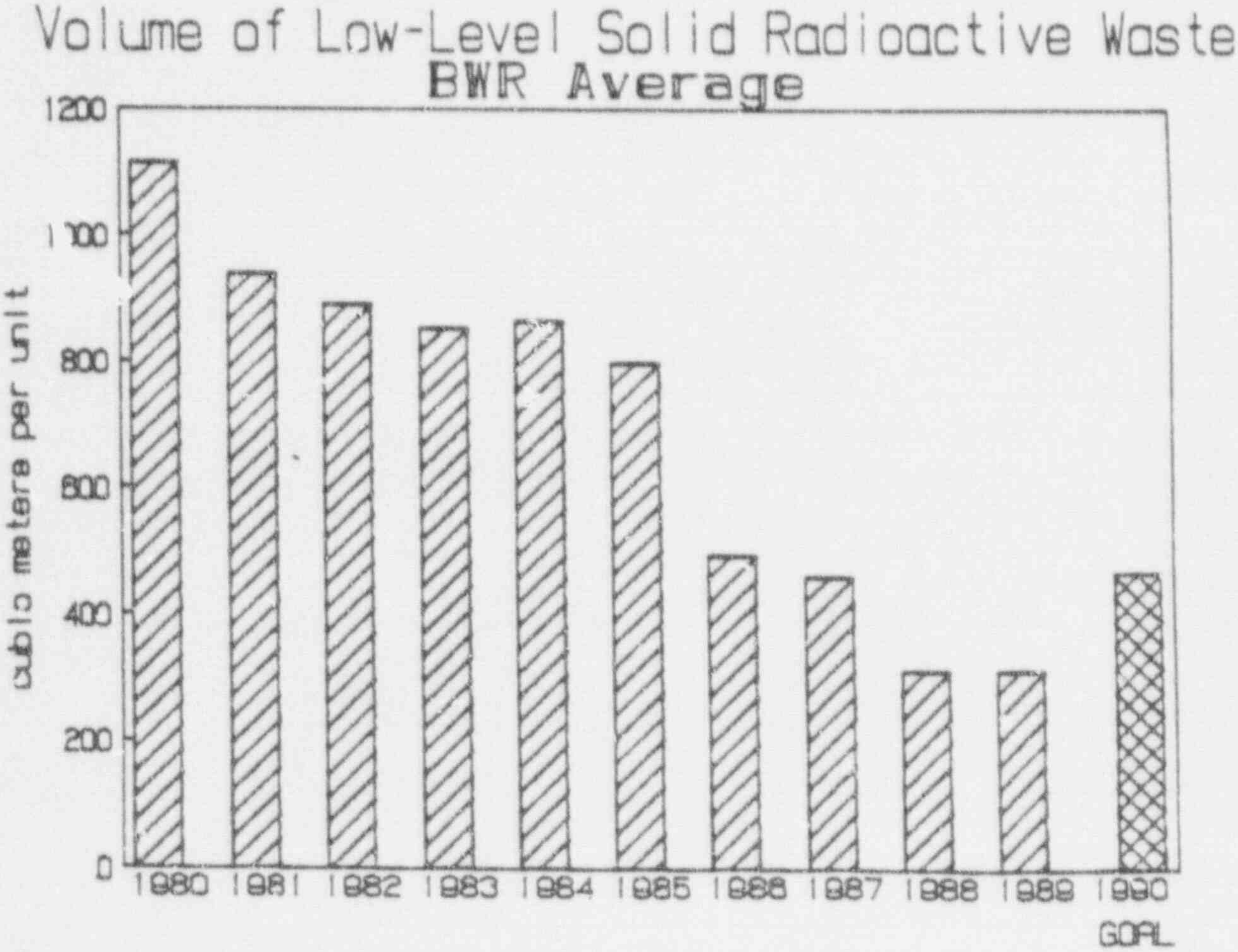
The other phase of our plan will use vendor supplied process equipment to reduce radwaste volumes. Offsite vendor decontamination facilities are used for large items or unusual waste volumes generated by modifications to existing equipment. Offsite super compaction and incineration facilities reduce the volume of waste to be buried while concentrating the radioactivity. Vendor supplied incineration and decontamination facilities can be used most cost effectively as regional facilities where wastes from many generators are processed.

Since 1982, radwaste volumes have been drastically reduced by the use of ion exchange resin for liquid waste processing, improved tool and equipment decontamination technology and improved compaction.

An increase of dedicated personnel assigned to radwaste management functions, and more effective administrative controls which make each worker responsible for the waste that he generates. The volumes of waste generated as a result of these efforts decreased from the 36,046 cubic feet per year per unit to 5,194 cubic feet per year per unit at Oconee. To date, Duke Power has invested $820 million in radwaste processing facilities at three sites for seven reactors. Operating and maintenance costs, including the cost of disposal, are $11.4 million per year. Disposal costs are about 30% of the O&M costs. A point of diminishing returns will soon be reached whereby further expenditures to reduce the volume of waste generated will no longer be economical.

Duke Power and other utilities are already reducing the volume of station wastes 96-98%. This reduction is the result of a three to four-fold reduction of waste sources combined with an overall process volume reduction of 30-40. Further volume reduction, will raise the cost of electricity to our customers.


Volume of Low-Level Solid Radioactive Waste
PWR Average
cubic meters per unit
0
100
200
300
400
500
600
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
GOAL


Volume of Low-Level Solid Radioactive Waste
BWR Average
cubic meters per unit
0
200
400
600
800
1000
1200
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
GOAL

