August 7, 1984

SUBJECT: Offsite Dose Calculation Manual
Revision 4

The General Office Radwaste Engineering staff is transmitting to you this date, Revision 4 of the Offsite Dose Calculation Manual. As this revision only affects Catawba Nuclear Station, the approval of other station managers is not necessary. Please update your copy No. 29, and discard affected pages.

REMOVE THESE PAGES	INSERT THESE PAGES
Remove the two pages currently located behind the tab labeled "Catawba".	Insert this package behind the tab labeled "Catawba".

NOTE: As this letter contains "LOEP" information, please insert this letter in front of the December 22, 1983 letter.

Approval Date: 7-09-84

Effective Date: 7-18-84

Mary L. Birch
System Radwaste Engineer

Approval Date: 7-09-84

Effective Date: 7-18-84

J. W. Hampton, Manager
Catawba Nuclear Station

If you have any questions concerning Revision 4, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.
Associate Health Physicist
Radwaste Engineering

JMS/nem

Enclosures

8408270169 840816
PDR ADOCK 05000269
P PDR

APPENDIX C

CATAWBA NUCLEAR STATION

SITE SPECIFIC INFORMATION

APPENDIX C - TABLE OF CONTENTS

C1.0 CATAWBA NUCLEAR STATION RADWASTE SYSTEMS

C1.1 LIQUID RADWASTE PROCESSING

The liquid radwaste system at Catawba Nuclear Station (CNS) is used to collect and treat fluid chemical and radiochemical by-products of unit operation. The system produces efflucents which can be reused in the plant or discharged in small, dilute quantities to the environment. The means of treatment vary with waste type and desired product in the various systems:

A) Filtration - All waste sources are filtered during processing. In some cases, such as the Floor Drain Tank (FDT) Subsystem of the Liquid Waste (WL) System, filtration may be the only treatment required.

B) Adsorption - Adsorption of halides and organic chemicals by activated charcoal (Carbon Filter) is used primarily in treating waste in the Laundry and Hot Shower Tank (LHST) Subsystem of the WL System. FDT waste may also be treated by this method.

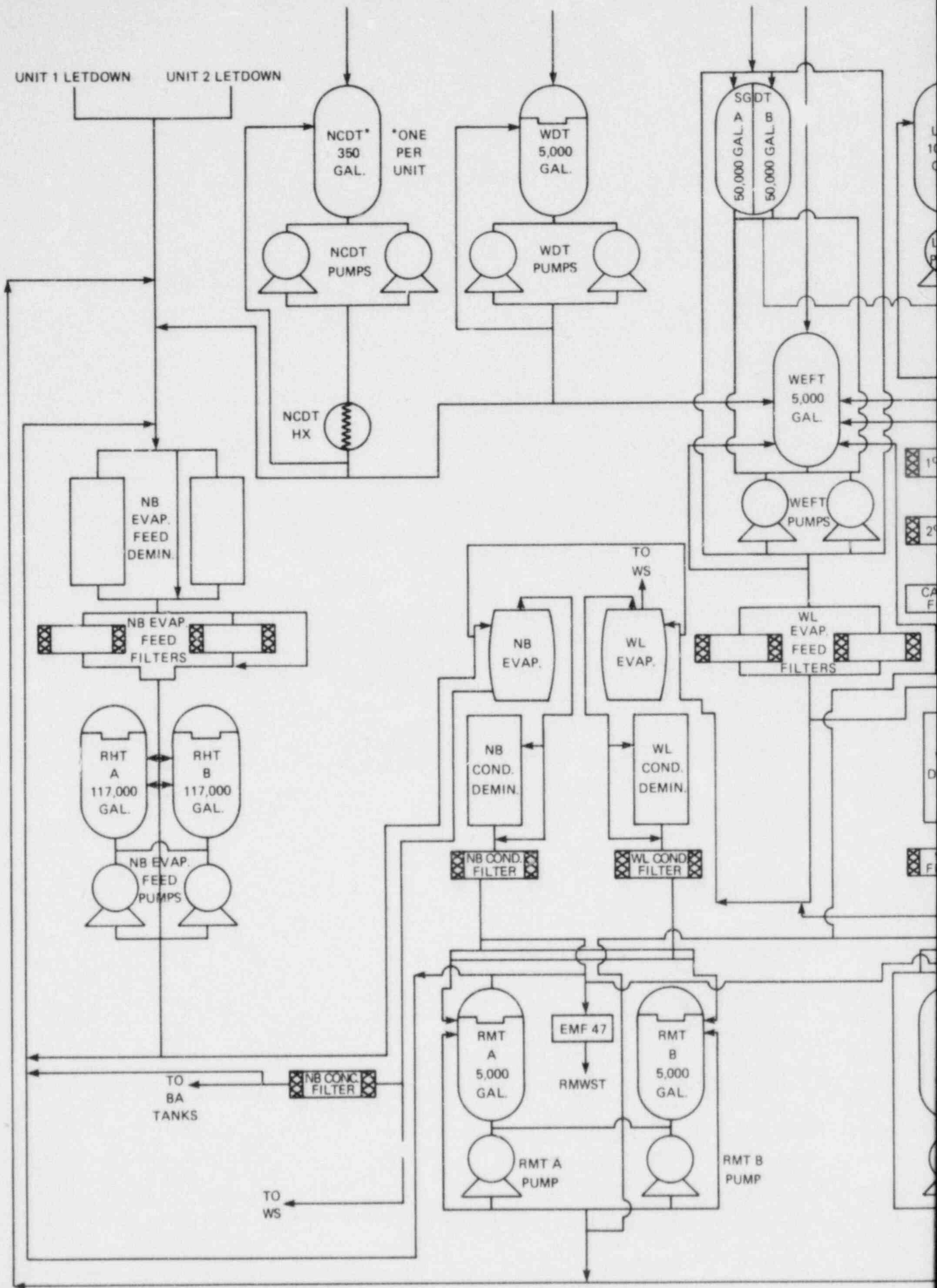
C) Ion Exchange - Ion exchange is used to remove radioactive cations from solution, as in the case of either LHST or FDT waste in the WL System after removal of organics by carbon filtration (adsorption). Ion exchange is also used in removing both cations (cobalt, manganese) and anions (chloride, fluoride) from evaporator distillates in order to purify the distillates for reuse as makeup water. Distillate from the Waste Evaporator in the WL System and the Boron Recycle Evaporator in the Boron Recycle System (NB) can be treated by this method, as well as FDT, LHST waste, and letdown.

D) Gas Stripping - Removal of gaseous radioactive fission products is accomplished in both the WL Evaporator and the NB Evaporator.

E) Distillation - Production of pure water from the waste by boiling it away from the contaminated solution which originally contained it is accomplished by both evaporators. Proper control of the process will yield water which can be reused for makeup. Polishing of this product can be achieved by ion exchange as pointed out above.

F) Concentration - In both the WL and NB Evaporators, dissolved chemicals are concentrated in the lower shell as water is boiled away. In the case of the WL Evaporator, the volume of water containing waste chemicals and radioactive cations is reduced so that the waste may be more easily and cheaply solidified and shipped for burial. In the NB Evaporator, the dilute boron is concentrated to 4% so that it may be reused for makeup to the reactor coolant system.