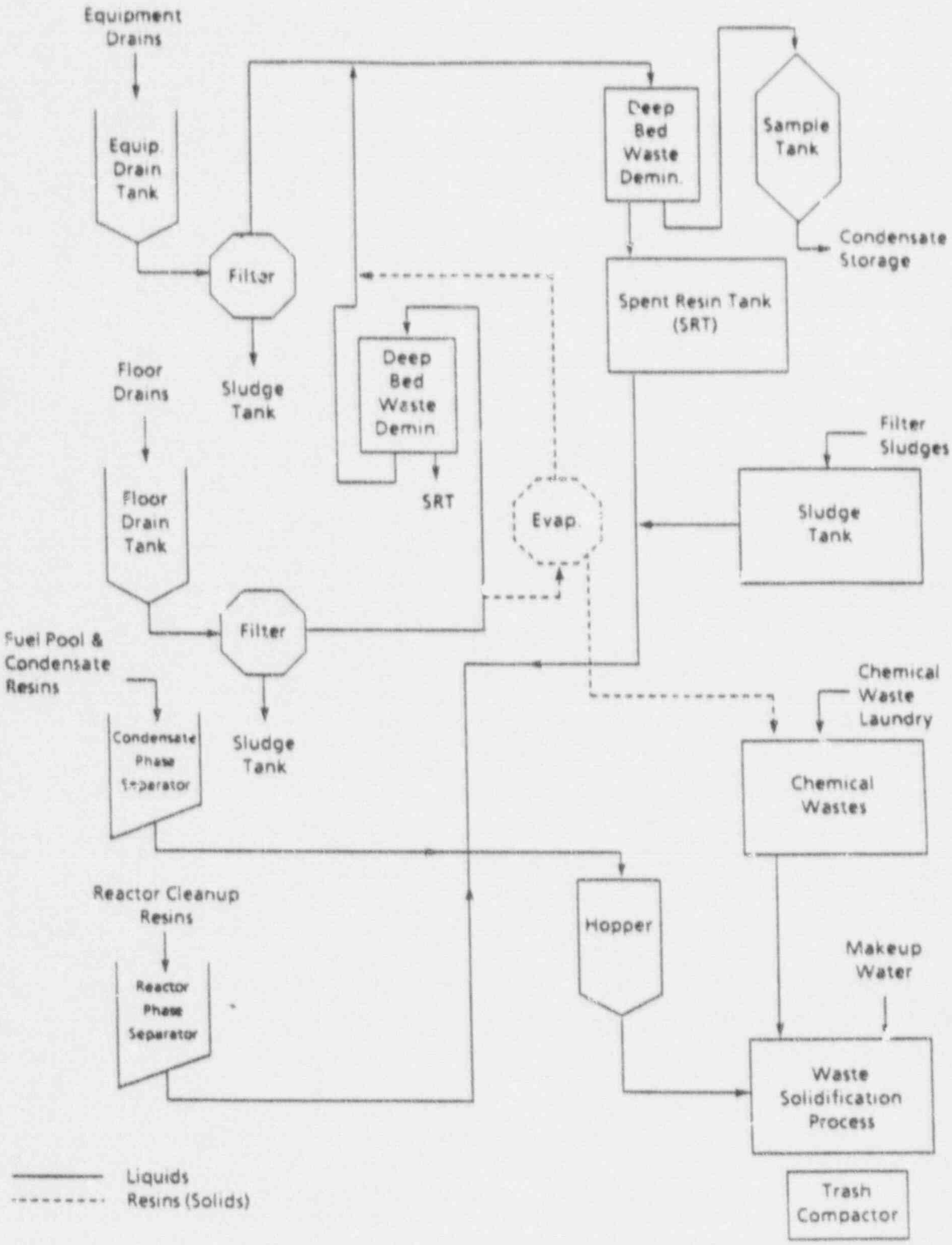


Figure 3 Simplified BWR Radwaste System: Powdered Resin and Reactor Cleanup Systems

"GENERIC" BWR
VOLUME REDUCTION PER UNIT

TYPE	CUBIC FEET PROCESSED	CUBIC FEET DISPOSAL	EXAMPLES	VR TECHNIQUES USED	APPLICABLE VR IMPROVEMENT TECHNIQUES
Reactor Coolant	74,000	200	Reactor Drainage Reactor Coolant Pump Seal Leakage Refueling Water Drainage Purification	Ion Exchange Purification Filtration Recycle (Direct)	Evaporation Recycle
Secondary Coolant	630,000	150	Sampling Systems Condensate Demineralizer Rinse & Transfer Solutions Demineralizer Backwash	Source Chemistry Control Ion Exchange Purification Filtration Incineration	None Exist
Equipment and Floor Drainage	380,000	650	Pump, Valve, Tank Drainage Cleaning water Laundry water	Source Chemistry Control Ion Exchange Purification Filtration	None Exist
Oils and Solvents	25,000	8	Reactor Pump Oil Drainage Hydraulic Oils Lab Analysis Solvents	Source Control Solidification Incineration	None Exist
Trace Activity Materials	5,000	50	Steam System Purification Resins Sanitary Waste Solids Settling Basin Solids	Analysis Data Evaluation BRC Application Incineration	None Exist
Normal Process	See "Reactor Coolant" "Equipment and Floor Drainage" "Secondary" Coolant"		Reactor Coolant Purification Resins Equipment Drain Process Resins Filter Cartridges	VR is Complete (High Radiation)	None Exist
Hardware	12,000	300	Tools, Buckets Valves, Pumps, Piping Insulation, Fuel Racks	Source Control Decontamination Reuse BRC Disposal Supercompaction	None Exist
Paper, Cloth, Plastic	30,000	3,150	Protective Clothing Tents & Laydown Sheets Cardboard, Wipe Cloths, Office Waste	Source Control Properties Control (PVC) Source Sorting Laundering and Dry Cleaning Compaction Incineration OR Supercompaction	None Exist
Wood, Plastic Piping	1,000	8	Ladders and Scaffolds Crates Special Piping Systems	Source Control Substitution by Metal Decontamination Reuse Incineration OR Supercompaction	None Exist

Total 1,157,000 : 4,566
VR 250 : 1

LIQUID RADWASTE MINIMIZATION EFFORTS

AT DUKE POWER COMPAN

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ABSTRACT

Most liquid radwaste processing systems are designed for "average" waste processing rates. Unfortunately, waste is not generated at this average rate but at varied rates which can overload the capacity of the systems. When the waste systems are overloaded, the operation of the entire power plant can be adversely affected. Duke Power has established a liquid radwaste minimization program designed to decrease loads on nonrecyclable waste stream process systems and to provide sufficient process capacity to handle the peak input rates in each waste stream. Elements of the program include: waste source segregation, reclamation, elimination, chemical control, leak detection, and the volume reduction of process system byproducts. Examples are given for each of these program elements. A variety of techniques are used in reducing or eliminating high-solids, high-radioactivity, and high-volume sources of waste which can overload waste systems and/or produce high volumes of byproducts for disposal. The examples illustrate that a combination of operating, engineering, and administrative tools are used to achieve the minimization program objectives.

INTRODUCTION

Duke Power operates seven nuclear reactors. They are located at Oconee, McGuire, and Catawba Nuclear Stations. All are Pressurized Water Reactors (PWR's). During the first years of operation at Oconee, the loads on the liquid waste systems were found to be higher than anticipated. Reactor trips, Steam Generator tube repair outages, and simultaneous unit outages produced waste volumes at high generation rates. These peak rates exceeded liquid waste system capacity and resulted in:

a. waste backlogs;
b. inability to receive additional waste;
c. outage delays in draining components for maintenance;
d. reactor start-up delays in allowing reactor coolant feed and bleed.

The costs in lost generating capacity, unit availability, and diversion of plant personnel to unusual plant operating conditions demonstrated first-hand the importance of waste sources control and waste system efficiency.