Figure C1.0-1 is a schematic representation of the liquid radwaste system at Catawba.



UNIT 1 LETDOWN
UNIT 2 LETDOWN
NCDT* 350 GAL.
*ONE PER UNIT
NCDT PUMPS
NCDT HX
WDT 5,000 GAL.
WDT PUMPS
SGDT
A 50,000 GAL.
B 50,000 GAL.
WEFT 5,000 GAL.
WEFT PUMPS
NB EVAP. FEED DEMIN.
NB EVAP FEED FILTERS
RHT A 117,000 GAL.
RHT B 117,000 GAL.
NB EVAP. FEED PUMPS
TO WS
NB EVAP.
WL EVAP.
WL EVAP. FEED FILTERS
NB COND. DEMIN.
WL COND. DEMIN.
NB COND. FILTER
WL COND FILTER
EMF 47
RMWST
RMT A 5,000 GAL.
RMT B 5,000 GAL.
RMT A PUMP
RMT B PUMP
TO BA TANKS
NB CONC. FILTER
TO WS

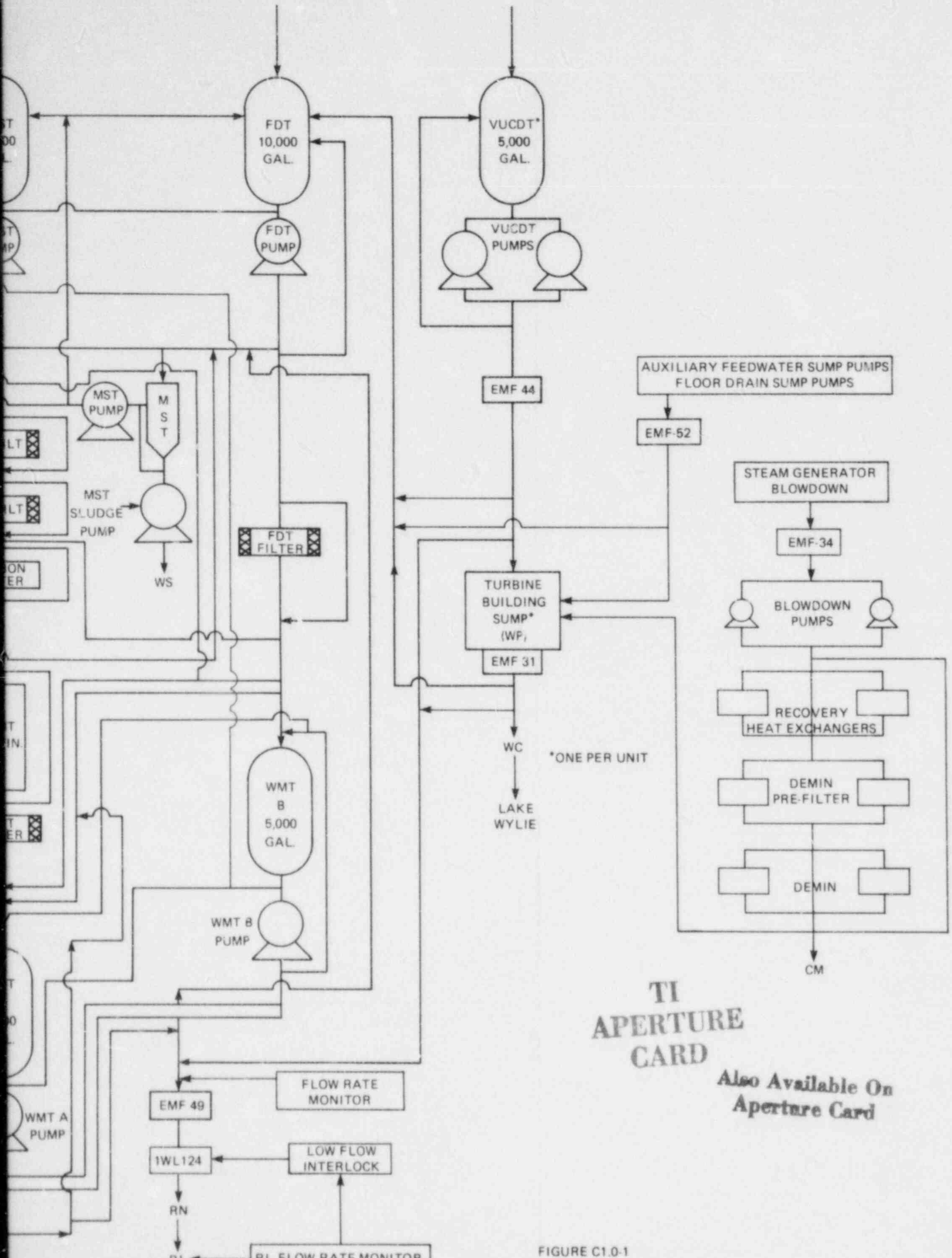


FIGURE C1.0-1
CATAWBA NUCLEAR STATION
LIQUID RADWASTE SYSTEM (WL)

Table C1.0-1

ABBREVIATIONS

Systems:

CM - Condensate System

KC - Component Cooling

NB - Boron Recycle

RL - Low Pressure Service Water

RN - Nuclear Service Water System

WC - Conventional Waste Water Treatment

WL - Liquid Waste Recycle

WP - Turbine Building Sump

WS - Nuclear Solid Waste Disposal

Tanks:

BA - Boric Acid Tank

FDT - Floor Drain Tank

LHST - Laundry and Hot Shower Tank

MST - Mixing and Settling Tank

NCDT - Reactor Coolant Drain Tank

RHT - Recycle Holdup Tank

RMT - Recycle Monitor Tank

RMWST - Reactor Makeup Water Storage Tank

SGDT - Steam Generator Drain Tank

VUCDT - Ventilation Unit Condensate Drain Tank

WDT - Waste Drain Tank

WEFT - Waste Evaporator Feed Tank

WMT - Waste Monitor Tank

C1.2 GASEOUS RADWASTE SYSTEMS

The gaseous waste disposal system for Catawba is designed with the capability of processing the fission-product gases from contaminated reactor coolant fluids resulting from operation. The system shown schematically in Fig. C1.0-2 is designed to allow for the retention, through the plant lifetime, of all the gaseous fission products to be discharged from the reactor coolant system to the chemical and volume control system or the boron recycle system, to limit the need for intentional discharge of radioactive gases from the waste gas holdup tanks. Thus, the only unavoidable sources of low-level radioactive gaseous discharge to the environment will be from periodic purging operations of the containment, from the auxiliary building ventilation system, and through the secondary system air ejector. With respect to the former, the potential contamination is expected to arise from uncollectable reactor coolant leakage. With respect to the air ejector, the potential source of contamination will be from leakage of the reactor coolant to the secondary system through defects in steam generator tubes. The gaseous waste disposal system includes two waste gas compressors, two catalytic hydrogen recombiners, six gas decay storage tanks for use during normal power generation, and two gas decay storage tanks for use during shutdown and startup operations.