As a result of this experience, and with the knowledge that McGuire and Catawba might experience similar operating difficulties, a program was established to achieve better waste control. The program is based on the evaluation of waste volumes and properties as a function of plant design, operating events, and station maintenance activities. The characteristics of each waste source are evaluated against the capabilities of radwaste process components. The program recognizes that waste sources can have complex physical, radiological, and chemical properties and that this complexity is frequently compounded when waste streams become mixed and then are introduced into process equipment.

The central program philosophy is:

> Minimize the input of radioactivity and dissolved solids to nonrecyclable (waste) systems. Segregate and control waste streams as close to the source as practical. Provide sufficient process capacity to handle peak loads from each segregated waste stream.

Specific program objectives are based on waste source characteristics and on the design limitations of process equipment. The objectives apply to both station design and operation. They include:

1. Segregation of Sources
2. Reclamation of Reactor Coolant
3. Chemical Control of Sources
4. Volume Reduction of Byproducts
5. Elimination of Sources
6. Leak Detection

A variety of methods are used in attempting to meet these objectives. Applications of these methods are shown in the examples described below. One example is presented for each of the six objectives. These examples -- and station operating experience -- illustrate that equipment modification is only one of several important program elements. Equally important are: 1) improved operating practices, 2) station administrative controls, and 3) ongoing waste program evaluation.

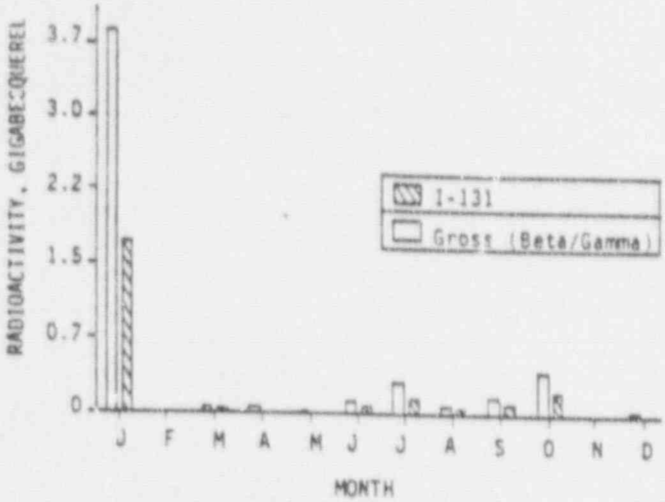

Fig. 3. Radioactivity in Ventilation Condensate

Condensate volumes during January and February (Fig. 2) illustrate the usefulness of the system in dealing with plant upsets. In late December, 1983, steam generator feedwater valve external leakage developed. Auxiliary Building condensate production is normally very low during the months of November through March, such that the volumes in January and February show the feedwater steam leak in the Reactor building. Had no other events occurred, the entire volume would have been discharged without processing.

In mid January, however, a small reactor coolant steam leak developed. The radioactive concentration gradually rose to the point that condensate could not be released because the feedwater steam was contaminated by the reactor coolant leak. Fig. 2 shows the volumes which required processing until the unit was shut down for refueling and repairs.

Based on these experiences, the Ventilation Unit Condensate System has been judged a valuable asset and is scheduled for modification to further improve its usefulness. Fig. 1 shows, in dotted lines, the addition of features to allow diversion of either Auxiliary or Reactor Building condensate drains to the process system prior to entry into the Condensate Drain Tank. The modification will reduce cross-contamination of sources to the tank during unusual operating conditions.

REACTOR COOLANT RECLAMATION

Reactor coolant grade liquids are high-volume liquid sources. Included are bleed liquid from chemical shim (boron concentration) changes in the reactor coolant system and drainage from the spent fuel pool and reactor coolant systems. Reactor trip recovery, reactor power change, reactor shutdown, and fuel pool maintenance drainage represent peak load challenges to liquid process systems. Annual volumes generated by McGuire are as follows:

Year	Gallons	Cubic Meters
1982	2.2 Million	8,300
1983	3.3 Million	12,500
1984	4.2 Million	15,900

These totals do not reflect peak loads. On one occasion, 750,000 gallons (2,800 cubic meters) was processed in one month.

Without recycle (reclamation) system capacity to reclaim the peak volumes of coolant-grade liquids, the only recourse is to divert these liquids to the nonrecyclable Waste System. The peak load demand on the recycle system is then superimposed on the peak load design base of the waste system. As illustrated in the introduction, operating experience has demonstrated that such concurrent peak loads do occur -- especially at multi-unit sites with shared liquid waste systems.

To address this problem, recycle systems have been upgraded. Westinghouse evaporators were submitted to test programs. The goal was to achieve 15 gpm (3.4 cubic meters per hour), 150,000 gallon (570 cubic meters) per week process capacity, and availability greater than 90%. Deficiencies in the vent system, gas stripper, distillate and concentrate loops were found and corrected. Process monitors and automatic controls have been added to convert each evaporator from manual batch processing to automatic continuous operation. Other recycle system modifications allow continuous use of recycle demineralizers prior to evaporator feed. Radioactive cobalt and cesium concentrations are reduced to 100 times lower than reactor coolant concentrations so as to maintain average evaporator and boric acid tank contact dose below 0.2 Rad/hr (2 mGy/hr). The waste evaporator has been converted to recycle service as a peak load and backup component. This minimizes the probability of coolant liquid diversion to the waste system.

Process rates for a peak week at McGuire show the system capability as modified. Both evaporators were used during this peak week:

- Feed Volume - 282,000 gallons (1070 cubic meters)
- Process Rate - 28 gpm (6.4 cubic meters per hour)
- Concentrates Reclaimed - 23,000 gallons (87 cubic meters)
- Distillate boron - 5 ppm (Kg B per million Kg Solution)
- Distillate Gross Gamma - Less than limit of detection

High evaporator distillate quality has been achieved without using the system's polishing ion exchange components. Recycle system peak loads have not required diversion to the waste systems at McGuire and Catawba. Duke has recently provided its modification package to a neighboring utility.

Components located in shielded areas accessible only by one - to - three ton hatch plugs are one example. Components in rooms which are kept locked due to high radiation fields are another example. Determining the location of an external leak requires accessing these areas one at a time until the source is found. The effort is dose-intensive, labor-intensive, and time-consuming.

In an effort to provide faster response to acute leakage events, a leak detector was developed. The detectors are press-fitted into floor drains and connected to alarm panel cables by plug connectors. The detectors use a float and microswitch actuator to provide alarm when input to an individual floor drain reaches rates greater than 0.1 gallons per minute (0.02 cubic meters per hour).

Detector assemblies are disposable and can be changed out in 15 seconds. The detector does not interfere with flow into the floor drain. Available flow area into the floor drain exceeds the area of the grating replaced by the detector.