C1.2.1 Gas Collection System

The gas collection system combines the waste hydrogen and fission gases from the volume control tanks and that from the boron recycle gas stripper evaporator produced during normal operation with the gas collected during the shutdown degasification (high percentage of nitrogen) and will cycle it through the catalytic recombiners to convert all the hydrogen to water. After the water vapor is removed, the resulting gas stream will be transferred from the recombiner into the gas decay tanks, where the accumulated activity may be contained in six approximately equal parts. From the decay tanks the gas will flow back to the compressor suction to complete the loop circuit.

C1.2.2 Containment and Auxiliary Building Ventilation

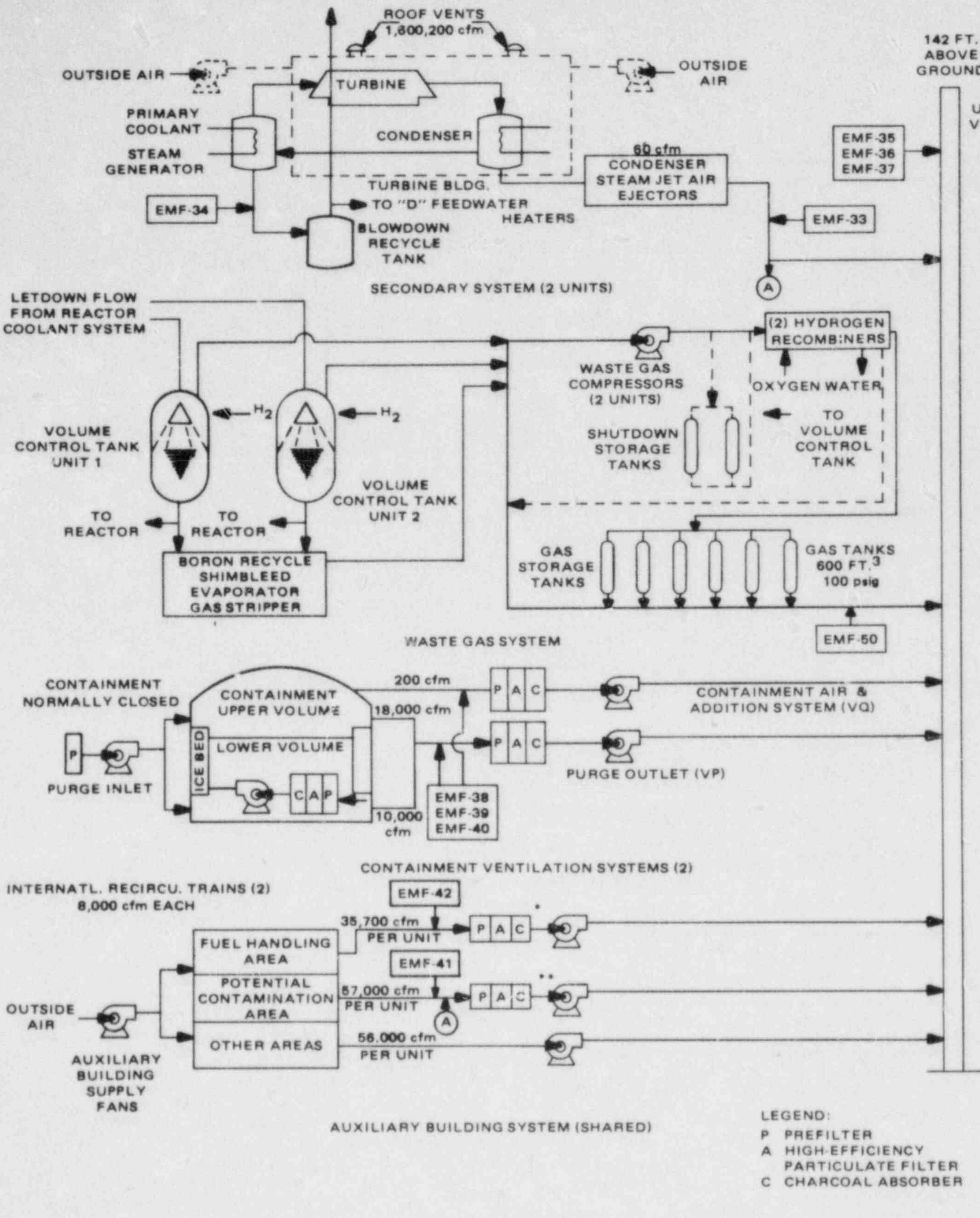
Nonrecyclable reactor coolant leakage occurring either inside the containment or inside the auxiliary building will generate gaseous activity. Gases resulting from leakage inside the containment will be contained until the containment air is released through the VQ or VP system. The containment atmosphere will be discharged through a charcoal adsorber and a particulate filter prior to release to the atmosphere.

Gases resulting from leakage inside the auxiliary building are released, without further decay, to the atmosphere via the auxiliary building ventilation system. The ventilation exhaust from potentially contaminated areas in the auxiliary building is normally unfiltered. However, on a radiation monitor alarm, the exhaust is passed through charcoal adsorbers to reduce releases to the atmosphere.

C1.2.3 Secondary Systems

Normally, condensate flow and steam generator blowdown will go parallel through 4 of the 5 condensate polishing demineralizers to remove activity and harmful ions from the water. Noncondensable gases will be taken from the secondary system by the condenser steam air ejector and are passed through a radiation monitor to the unit vent.

Figure C1.0-2 is a schematic representation of the gaseous radwaste system at Catawba.



* FUEL HANDLING AREA IS NORMALLY UNFILTERED. UPON A RADIATION ALARM BY EMF-42, THE EXHAUST WILL BE DIVERTED TO THE FILTERED MODE.

** POTENTIALLY CONTAIMINATED AREAS OF THE AUXILIARY BUILDING ARE NORMALLY UNFILTERED. UPON A RADIATION ALARM BY EMF-41, THE EXHAUST WILL BE DIVERTED TO THE FILTERED MODE.

FIGURE C1.0-2
CATAWBA NUCLEAR STATION
GASEOUS RADWASTE SYSTEM

C2.0 RELEASE RATE CALCULATION

Generic release rate calculations are presented in Section 1.0; these calculations will be used to calculate release rates for Catawba Nuclear Station. Catawba Nuclear Station will operate as a single unit until the second unit is completed and licensed. As a single unit, releases shall be administratively controlled to assure that release rate calculations limit releases as stated in the Technical Specifications.

C2.1 LIQUID RELEASE RATE CALCULATIONS

There are two potential release points at Catawba. They are as follows:

1. Liquid Waste Effluent Discharge Line
2. Conventional Waste Water Treatment System Effluent Line

C2.1.1 Liquid Waste Effluent Discharge Line

There are three low-pressure service water pumps with a minimum flow rate of 16,500 gpm each and four nuclear service water pumps with a minimum flow rate of 9,000 gpm each which provide the required dilution water needed for a release. The LPSW system flow rate monitor has a variable setpoint which terminates the release by closing the isolation valve, 1 WL124 should the dilution flow fall below the setpoint. The following equation shall be used to calculate a discharge flow, in gpm.

$$f \leq F_{RL} \div \sigma \sum_{i=1}^{n} \frac{C_i}{MPC_i}$$

where:

f = the undiluted effluent flow, in gpm.