Detector location is identified on each local alarm panel. The central alarm panel directs the operator to the appropriate local panel. Operating experience has demonstrated the ability to identify exact location of Auxiliary Building leaks within 5 minutes. Detector inspection and replacement are scheduled as other maintenance needs require entry to each room. The system is in operation at McGuire and is scheduled for installation at Catawba.

SUMMARY

Duke Power has established programs to reduce inputs to waste systems which produce plant effluents and which produce the highest volumes of byproducts requiring disposal. Program objectives and examples of each include:

1. Source Segregation of Ventilation Condensate.
2. Reactor Coolant Recycle by Evaporator and Recycle System Upgrade.
3. Source Chemical Control by Chemical Approval and Evaporator Feed Treatment.
4. Source elimination of Decontamination Chemicals by Equipment Upgrade.
5. Process Byproduct Volume/Cost Reduction by Waste System Filter Upgrade.
6. Source Leak Detection by Development and Installation of Floor Drain Detectors.

The application of administrative controls, refined operating practices, and equipment modifications has yielded progress toward the segregation and process capacity for station waste streams. Each program objective has contributed to reduce liquid waste byproducts, cost, and inventory backlog.

TABLE I

FILTER PERFORMANCE DATA

	ORIGINAL	UPGRADE
Operating Mode:	Single Cartridge	2 Parallel
Service Life:	2000 gal (7.6 M^3)	60,000 Gallons (230 M^3)
Filter Area:	1.2 ft.^{2} (0.1 M^2)	16 x 2 ft^2 (3.0 M^2)
Flux:	17 gpm/ft.^{2} (17 Kg/s M^2)	0.6gpm/ft.^{2} (0.4 Kg/s M^2)
Exhausted Contact Dose:	5 R/hr (50 mGy/hr) Design Base	0.4 Actual R/hr (4 mGy/hr)

SOLID WASTE MINIMIZATION

AT DUKE POWER COMPANY

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ABSTRACT

As more nuclear stations come on line, Duke is faced with the fact of increasing solid waste volumes and increasing burial site rates. In an attempt to reduce these volumes, studies were conducted to quantify and qualify "solid waste". As each component waste type was identified, a volume reduction scheme was developed to address specific waste forms. The schemes used include administrative controls, equipment purchase and building modification, and requests for regulatory exemptions.

INTRODUCTION

"Solid" radioactive waste can generally be broken down into three categories - 1) waste products from liquid processing (eg., filters, demineralizers, solidified evaporator concentrates), 2) miscellaneous waste (eg., DAW, contaminated tools and components), or 3) unusual sources. This paper details Duke Power's attempts to minimize the volume of miscellaneous waste and unusual source waste to be buried at low level disposal sites.

BACKGROUND

Duke Power Company experience at Oconee and McGuire has shown that low level waste volumes increase rapidly in early plant life. The rate of increase levels off after about five to eight years. For example, the McGuire miscellaneous waste volume has increased an average of 175% per year for its first four years. (Fig. 1)

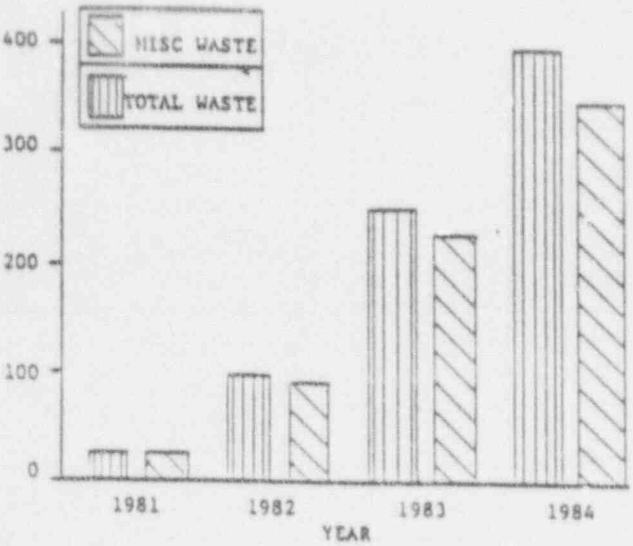

Fig. 1 MNS Waste Volumes

After six years of operation, Oconee's rate of increase had slowed down to about 25% per year. Annual miscellaneous waste volumes had increased to 2000 cubic meters (71,000 cubic feet) in 1982. (Fig. 2).

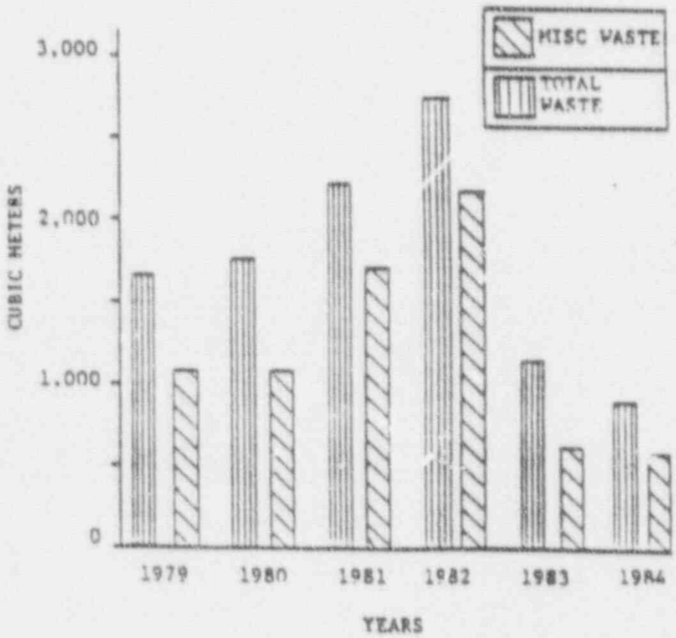

Fig. 2 ONS Waste Volumes

With this number and 7 nuclear units, Duke was facing a possible 4667 cubic meters (165,000 cubic feet) or 667 cubic meters (23,500 cubic feet) per unit <u>annual</u> burial volume.

This volume was viewed with concern for several reasons. The first was a history of burial site cost inflation averaging 40% per year. (Fig. 3) Another was the location of McGuire Nuclear Station outside the state of South Carolina with no guaranteed burial code all trash barrels within the RCA. Red and yellow barrels are for contaminated or potentially contaminated DAW. Blue and white barrels are for clean trash. The "clean" trash is monitored prior to leaving the Auxiliary Building to insure it is non-contaminated. The acceptable radiation limits are background readings. This trash is again monitored prior to leaving the site as sanitary waste. Levels must not exceed 0.5 micro Sievert/hr (.05 mrem/hr). This practice is estimated to save Duke approximately 1416 cubic meters (50,000 cubic feet) of burial space per year.

This program is not a "sorting" program as conveniently defined. Duke Power does not check "potentially" contaminated material (ie., red and yellow barrels) and remove any clean trash. Duke chooses not to sort contaminated DAW for two reasons. The first is the regulatory uncertainty as to what is or is not "radioactive." Since Duke has not applied for a "de minimis" ruling on this waste form no such cutoff level can be set. The other reason is economic - in order to be cost effective at least 10% of the "contaminated" material must be found to be "clean". Due to the success of its administrative controls, Duke does not believe this number is achievable under current conditions.

Another aspect of administrative controls is to make individuals responsible for certain types of material taken into the RCA. For example, all tools are signed out by a specific individual. This individual is held accountable for that tool. This method insures tools are returned after use and not thrown into the trash. Respirators are handled the same way. These controls make trash sorting to recover reuseable items unnecessary.

TOOL DECON

Another major contributor to the solid waste burial volume is "non-compacted" material. This group includes tools, equipment, metal, wood, cable, etc. These materials contribute about 1,260 cubic meters (44,500 cubic feet) per year to radwaste volumes.

In 1981-1982, the dates for the original study, the only decontamination methods available were hand wiping or water baths. Water baths used small ultrasonics or larger turbulators. Due to liquid radwaste system design, no cleaning chemicals could be used with the water baths. This type of decon proved to be ineffective on all fixed contamination and on high levels of loose contamination. Any tools or equipment that could not be placed in water (eg., electronics) or were too large for the tanks could not be deconned.

Review of published reports, especially some EPRI work, and industry experience lead Duke to conclude that with properly selected decon equipment this volume could at least be cut in half. By assuming a required three year payback, each station could spend approximately $270,000 on new decontamination equipment and any required modifications.

The first step in the decon upgrade was to identify which decontamination options were available to Duke. The possibilities included:

1. Upgrade the liquid waste system such that aggressive decon chemicals could be used in the existing tanks.
2. Switch to alternate technologies which could include electropolishing, sand blasting, liquid abrasive blasting, freon high pressure spray, or freon ultrasonic.

The upgrade of the liquid system was eliminated since that would cost more than the $270,000 available.

At this point Duke decided to undertake a two part study. The first objective was to qualify and quantify exactly what "non-compacted waste" was at Duke's stations. The second study objective was to actually field test each possible decon technology to get some realistic numbers of their effectiveness, problems, manpower requirements, etc. This study was set up to bring different vendors into the station to provide decontamination services during outages. Vendors were selected such that each identified technology was actually tried at a Duke station. This study was continued for four outages at Oconee and McGuire.

In order to evaluate each technology a log was developed to record decon data. Information available included:

1. Decon process (ie., electropolisher, freon ultrasonic, etc.)
2. Material type (ie., metal, tool, cable, etc.)
3. Decon time
4. Initial contamination/radiation level
5. Residual contamination/radiation level

This study revealed the following about the types of material that needed to be deconned:

1. 90% covered with oils or grease
2. 75% painted
3. 60% metal
4. 23% electrical or pneumatic
5. 12% miscellaneous material (hoses, slings, extension cords, etc.)

The average radiation levels on this material ranged from .5 to 90 micro Sieverts/hr (.05 to 9 mrem/hr) and the average contamination level ranged from 2,000 to 10,000 dpm/100 square centimeters.

This data was invaluable in developing equipment selection criteria. The first requirement was for a method to remove oils - only hand wiping or freon technologies could accomplish this. The second requirement was for a method to decontaminate electrical equipment - only freon technologies could accomplish this. A third requirement was that any new equipment had to be simple and

ATTACHMENT III. Low Level Radwaste

MIXED WASTE CHARACTERIZATION AND PROCESSING

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ABSTRACT

Waste that is both radioactive and hazardous is regulated by both the NRC and the EPA. Since there are few treatment, storage, or disposal facilities licensed by both these agencies, mixed waste generated at Duke Power Company facilities is stored at the generation site. Processing methods for eliminating this inventory of stored mixed waste are being developed using the limited options available to facilities not possessing a hazardous waste treatment permit. In order to ensure that the above storage and processing is in compliance with EPA requirements, periodic characterization of these mixed wastes is necessary. This paper describes Duke Power Company's mixed waste characterization and processing programs and outlines the results achieved to date.

INTRODUCTION

Mixed waste is low-level radioactive waste (LLW), as defined in the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA), that also contains constituents that are either a listed hazardous waste or exhibit hazardous characteristics as described in Environmental Protection Agency (EPA) regulation 40CFR Part 261. Prior to 1985, mixed waste was generally disposed of just like LLW with the Nuclear Regulatory Commission having regulatory authority. However, during formulation of the LLRWPAA, questions arose as to which agency, the EPA or the NRC, should have regulatory authority over mixed waste. Congress directed these two agencies to administratively resolve the problem. As a result, the NRC and the EPA issued a joint guidance document that stated the NRC had jurisdiction over the radionuclide portion of the mixed waste while the EPA had authority over the hazardous constituents. With the issuance of the NRC-EPA joint guidance document, a mixed waste treatment, storage, and disposal facility (TSDF) was required to conform to both NRC and EPA regulations. EPA regulations require that a mixed waste TSDF obtain an EPA permit and that they characterize their mixed waste to ensure that it can be treated, stored, or disposed of in compliance with the storage permit and EPA regulations. Due to the projected high costs associated with TSDF permits, Duke Power Company has implemented mixed waste characterization and processing programs whose goal is to eliminate any need to maintain these permits by eliminating mixed waste inventories.

A Waste Analysis Plan (WAP) was then developed which outlined the procedures necessary to ensure that each known or potential mixed waste was characterized as per the requirements of 40CFR Part 265. This WAP provides the following information for each of these waste streams:

* the parameters for which the waste will be analyzed
* the rationale for the selection of these parameters
* the sampling methods which will be used to ensure a representative sample of the waste is collected
* the test methods which will be used to analyze for the selected parameters
* the frequency with which the analysis of the waste will be repeated
* the test acceptance criteria

After development of the WAP, the known or potential mixed wastes were characterized. The initial characterization results for these known or potential mixed waste streams are shown in Table I and II respectively. Table III lists the LLW which is not and should never become mixed waste.