F_{RL} = actual low pressure service water flowrate, in gpm, from the sum of the flowrate monitors located in the Control Room.

σ = the recirculation factor at equilibrim (dimensionless), 1.027.

$$\sigma = 1 + \frac{Q_R}{Q_H} = 1 + \frac{120 \text{ cfs}}{4400 \text{ cfs}} = 1.027$$

where:

Q_R = average dilution flow (120 cfs)

Q_H = average flow past Wylie Dam (4400 cfs)

C_i = the concentration of radionuclide, i, in undiluted effluent as determined by laboratory analyses, in µCi/ml.

MPC_i = the concentration of radionuclide, i, from 10CFR20, Appendix B, Table II, Column 2. If radionuclide, i, is a dissolved noble gas, the MPC_i = 2.0E-04 µCi/ml.

C2.1.2 Conventional Waste Water Treatment System Effluent Line

The conventional waste water treatment system effluent is normally considered nonradioactive; that is, it is unlikely the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring measurements and by periodic analyses of the composite sample collected on that line. The water sources listed below that are normally discharged via the conventional waste water treatment system and/or the Turbine Building Sump will be diverted if they become radioactive.

a. Containment Ventilation Unit Condensate Effluent Line

Normally the containment ventilation unit condensate effluent line would discharge into the Turbine Building sump, but if radiation is detected above background, the discharge will be terminated and an alarm actuated. The containment ventilation unit condensate tank will then be recirculated, sampled and then discharged through the liquid waste effluent line and monitored or processed thru the WL system.

b. Auxiliary Feedwater Sump Pumps and Floor Drain Sump Pump Line

Normally the discharge line coming from these sumps will discharge into the Turbine Building sump, but if radiation is detected above background, the discharge flow will automatically be routed to the floor drain tank for processing and later be discharged through the liquid waste effluent line.

c. Turbine Building Sump Discharge Line

Normally the discharge from the Turbine Building sump will go into the conventional waste water treatment system, but if radiation is detected above background, the sump pumps A, B, and C will stop and an alarm actuated. The Turbine Building sump discharge line can either be routed to the floor drain tank for processing or routed directly to the liquid waste effluent discharge line.

d. Steam Generator Blowdown Line

Normally the discharge from the Steam Generator Blowdown will be pumped to the Turbine Building Sump, but if radiation is detected above background, each blowdown flow control valve, the atmospheric vent, and the valve to the Turbine Building Sump will close, thus terminating the discharge. Blowdown can only be continued by venting the steam to "D" heater and pumping the liquid to the condensate system.

C2.2 GASEOUS RELEASE RATE CALCULATIONS

The unit vent is the release point for waste gas decay tanks, containment air releases, the condenser air ejector, and auxiliary building ventilation. The condenser air ejector effluent is normally considered nonradioactive; that is, it is unlikely the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring measurements and/or by analyses of periodic samples collected on that line. Radiation monitoring alarm/trip setpoints in conjunction with administrative controls assure that release limits are not exceeded; see section C.3.0 on radiation monitoring setpoints.

The following calculations, when solved for flowrate, are the release rates for noble gases and for radioiodines, particulates and other radionuclides with half-lives greater than 8 days; the most conservative of release rates calculated in C2.2.1 and C2.2.2 shall control the release rate for a single release point.

C2.2.1 Noble Gases

$$\sum_i K_i \; [(\overline{X/Q})\tilde{Q}_i] < 500 \text{ mrem/yr, and}$$

$$\sum_i (L_i + 1.1\, M_i) \; [(\overline{X/Q})\tilde{Q}_i] < 3000 \text{ mrem/yr}$$

where the terms are defined below.

C2.2.2 Radioiodines, Particulates, and Other Radionuclides With T 1/2 > 8 Days

$$\sum_i P_i \; [W\, \tilde{Q}_i] < 1500 \text{ mrem/yr}$$

where:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per μCi/m^3 from Table 1.2-1.

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide, in mrem/yr per μCi/m^3 from Table 1.2-1.

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per μCi/m^3 from Table 1.2-1 (unit conversion constant of 1.1 mrem/mrad converts air dose to skin dose).

P_i = The dose parameter for radionuclides other than noble gases for the inhalation pathway, in mrem/yr per μCi/m^3 and for the food and ground plane pathways in m^2·(mrem/yr) per μCi/sec from Table 1.2-2. The dose factors are based on the critical individual organ and most restrictive age group (child or infant).

$\tilde{Q}_i$ = The release rate of radionuclides, i, in gaseous effluent from all release points at the site, in μCi/sec.

$(\overline{X/Q})$ = 3.10E-05 sec/m^3. The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary. The location is the NNE sector @ 0.5 miles.

W = The highest calculated annual average dispersion parameter for estimating the dose to an individual at the controlling location:

W = 3.1E-05 sec/m^3, for the inhalation pathway. The location is the unrestricted area in the NNE sector @ 0.5 miles.

W = 1.1E-07 $meter^{-2}$, for the food and ground plane pathways. The location is the unrestricted area boundary in the NE/NNE sector @ 0.5 miles (nearest residence, and vegetable garden).

$$\tilde{Q}_i = k_1 C_i f \div k_2 = 4.72E{+}2 C_i f$$

where:

C_i = the concentration of radionuclide, i, in undiluted gaseous effluent, in µCi/ml.

f = the undiluted effluent flow, in cfm

k_1 = conversion factor, 2.83E4 ml/ft^3

k_2 = conversion factor, 6E1 sec/min

C3.0 RADIATION MONITOR SETPOINTS

Using the generic calculations presented in Section 2.0, radiation monitoring setpoints are calculated for monitoring as required by the Technical Specifications.

All radiation monitors for Catawba are off-line except EMF-50 (Waste Gas System) which is in-line. These monitors alarm on low flow; the minimum flow alarm level for both the liquid monitors and the gas monitors is based on the manufacturer's recommendations. These monitors measure the activity in the liquid or gas volume exposed to the detector and are independent of flow rate if a minimum flow rate is assured.

Radiation monitoring setpoints calculated in the following sections are expressed in activity concentrations; in reality the monitor readout is in counts per minute. The relationship between concentration and counts per minute is established by a station procedure using the following relationship:

$$c = \frac{r}{2.22 \times 10^6 e\ V}$$

where:

c = the gross activity, in μCi/ml
r = the count rate, in cpm
2.22×10^6 = the disintegration per minute per μCi
e = the counting efficiency, cpm/dpm
V = the volume of fluid exposed to the detector, in ml.

For those occurrences when simultaneous releases of radioactive material must be made, monitor setpoints will be adjusted downward in accordance with Station Procedures to insure that instantaneous concentrations will not be exceeded.