Table I

Initial characterization results for LLW known to be mixed waste because they contain or have contacted a listed hazardous solvent

Waste Stream	Parameter (See Note 1)	Result
dry cleaner filters, paper portion	freon	200 - 2200 ppm
	ignitability	non-ignitable
	toxicity	toxic, up to 2.0 ppm Cd and 16.0 ppm Pb
dry cleaner filters, carbon portion	freon	120 - 350,000 ppm
	ignitability	non-ignitable
	toxicity	non-toxic

Table II

Initial characterization results for LLW which could be mixed waste because they have the potential for exhibiting hazardous characteristics

Waste Stream	Potential Characteristics	Result
paint solids	ignitability	non-ignitable
chromate analysis waste	toxicity	toxic, up to 240 ppm Cr
reactor coolant pump decon solution	toxicity	toxic, up to 3560 ppm Cr
sludge lance filters/sludge	toxicity	non-toxic
chloride analysis waste	toxicity	toxic, up to 780 ppm Hg
liquid radwaste filter (laundry system)	toxicity	non-toxic
liquid radwaste filter (floor drain system)	toxicity	non-toxic
laundry liquids	toxicity	non-toxic
	corrosivity	non-corrosive PH=7.2
floor drain liquids	toxicity	non-toxic
	corrosivity	non-corrosive PH=6.9
wet blast decon unit grit/filters	toxicity	toxic, up to 28 ppm Cd and 30 ppm Pb
lead batteries/ shielding	See Note 1	

Notes: 1) Lead batteries and shielding are decontaminated. Consequently, no analysis has been performed on this waste.

Two general strategies are being employed to achieve this goal:

Strategy #1 - involves the submittal of delisting petitions for mixed waste streams that contain or have contacted a listed hazardous solvent. Prior to petition submittal, the concentration of the hazardous solvent in the mixed waste will be reduced as low as possible.

Strategy #2 - is applicable to a mixed waste that exhibits a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity). These wastes will be treated in-container to eliminate their hazardous characteristics.

Table IV lists the mixed wastes that are currently being generated at Duke Power facilities, as identified by the characterization program. In addition, their hazardous properties and the general processing strategies to be applied to these mixed wastes are provided.

Table IV

General Process Strategy For Mixed Waste Streams Currently Being Generated At Duke Power Facilities

Mixed Waste Stream	Hazardous Properties	Strategy
dry cleaner filters, paper portion	listed waste (freon), toxic (Cd,Pb)	#1 and #2 See Note 1
dry cleaner filters, carbon portion	listed waste (freon)	#1
dry cleaner bottoms	listed waste (freon), toxic (Pb)	#1 and #2
scintillation cocktail	ignitable, See Note 2	#2, See Note 3
acetone based cleaning solutions	listed waste (acetone)	#2, See Note 4
waste oil/solvent mixtures	listed waste (solvents)	#1, See Note 5
tool decon unit filters	listed waste (freon), See Note 6	#1

Table IV (continued)

5) An alternative option being pursued for mixed waste comprised of oil and listed hazardous solvents is approval from the applicable regulatory agencies for a one time burn of current inventories. Afterwards, an oil and solvent segregation program should prevent the generation of additional amounts of this mixed waste.

6) The tool decon unit waste characterization has not been completed.

Application of Strategy #1 to the applicable wastes required an investigation into effective methods for reducing the listed solvent concentrations of these wastes. At this time, no testing has been performed on methods for reducing the listed solvent concentration of the waste oil/solvent mixtures. For the freon related wastes, two methods have been tested - distillation and drying using the heat cycle of the dry cleaners. Neither of these two methods of reclaiming freon require a hazardous waste treatment permit. Strategy #2 is being employed to eliminate the hazardous characteristics associated with any of the identified mixed wastes. Generally, these wastes are being solidified with a gypsum based solidification agent. Again, a treatment permit is not required as long as the solidifications are performed in the original waste container within 90 days of the waste generation date.

At this time, the only full scale application of the above process strategies has been on the scintillation cocktail and the reactor coolant pump decon solution. Full scale processing of the remaining mixed wastes was delayed pending the results of bench scale processing of these wastes. The mixed waste processing results achieved thus far are shown in Table V. Testing is in progress for the identified mixed waste streams for which no results are shown.

Table V

Current Duke Power Mixed Waste Processing Results

Mixed Waste	Process Description	Pre-processed Properties	Post-processed Properties
dry cleaner filters, paper	dried 4 hours @ 120 degrees F, then solidified	2200 ppm freon, 2 ppm Cd and 16 ppm Pb	1200 ppm freon, < 0.2 Cd and < 0.3 Pb, See Notes 1 thru 5

Table V (continued)

4) The scintiliation cocktail and the coolant pump decon solution results were obtained from full scale processing. All other post-processed results were obtained from bench scale process testing.

5) The solidification of the reactor coolant pump decon solution was done using cement. All other waste solidifications were performed using a gypsum based solidification agent.

6) This wet blast filters/grit processing was performed on a waste batch that contained only 2.3 ppm Cd. The processing of batches containing Pb and higher levels of Cd is in progress.

SUMMARY AND CONCLUSION

The Duke Power characterization program has identified all mixed waste currently being generated at Duke Power facilities. This program provides for the periodic characterization of these wastes and ensures that they continue to be stored and processed in accordance with the requirements of 40CFR Part 265.
The Duke Power processing program has eliminated two of the identified mixed wastes from the companies hazardous waste storage permits - scintillation cocktail and reactor coolant pump decon solution. The processing of the remaining mixed waste is in progress and the preliminary results are satisfactory. Based upon these results, there is a reasonable possibility that all Duke Power mixed waste inventories and hazardous waste storage permits can be eliminated.

REFERENCES

1. Low Level Radioactive Waste Policy Amendments Act, January 1986.

2. Resource Conservation and Recovery Act of 1976, October 1976.

3. Environmental Protection Agency and U.S. Nuclear Regulatory Commission, " Guidance on the Definition and Identification of Commercial Mixed Low-Level Radioactive and Hazardous Waste and Answers to Anticipated Questions", January 8, 1987.

4. Code of Federal Regulations, Title 40, Parts 260 thru 262, and Parts 264 thru 270.

AQUATIC RESOURCE QUESTIONS

This request for information is designed to obtain the utility overview of its power plant's impacts on aquatic resources. It is not intended to require new surveys, data collection, or extensive new analyses of existing data. Responses can be based on existing information, for example, by summarization of information contained in monitoring reports, publications, or unpublished files. The questions should be answered separately for each site operated by the utility.

Documents that may be useful in addressing the following questions are:

- o Annual Aquatic Monitoring Report submitted to the responsible State Agency
- o Final Environmental Statement
- o Annual Non-Radiological Monitoring Report as required by Environmental Protection Plan of Technical Specifications, Appendix B
- o Section 316 (a) and (b) Demonstration Report submitted to Environmental Protection Agency

Based on our pilot study, the Aquatic Resource questions should take approximately 40 man-hours to answer.

1. Post-licensing modifications and/or changes in operations of intake and/or discharge systems may have altered the effects of the power plant on aquatic resources, or may have been made specifically to mitigate impacts that were not anticipated in the design of the plant. Describe any such modifications and/or operational changes to the condenser cooling water intake and discharge systems since the issuance of the Operating License.

2. Summarize and describe (or provide documentation of) any known impacts on aquatic resources (e.g., fish kills, violations of discharge permit

the Operating License including those that may have resulted in different plant impacts than those initially predicted.