C3.1 LIQUID RADIATION MONITORS

C3.1.1 Waste Liquid Effluent Line

As described in Section C2.1.1 on release rate calculations for the waste liquid effluent, the release is controlled by limiting the flow rate of effluent from the station. Although the release rate is flow rate controlled, the radiation monitor setpoint shall be set to terminate the release if the effluent activity should exceed that determined by laboratory analyses and used to calculate the release rate. A typical radiation monitor setpoint may be calculated as follows:

$$c \leq \frac{MPC \times F}{\sigma f} \leq 2.48E\text{-}05\ \mu Ci/ml$$

where:

c = the gross activity in undiluted effluent, in μCi/ml

f = the flow from the tank may vary from 0-100 gpm but, for this calculation, is assumed to be 100 gpm.

MPC = 1.0E-07 μCi/ml, the MPC for an unidentified mixture

σ = 1.027 (See Section C2.1.1)

F = the dilution flow may vary as described in section C2.1.1, but is conservatively estimated at 25,500 gpm, the minimum flow available.

C3.1.2 Containment Ventilation Unit Condensate Effluent Line - EMF 44

As described in Section C2.1.2 on release rate calculations for the containment ventilation unit condensate effluent, it is possible but unlikely that the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring. Since the tank contents are discharged automatically, the radiation monitor setpoint will be set at 1.0E-06 μCi/ml (the monitor's lowest level of detection) plus background to assure that release limits are not exceeded.

C3.1.3 Auxiliary Feedwater Sump Pumps and Floor Drain Sump Pump - EMF 52

As described in Section C2.1.2 on release rate calculations for the auxiliary feedwater sump pumps and floor drain sump pump effluents, it is possible but unlikely that the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring. Since the sumps are discharged automatically, the radiation monitor setpoint will be set at 1.0E-06 μCi/ml (the monitor's lowest level of detection) plus background to assure that release limits are not exceeded.

C3.1.4 Turbine Building Sump Discharge Line - EMF 31

As described in Section C2.1.2 on release rate calculations for the turbine building sumps, it is possible but unlikely that the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring. Since the sump contents are discharged automatically, the radiation monitor setpoint will be set at 1.0E-06 μCi/ml (the monitor's lowest level of detection) plus background to assure that release limits are not exceeded.

C3.1.5 Steam Generator Blowdown Line - EMF 34

As described in Section C2.1.2 on Release Rate Calculations for the Steam Generator Blowdown, it is possible but unlikely that the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring. Since the Steam Generator Blowdown line is discharged automatically, the radiation monitor setpoint will be set at 1.0E-06 μCi/ml (the monitor's lowest level of detection) plus background to assure that release limits are not exceeded.

C3.2 GAS MONITORS

The following equation shall be used to calculate noble gas radiation monitor setpoints based on Xe-133 (Historical data shows that Xe-133 is most predominant isotope):

$$K(\overline{X/Q})\tilde{Q}_i < 500 \qquad \text{(see Section C2.2.1)}$$

$$\tilde{Q}_i = 4.72E{+}02\ C_i f \ \text{(see Section C2.2.2)}$$

$$C_i < 1.16/f$$

where:

C_i = the gross activity in undiluted effluent, in µCi/ml

f = the flow from the tank or building sources, in cfm

K = from Table 1.2-1 for Xe-133, 2.94E+2 mrem/yr per $\mu Ci/m^3$

$\overline{X/Q}$ = 3.1E-05, as defined in Section C.2.2.2

As stated in Section C2.2, the unit vent is the release point for the containment purge ventilation system, the containment air release and addition system, the condenser air ejector, and auxiliary building ventilation.

For releases from the containment purge ventilation system, a typical radiation monitor setpoint may be calculated as follows:

$$C_i < 1.16/f = 6.5E{-}06$$

where:

f = 151,000 cfm (auxiliary building ventilation) + 28,000 cfm (containment purge) = 179,000 cfm

For release from the containment air release and addition system, the waste gas decay tanks, the condenser air ejectors, and the auxiliary building ventilation, a typical radiation monitor setpoint may be calculated as follows:

$$C_i < 1.16/f = 7.7E{-}06$$

where:

f = 151,000 cfm (auxiliary building ventilation)

C4.0 DOSE CALCULATIONS

C4.1 FREQUENCY OF CALCULATIONS

Dose contributions to the maximum exposed individual shall be calculated every 31 days, quarterly, semiannually, and annually (as required by Technical Specifications) using the methodology in the generic information sections. This methodology shall also be used for any special reports. Dose projections shall be performed using simplified estimates. Fuel cycle dose calculations shall be performed annually or as required by special reports. Dose contributions may be calculated using the methodology in the appropriate generic information sections.

C4.2 DOSE MODELS FOR MAXIMUM EXPOSED INDIVIDUAL

C4.2.1 Liquid Effluents

For dose contributions from liquid radioactive releases, one of the two following cases will apply:

1. If the radionuclides Co-58 and/or Co-60 have been detected and Cs-134 and/or Cs-137 have not been detected (i.e., plants without any fuel failure) dose calculations will be based upon an adult who consumed fish caught in the discharge canal and who drank water from the nearest "downstream" potable water intake. The dose from these two radionuclides has been calculated to be 13% of that individual's total body dose.

2. If the radionuclides Cs-134 and/or Cs-137 have been detected, dose calculations indicate that the maximum exposed individual would be an adult who consumed fish caught in the discharge canal and who drank water from the nearest "downstream" potable water intake. The dose from these two radionuclides has been calculated to be 90% of that individual's total body dose.

C4.2.2 Gaseous Effluents

C4.2.2.1 Noble Gases

For dose contributions from exposure to beta and gamma radiation from noble gases, it is assumed that the maximum exposed individual is an adult on the site boundary in each meteorological sectors.

C4.2.2.2 Radioiodines, Particulates, and Other Radionuclides $T_{1/2} > 8$ days

For dose contributions from radioiodines, particulates and other radionuclides; it is assumed that the maximum exposed individual is an infant who breathes the air and consumes milk from the nearest goat or cow in each meteorological sector.

C4.3 SIMPLIFIED DOSE ESTIMATE

C4.3.1 Liquid Effluents

For dose estimates, two simplified calculations using the assumptions presented in Section C4.2.1 and source terms presented in the FSAR are presented. Once operational source term data is available, this information shall be used to revise these calculations, if necessary.

Case 1 - No Cs-134 or Cs-137 present in effluent.

$$D_{WB} = 1.57E{+}03 \sum_{\ell=1}^{m} (F_\ell)(T_\ell)\ (C_{Co-60} + 0.35\ C_{Co-58})$$

where:

$1.57E{+}03 = 1.14E{+}05\ (U_{aw}/D_w + U_{af}\ BF_i)\ DF_{ai\tau}\ (7.69)$

where:

$1.14E{+}05 = 10^6 pCi/\mu Ci \times 10^3 ml/kg \div 8760\ hr/yr$

U_{aw} = 730 kg/yr, adult water consumption

D_w = 37.7, dilution factor from the near field area to the nearest potable water intake.

where:

$D_W = \dfrac{\sigma}{Q_R + Q_H}$ (See Section C2.1.1)

U_{af} = 21 kg/yr, adult fish consumption

BF_i = 5.0E+01, bioaccumulation factor for Cobalt (Table 3.1-1)

$DF_{ai\tau}$ = 1.67E-06, adult, total body, ingestion dose factor for Co-60 (Table 3.1-2)

7.69 = factor derived from assumption that 13% of dose is from Co-58 and Co-60 or 100% ÷ 13% = 7.69

And where:

$$F_\ell = \frac{f\sigma}{F + f}$$

where:

f = liquid radwaste flow, in gpm

σ = recirculation factor at equilibrium, 1.027 (see Section C2.1.1)

F = dilution flow, in gpm

And where:

T_ℓ = The length of time, in hours, over which C_{Co-58}, C_{Co-60}, and F_ℓ are averaged.

C_{Co-58} = the average concentration of Co-58 in undiluted effluent, in µCi/ml, during the time period considered.

C_{Co-60} = the average concentration of Co-60 in undiluted effluent, in µCi/ml, during the time period considered.

0.35 = The r tio of the adult total body ingestion dose factors for Co-58 and Co-60 or 1.67E-06 ÷ 4.72E-06 - Table 3.1-2.

Case 2 - Cs-134 and/or Cs-137 present in effluent.

$$D_{WB} = 6.38E{+}05 \sum_{\ell=1}^{m} (F_\ell)(T_\ell)\,(C_{Cs-134} + 0.59\,C_{Cs-137})$$

where:

$$6.38E{+}05 = 1.14E{+}05\,(U_{aw}/D_w + U_{af}\,BF_i)\,DF_{ai\tau}\,(1.10)$$

where:

$1.14E{+}05 = 10^6$pCi/µCi x 10^3ml/kg ÷ 8760 hr/yr

U_{aw} = 730 kg/yr, adult water consumption

D_w = 37.7, dilution factor from the near field area to the nearest potable water intake.

where:

$$D_w = \frac{\sigma}{Q_R + Q_H} \text{ (see Section C2.1.1)}$$

U_{af} = 21 kg/yr, adult fish consumption

BF_i = 2.00E+03, bioaccumulation factor for Cesium (Table 3.1-1)

$DF_{ai\tau}$ = 1.21E-04, adult, total body, ingestion dose factor for Cs-134 (Table 3.1-2)

1.10 = factor derived from the assumption that 90% of dose is from Cs-134 and Cs-137 or 100% ÷ 90% = 1.10

And where:

$$F_\ell = \frac{f\sigma}{F + f}$$

where:

f = liquid radwaste flow, in gpm

σ = recirculation factor at equilibrium, 1.027 (see Section C2.1.1)

F = dilution flow, in gpm

And where:

T_ℓ = The length of time, in hours, over which C_{Cs-134}, C_{Cs-137}, and F_ℓ are averaged.

C_{Cs-134} = the average concentration of Cs-134 in undiluted effluent, in μCi/ml, during the time period considered.

C_{Cs-137} = the average concentration of Cs-137 in undiluted effluent, in μCi/ml, during the time period considered.

0.59 = The ratio of the adult total body ingestion dose factors for Cs-134 and Cs-137 or 7.14E-05 ÷ 1.21E-04 = 0.59

C4.3.2 Gaseous Effluents

Meteorological data is provided in Tables C4.0-1 and C4.0-2.

C4.3.2.1 Noble Gases

For dose estimates, simplified dose estimates using the assumptions in C4.2.2.1 and source terms in the FSAR are presented below. Once operational source term data is available, this information shall be used to revise these calculations, if necessary. These calculations further assume that the annual average dispersion parameter is used and that Xenon-133 contributes 45% of the dose.

$$D_\gamma = 3.47E\text{-}10\ [\tilde{Q}]_{Xe-133}\ (2.22)$$

$$D_\beta = 1.03E\text{-}09\ [\tilde{Q}]_{Xe-133}\ (2.22)$$

where:

3.47E-10 = (3.17E-8)(353) $(\overline{X/Q})$, derived from equation presented in Section 3.1.2.1.

1.03E-09 = (3.17E-08) (1050) $(\overline{X/Q})$, derived from equation presented in Section 3.1.2.1.

$\overline{X/Q}$ = 3.1E-05 sec/m^3, as defined in Section C2.2.2

$[\tilde{Q}]_{Xe-133}$ = the total Xenon-133 activity released in μCi

2.22 = factor derived from the conservative assumption (based on historical data) that 45% of the dose is contributed by Xe-133.

C4.3.2.2 Radioiodines, Particulates, and Other Radionuclides with $T\ 1/2 > 8$ days

For dose estimates, simplified dose estimates using the assumptions in C4.2.2.2 and source terms in the FSAR are presented below. Once operational source term data is available, this information shall be used to revise these calculations, if necessary. These calculations further assume that the annual average dispersion/deposition parameter is used and that 95% of the dose is from Iodine-131 concentrated in goat's milk. The simplified dose estimate to the thyroid of an infant is:

$$D = 1.84E{+}04\ w\ (\tilde{Q})_{I\text{-}131}\ (1.05)$$

where:

$w = 7.3E{-}10 = \overline{D/Q}$ for food and ground plane pathway, in m^{-2} from Table C4.0-2 for location of nearest real goat (NW sector at 2.5 miles).

$(\tilde{Q})_{I\text{-}131}$ = the total Iodine-131 activity released in µCi.

1.84E+04 = $(3.17E{-}08)(R_i^C\ [\overline{D/Q}])$ with the appropriate substitutions for goat's milk in the grass-cow-milk-pathway factor, $R_i^C\ [\overline{D/Q}]$ for Iodine-131. See Section 3.1.2.2.

1.05 = factor derived from the conservative assumption (based on historical data) that 95% of the dose is contributed by I-131.

C4.3 FUEL CYCLE CALCULATIONS

As discussed in Section 3.3.5, more than one nuclear power station site may contribute to the doses to be considered in making fuel cycle dose assessments in accordance with 40CFR190. The fuel cycle dose assessments for Catawba Nuclear Station must include dose contributions from McGuire Nuclear Station, which is located upstream approximately thirty miles NNE of Catawba. For this dose assessment, the maximum exposed individual is conservatively assumed to live 5 miles NNE of Catawba and 5 miles SSW of McGuire; this individual eats fish caught in the discharge area at Catawba.

The dose contributions resulting from gaseous effluents are calculated using the methodology in Section 3.1.2:

$$D_f(g) < 0.47\ D_M(g) + 0.55\ D_C(g)$$

Where:

$D_M(g)$ = dose contribution from McGuire calculated using $\overline{X/Q} = 1.5E{-}07\ sec/m^3$ and $\overline{D/Q} = 3.8E{-}10\ sec/m^3$. The location is 5 miles SSW of McGuire.

0.47 = fraction of time the wind direction is out of NNE.

$D_c(g)$ = dose contribution from Catawba calculated using $\overline{X/Q}$ = 3.3E-07 sec/m^3 and $\overline{D/Q}$ = 3.5E-10 sec/m^3. The location is 5 miles NNE of Catawba.

0.55 = Fraction of time the wind direction is out of SSW.