7. Plant operations may have had positive, negative, or no impact on the use of aquatic resources by others. Harvest by commercial or recreational fishermen may be constrained by plant operation. Alternatively commercial harvesting may be relatively large compared with fish losses caused by the plant. Describe (or provide documentation for) other nearby uses of waters affected by cooling water systems (e.g., swimming, boating, annual harvest by commercial and recreational fisheries) and how these impacts have changed since issuance of the Operating License.

8. Describe other sources of impacts on aquatic resources (e.g., industrial discharges, other power plants, agricultural runoff) that could contribute to cumulative impacts. What are the relative contributions by percent of these sources, including the contributions due to the power plant, to overall water quality degradation and losses of aquatic biota?

9. Provide a copy of your Section 316(a) and (b) Demonstration Report required by the Clean Waste Act. What Section 316(a) and (b) determinations have been made by the regulatory authorities?

July 3, 1990

MEMORANDUM

TO: Tami Carpenter
Design Engineering
EC09-H

FROM: Gail Addis

SUBJECT: NUMARC Socioeconomic Impact Questionnaire

1. Estimates of number of permanent workers on site for most recent year:

Average permanent workers	= 1509
QA	= 82
CMD	= 375
PSD	= 52
NPD	= 1000

Does not include K-Mac (approximately 95) or Globe (approximately 150)

2. Average permanent workers in five-year increments since plant received Operating License:

	TOTAL	NPD	CMD/SMS*	QA	PSD
1980 =	953*	~621	250	82	-
1985 =	1118*	~786	250	82	-
1990 =	1509	~1000	375	82	52

*CMD was basically SMS as far as plant maintenance support in '80 and '85.

3. Three cases, a typical planned outage, an ISI outage and the largest single outage.

A. *Typical Planned Outage - 2EOC5

Length: 76 days Start Date: 7/5/89 Finish Date: 9/19/89

Cost: $20,234,000

Total Additional Workforce (Peak): 1055

C. *Largest Single Outage - 1EOC6

Length: 132 days   Start Date: 1/8/90   Finish Date: 5/20/90

Cost: $25,000,000 (estimate all invoices not yet received)

Total Additional Workforce (Peak): 1025

Principal Task Workforce:

Refueling	15	
NCP Maintenance	20	
Modifications	145	
S/G Sludge Lance}		
S/G Shot Peen}		
S/G Sleeving}		135
S/G Tube Pull}		
S/G Plug Removal}		
Routine Maintenance	710	

Total Occupational Dose Received: 487R

Principal Task Dose:

Refueling	28
NCP maintenance	20
Modifications	16
S/G Sludge Lance	13
S/G Shot Peen	33
S/G Sleeving	40
S/G Tube Pull	37
S/G Plug Removal	16
Routine Maintenance	284

*All figures are actual except cost.

Please call if you have questions.

cc: T. L. McConnell
J. W. Boyle
W. R. Kelley

1. To understand the importance of the plant and the degree of its socioeconomic impacts on the local region, estimate the number of permanent workers on-site for the most recent year for which data are available.

As of 7/1/90: 1157 NPD
87 Permanent Vendors
1244 Total

2. To understand the importance of the plant to the local region, and how that has changed over time, estimate the average number of permanent workers on site, in five-year increments starting with the issuance of the plant's Operating License. If possible, provide this information for each unit at a plant site.

Data For Both Units:
1/1/89 - 1,248
1/1/88 - 1,242
3/1/87 - 1,099
3/1/86 - 1,075
3/1/85 - 1,052
Total: 5,716 - 5 = 1,143 Average

3. To understand the potential impact of continued operation for an additional 20 years beyond the original licensing term, please provide for the following three cases:

A) A Typical Planned Outage:

1. Estimate of additional workers involved for entire outage:
60 I&E
588 Mechanical
138 HP
786 Total

2. Length Of Outage: 62 Days Planned
74 Days Actual

3. Months & Year In Which Work Occurred:
November 1988 to February 1989

4. Cost: Accounting information not available.

5. Occupational Doses Received By Permanent And Temporary Workers During Each Principal Task:
Total Occupational Dose 313.124 Per Rem
(See attached sheet for breakdown on exposure)

:A

FUNCTION	DOSE (REM)
360 ECT & U-Bend Stress Relief (UBSR)	54.910
Platform and Playpen Set Up/Clean Up	15.645
Nozzle Dam Installation/Removal	15.535
Tube Plugging	14.540
Code Eddy Current Testing (ECT)	13.450
Manway/Diaphragm Removal and Installation	9.480
Tube Dampening	4.930
Bowl Washdown and Initial HP Survey	2.760
FOSAR	1.410
TOTAL	132.660

FUNCTION	DOSE (REM)
Valve Repair	35.380
MOVATS	8.750
Limitorque Operator PM	1.975
TOTAL	45.500

FUNCTION	DOSE (REM)
Reactor Head Removal/Assembly	13.200
ISI of piping welds/hangers	11.420
Snubber inspection/testing	8.935
General Health Physics Surveillance (RB)	7.950
SRWP dose for outage tasks	7.910
Inspect/Replace 214 pipe clamps	7.320
General Operations Surveillance (RB)	7.050
General Decontamination (RB)	6.775
Socket weld tube fittings	5.665
Miscellaneous PM/PT	5.605
Hanging valve/component labels	4.425
Refuel Cavity Decontamination	3.490
RB/Annulus General Entry	2.915
Miscellaneous Instrument Calibration	2.880
Replace S/G Snubbers	2.735
Relocate 1NV014	2.595
Inspect/Retube KC HX's 1A/1B	2.455
ECT NV Letdown HX	2.145
TOTAL	105.470
Miscellaneous Work	29.494

ACTIVITIES HAVING ESTIMATED EXPOSURES > 1 PERSON - REM

General Outage Work
(Not Associated with a Specific Significant Job or NSM/VN)

ACTIVITY	ESTIMATED EXPOSURE (Person - Rem)
Temporary Shielding	2.5
Upper Containment General Entry	1.0
Housekeeping in Upper Containment	1.065
Upper Containment Canal Decon	5.0
Lower Containment General Entry	1.5
General Decon in Lower Containment	6.0
General R. P. Surveillance in Lower Containment	6.0
Operations Surveillance and Red Tags	6.7
Miscellaneous Work on SRWP's	15.0
Miscellaneous Instrumentation Calibration	4.0
Miscellaneous PM's and PTs	4.5

Subtotal for General Outage Work: 53.265 person - rem

NSM's/VN's

ACTIVITY	ESTIMATED EXPOSURE (Person - Rem)
CN 20330 Modify control circuitry wiring on MOV's	2.0
CN 20566 Replace inside containment BB isolation valves	5.0
CN 20582 Provide data for MOV testing	2.0
CN 20594 Delete HVAC Duct in Annulus	1.0

Subtotal for NSM's/VNs: 11.1 person - rem

Miscellaneous Work	12.455

B. **Taxes**

These questions are asked to validate information obtained from local government sources or to obtain information if local governments fail to provide it.