Using the methodology above and the assumption that each station releases their maximum Technical Specification dose limit, the gaseous effluent contribution to the fuel cycle calculation is but a small fraction (< 1/100) of the allowable dose. Therefore, fuel cycle calculations will not normally be performed unless either station exceeds their gaseous effluent Technical Specifications by a factor of 10.

The dose contribution resulting from liquid effluents is calculated using the methodology in Section 3.1.1:

$$D_f(\ell) < 0.607 \cdot D_M(\ell) + D_C(\ell)$$

Where:

$$.607 = \frac{\text{2670 cfs (average flow past Cowans Ford Dam)}}{\text{4400 cfs (average flow past Lake Wylie Dam)}} \text{ diluti n}$$

$D_m(\ell)$ = Dose contribution from McGuire via liquid effluents

$D_c(\ell)$ = Dose contribution from Catawba via liquid effluents

Using the methodology above and the assumption that each station releases its maximum Technical Specification dose limit, the liquid effluent contribution to the fuel cycle calculation would be 48% of the allowable dose. Therefore, fuel cycle calculations will not normally be preformed unless either station exceeds its liquid effluent Technical Specifications by a factor of 2.

In summary, Technical Specification 3.11.4 will be the deciding criteria for Catawba fuel cycle calculations since it is either equal to (liquid) or is more restrictive than (gaseous) the cases outlined above.

TABLE C4.0-1

CATAWBA NUCLEAR STATION

The values presented in this table were generated by using the computer program XOQDOQ (NUREQ/CR-2919) which implements NRC Regulatory Guide 1.111 (1977) and the following assumptions:

1. Data Collection Period, 12/17/75 to 12/16/77.

2. Ground Level Releases.

3. Height of The Vent's Building = 47 meters.

4. Open Terrain Recirculation Connection Factors.

TABLE C4.0-1

(1 of 2)

CATAWBA NUCLEAR STATION

DISPERSION PARAMETER ($\overline{X/Q}$) FOR LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

(sec/m³)

	Distance to the control location, (miles)									
Sector	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
N	2.6E-5	6.5E-6	2.7E-6	1.5E-6	9.7E-7	6.9E-7	5.2E-7	4.1E-7	3.3E-7	2.8E-7
NNE	3.1E-5	8.1E-6	3.3E-6	1.8E-6	1.2E-6	8.2E-7	6.2E-7	4.9E-7	4.0E-7	3.3E-7
NE	3.0E-5	7.8E-6	3.2E-6	1.8E-6	1.1E-6	8.0E-7	6.0E-7	4.7E-7	3.9E-7	3.2E-7
ENE	1.5E-5	3.9E-6	1.6E-6	8.9E-7	5.7E-7	4.1E-7	3.1E-7	2.4E-7	2.0E-7	1.6E-7
E	1.4E-5	3.7E-6	1.5E-6	8.4E-7	5.4E-7	3.8E-7	2.9E-7	2.3E-7	1.9E-7	1.6E-7
ESE	9.0E-6	2.3E-6	9.5E-7	5.3E-7	3.4E-7	2.4E-7	1.8E-7	1.4E-7	1.2E-7	9.7E-8
SE	9.2E-6	2.4E-6	9.8E-7	5.4E-7	3.5E-7	2.4E-7	1.8E-7	1.4E-7	1.2E-7	9.8E-8
SSE	1.1E-5	2.9E-6	1.2E-6	6.4E-7	4.1E-7	2.9E-7	2.2E-7	1.7E-7	1.4E-7	1.1E-7
S	2.5E-5	6.4E-6	2.6E-6	1.5E-6	9.3E-7	6.6E-7	5.0E-7	3.9E-7	3.2E-7	2.7E-7
SSW	1.7E-5	4.4E-6	1.8E-6	1.0E-6	6.4E-7	4.5E-7	3.4E-7	2.7E-7	2.2E-7	1.8E-7
SW	1.3E-5	3.4E-6	1.4E-6	7.4E-7	4.7E-7	3.3E-7	2.4E-7	1.9E-7	1.5E-7	1.3E-7
WSW	7.0E-6	1.8E-6	7.2E-7	3.9E-7	2.5E-7	1.7E-7	1.3E-7	1.0E-7	8.2E-8	6.8E-8
W	8.9E-6	2.3E-6	9.3E-7	5.0E-7	3.2E-7	2.2E-7	1.7E-7	1.3E-7	1.1E-7	8.7E-8
WNW	6.6E-6	1.7E-6	6.8E-7	3.7E-7	2.4E-7	1.7E-7	1.3E-7	9.8E-8	8.0E-8	6.6E-8
NW	1.0E-5	2.6E-6	1.1E-6	5.9E-7	3.8E-7	2.7E-7	2.0E-7	1.6E-7	1.3E-7	1.1E-7
NNW	1.3E-5	3.3E-6	1.4E-6	7.5E-7	4.8E-7	3.4E-7	2.6E-7	2.0E-7	1.6E-7	1.4E-7

CATAWBA NUCLEAR STATION

The values presented in this table were generated by using the computer program XOQDOQ (NUREQ/CR-2919) which implements NRC Regulatory Guide 1.111 (1977) and the following assumptions:

1. Data Collection Period, 12/17/75 to 12/16/77.

2. Ground Level Releases.

3. Height of The Vent's Building = 47 meters.

4. Open Terrain Recirculation Connection Factors.

TABLE C4.0-2

(1 of 2)

CATAWBA NUCLEAR STATION

DIPERSION PARAMETER ($\overline{D/Q}$) FOR LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

(meter $^{-2}$)

	Distance to the control location, (miles)									
Sector	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
N	6.4E-8	1.6E-8	5.6E-9	2.8E-9	1.6E-9	1.1E-9	7.5E-10	5.6E-10	4.3E-10	3.4E-10
NNE	1.1E-7	2.7E-8	9.6E-9	4.7E-9	2.8E-9	1.8E-9	1.3E-9	9.5E-10	7.4E-10	5.8E-10
NE	1.1E-7	2.6E-8	9.3E-9	4.6E-9	2.7E-9	1.8E-9	1.3E-9	9.3E-10	7.2E-10	5.7E-10
ENE	4.1E-8	1.0E-8	3.6E-9	1.8E-9	1.1E-9	6.9E-10	4.9E-10	3.6E-10	2.8E-10	2.2E-10
E	3.6E-8	8.8E-9	3.2E-9	1.6E-9	9.3E-10	6.1E-10	4.3E-10	3.2E-10	2.4E-10	1.9E-10
ESE	2.5E-8	6.0E-9	2.2E-9	1.1E-9	6.3E-10	4.2E-10	2.9E-10	2.2E-10	1.7E-10	1.3E-10
SE	3.0E-8	7.3E-9	2.6E-9	1.3E-9	7.7E-10	5.0E-10	3.5E-10	2.6E-10	2.0E-10	1.6E-10
SSE	3.8E-8	9.3E-9	3.3E-9	1.7E-9	9.7E-10	6.4E-10	4.5E-10	3.3E-10	2.6E-10	2.0E-10
S	7.2E-8	1.8E-8	6.3E-9	3.1E-9	1.8E-9	1.2E-9	8.5E-10	6.3E-10	4.8E-10	3.8E-10
SSW	6.6E-8	1.6E-8	5.8E-9	2.9E-9	1.7E-9	1.1E-9	7.8E-10	5.8E-10	4.4E-10	3.5E-10
SW	5.7E-8	1.4E-8	5.0E-9	2.5E-9	1.5E-9	9.6E-10	6.7E-10	5.0E-10	3.9E-10	3.1E-10
WSW	2.4E-8	5.7E-9	2.1E-9	1.0E-9	6.0E-10	4.0E-10	2.8E-10	2.1E-10	1.6E-10	1.3E-10
W	2.8E-8	6.7E-9	2.4E-9	1.2E-9	7.0E-10	4.6E-10	3.2E-10	2.4E-10	1.9E-10	1.5E-10
WNW	1.9E-8	4.6E-9	1.7E-9	8.2E-10	4.8E-10	3.2E-10	2.2E-10	1.6E-10	1.3E-10	1.0E-10
NW	2.9E-8	7.0E-9	2.5E-9	1.3E-9	7.3E-10	4.8E-10	3.4E-10	2.5E-10	1.9E-10	1.5E-10
NNW	4.1E-8	9.9E-9	3.6E-9	1.8E-9	1.0E-9	6.8E-10	4.8E-10	3.6E-10	2.7E-10	2.2E-10