1. What types of local taxes must be paid on the plant and property?
   ad valorem property tax
2. To what jurisdictions are these taxes paid?
   see schedule
3. What types of state taxes must be paid on the plant and property?
   none
4. For each tax type, please estimate the total amount the utility paid to each relevant state and local jurisdiction in 1980, 1985 and 1989 (or the most recent year for which data are available).
   see schedule
5. Have major plant modifications or refurbishment affected the plant's taxable assessed value?
   no
6. Would an extended outage for major plant modifications or refurbishment result in a temporary cessation or reduction of tax payments to state and/or local governments?
   no
7. Would tax payments cease in the event of plant decommissioning?
   Yes

C. **Public Services**

n/a

This question is asked to validate information obtained from local government sources or to obtain information if local governments fail to provide it.

1) Please estimate the total annual plant expenditure for each fee-paid public service (e.g., water, sewer, etc.) in five year intervals since plant operations began.

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

SOCIOECONOMIC QUESTIONNAIRE

3. To understand the potential impact of continued operation for an additional 20 years beyond the original licensing term, please provide for the following three cases; (a) a typical planned outage; (b) an ISI outage; (c) the largest single outage (in terms of the number of workers involved) that has occured to date. An estimate of additional workers involved (for the entire outage and for each principle task), length of outage, months and year in which work occured, and cost. Also, estimate occupational doses received by permanent and temporary workers during each principle task.

(a) Typical planned outage: The normal length for a typical planned outage is approximately 45 days. Outages occur at the end of a cycle length. Some power manuevering may be used to avoid summer/winter power peaks. The following is a listing of additional workers/support involved in the outage:

Workers/Support	Total
Building	20
Performance Support	3
Electrical (TSM's)	10
Equipment Operator (not Polar Crane)	4
Valve Limitorque	15
Hanger	5
Heat Exchangers	20
Material Handling (RB Move)	8
Insulation	30
Material Handling	10
Polar Crane Operator	6
Reactor Coolant Pumps	18
General Support	15
Snubber	5
Steel Work (Flagman)	6
Tool/Room Worker	15
Valves	44
Warehouse/Materials Support	8
Welding/ISI	30
TOTAL WORKERS	272

The following is the estimated Dose received during an ISI Outage by task:

Tasks	Dose
OTSG Work	50
Valve Work	25
Head Work	20
Decon Work	15
Insulation	15
Inspecting/General Entry	10
Miscellaneous	10
I&E Work	10
RCP and Motor Work	10
ISI Activities	49
RBCUS	10
NSMS	10
Stage/Remove Equipment	10
RP Surveys	8
Scaffolding	5
Defuel/refuel Activities	4
Shielding	4
Miscellaneous Pump Work	4
Performance Testing	3
Tendon Work	2
Turbine Building Activities	
(1) Snubber Work	1
(2) Paint Basement Floor	1
TOTAL DOSE	276

(c) Largest Single Outage: The largest Oconee Outage to date by additional workers involved is not readily available; however, it shou`` not differ significantly from a typical ISI Outage. Further, we have no accounting records documenting the work incurred cost, nor are our accounting records established to provide a breakdown.

(b) Conduct Career Day presentation to high schools in an effort to: educate students about Duke Power Company, to inform students of the types of employment opportunities within Duke Power Company and the Oconee Nuclear Station, and to inform students of what skills/qualifications are needed to be considered for the various opportunities.

(c) Conducting Career Day presentations at two-year Technical Schools, including predominately minority attended schools.

(d) Serve as company representatives on advisory councils organized in various high schools.

4. **To understand the importance of the plant to specific jurisdiction near the plant, what is the current distribution, by city and county or zip code of residence of permanent workers on site?**

Please see the attached printout.

BOSTIC	28018		1
		*	1
BOWERSVILLE	30516		1
		*	1
BREVARD	28712		2
		*	2

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S, OSRG, TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
BUFFALO	29321		1
		*	1
CAMPOBELLO	29322		1
		*	1
CARNESVILLE	30521		2
		*	2
CASHIERS	28717		6
		*	6
CENTRAL	29630		130

		*	1
CLOVER	29710		2
		*	2

[redacted]

COWPENS	29330		2
		*	2
CULLOWHEE	28723		1
		*	1

[redacted]

DONALDS	29638		4
		*	4
DUNCAN	29334		2

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GREENVILLE	29605		3
	29607		1
	29609		5
	29611		10
	29615		4
		*	23

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSE, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
GREENWOOD	29646		1
		*	1
GREER	29650		1
	29651		5
	29652		1
		*	7

[redacted]

HARTWELL	30643		6
		*	6
HODGES	29653		1
		*	1
HONEA PATH	29654		11

LAURENS	29360		1
		*	1
LAVONIA	30553		5
		*	5
[redacted]			
LIBERTY	29657		81
		*	81
[redacted]			
LYMAN	29365		1
		*	1
MANNING	29102		1
		*	1
MARIETTA	29661		2
		*	2
MARTIN	30557		10

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CITY/COUNTY DISTRIBUTION

CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
[redacted]			
[redacted]			
NEWRY	29665		1
		*	1
NEWTON	28658		2
		*	2
NINETY SIX	29666		1
		*	1
NORRIS	29667		4
		*	4
PELZER	29669		4
		*	4
PENDELTON	29670		1

		*	2
SALEM	29676		72
		*	72
SENECA	29678		519
	29679		41
		*	560
SHERRILLS FRD	28673		1
		*	1
SIMPSONVILLE	29681		2
		*	2
SIX MILE	29682		96
		*	96
SIX MILES	29682		1
		*	1
SPARTANBURG	29301		4
	29303		2
	29305		1

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CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S,OSRG,TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES

CITY/COUNTY DISTRIBUTION
OCONEE NUCLEAR STATION
(INCLUES WOE, QA, PSD, NPD, DE, CMD-S, OSRG, TRANS)
EXCLUDES PART-TIME AND TEMPORARY EMPLOYEES

CITY NAME	ZIP CODE		NUMBER OF EMPLOYEES
		*	3
WALHALLA	29691		157
		*	157
WALLALLA	29691		1
		*	1
WARE SHOALS	29692		2
		*	2
WATERLOO	29384		1
		*	1
WAXHAW	28173		2
		*	2
WEST PELZER	29669		2
		*	2
WEST UNION	29686		1
	29696		67
		*	68
WESTMINISTER	29693		1
		*	1
WESTMINSTER	29630		1