TABLE C4.0-2

(2 of 2)

CATAWBA NUCLEAR STATION

The valves presented in this table were generated by using the computer program XOQDOQ (NUREQ/CR-2919) which implements NRC Regulatory Guide 1.111 (1977) and the following assumptions:

1. Data Collection Period, 12/17/75 to 12/16/77.

2. Ground Level Releases.

3. Height of The Vent's Building = 47 meters.

4. Open Terrain Recirculation Connection Factors.

TABLE C4.0-3 *

(1 of 3)

CATAWBA NUCLEAR STATION
ADULT $A_{ai\tau}$ DOSE PARAMETERS

(mrem/hr per μCi/ml)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	4.58E-01	4.58E-01	4.58E-01	4.58E-01	4.58E-01	4.58E-01
NA 24	4.11E+02	4.11E+02	4.11E+02	4.11E+02	4.11E+02	4.11E+02	4.11E+02
CR 51	0.0	0.0	1.28E+00	7.65E-01	2.82E-01	1.70E+00	3.22E+02
MN 54	0.0	4.39E+03	8.37E+02	0.0	1.31E+03	0.0	1.34E+04
MN 56	0.0	1.10E+02	1.96E+01	0.0	1.40E+02	0.0	3.52E+03
FE 55	6.64E+02	4.59E+02	1.07E+02	0.0	0.0	2.56E+02	2.63E+02
FE 59	1.05E+03	2.46E+03	9.45E+02	0.0	0.0	6.89E+02	8.21E+03
CO 58	0.0	9.08E+01	2.04E+02	0.0	0.0	0.0	1.84E+03
CO 60	0.0	2.61E+02	5.75E+02	0.0	0.0	0.0	4.90E+03
NI 63	3.14E+04	2.18E+03	1.05E+03	0.0	0.0	0.0	4.54E+02
NI 65	1.28E+02	1.66E+01	7.56E+00	0.0	0.0	0.0	4.20E+02
CU 64	0.0	1.02E+01	4.77E+00	0.0	2.56E+01	0.0	8.66E+02
ZN 65	2.32E+04	7.38E+04	3.33E+04	0.0	4.93E+04	0.0	4.65E+04
ZN 69	4.93E+01	9.44E+01	6.56E+00	0.0	6.13E+01	0.0	1.42E+01
BR 83	0.0	0.0	4.05E+01	0.0	0.0	0.0	5.83E+01
BR 84	0.0	0.0	5.25E+01	0.0	0.0	0.0	4.12E-04
BR 85	0.0	0.0	2.16E+00	0.0	0.0	0.0	0.0
RB 86	0.0	1.01E+05	4.71E+04	0.0	0.0	0.0	1.99E+04
RB 88	0.0	2.90E+02	1.54E+02	0.0	0.0	0.0	4.00E-09
RB 89	0.0	1.92E+02	1.35E+02	0.0	0.0	0.0	1.12E-11
SR 89	2.28E+04	0.0	6.54E+02	0.0	0.0	0.0	3.66E+03
SR 90	2.84E+05	0.0	7.62E+04	0.0	0.0	0.0	1.62E+04
SR 91	4.20E+02	0.0	1.70E+01	0.0	0.0	0.0	2.00E+03
SR 92	1.59E+02	0.0	6.88E+00	0.0	0.0	0.0	3.15E+03
Y 90	5.97E-01	0.0	1.60E-02	0.0	0.0	0.0	6.33E+03
Y 91M	5.64E-03	0.0	2.18E-04	0.0	0.0	0.0	1.66E-02
Y 91	8.75E+00	0.0	2.34E-01	0.0	0.0	0.0	4.82E+03
Y 92	5.24E-02	0.0	1.53E-03	0.0	0.0	0.0	9.18E+02

* Methodology for table provided by: M. E. Wrangler, RAB:NRR:NRC on 3/17/83

TABLE C4.0-3

(2 of 3)

CATAWBA NUCLEAR STATION
ADULT $A_{ai\tau}$ DOSE PARAMETERS

(mrem/hr per μCi/ml)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LII
Y 93	1.66E-01	0.0	4.59E-03	0.0	0.0	0.0	5.27E+03
ZR 95	3.07E-01	9.85E-02	6.67E-02	0.0	1.55E-01	0.0	3.12E+02
ZR 97	1.70E-02	3.43E-03	1.57E-03	0.0	5.18E-03	0.0	1.06E+03
NB 95	4.47E+02	2.49E+02	1.34E+02	0.0	2.46E+02	0.0	1.51E+06
MO 99	0.0	1.13E+02	2.14E+01	0.0	2.55E+02	0.0	2.61E+02
TC 99M	9.41E-03	2.66E-02	3.39E-01	0.0	4.04E-01	1.30E-02	1.57E+01
TC 101	9.68E-03	1.40E-02	1.37E-01	0.0	2.51E-01	7.13E-03	4.19E-14
RU 103	4.84E+00	0.0	2.08E+00	0.0	1.85E+01	0.0	5.65E+02
RU 105	4.03E-01	0.0	1.59E-01	0.0	5.20E+00	0.0	2.46E+02
RU 106	7.19E+01	0.0	9.10E+00	0.0	1.39E+02	0.0	4.65E+03
AG 110M	1.23E+00	1.14E+00	6.78E-01	0.0	2.24E+00	0.0	4.66E+02
TE 125M	2.57E+03	9.32E+02	3.45E+02	7.74E+02	1.05E+04	0.0	1.03E+04
TE 127M	6.50E+03	2.32E+03	7.92E+02	1.66E+03	2.64E+04	0.0	2.18E+04
TE 127	1.06E+02	3.79E+01	2.28E+01	7.32E+01	4.30E+02	0.0	8.33E+03
TE 129M	1.10E+04	4.12E+03	1.75E+03	3.79E+03	4.61E+04	0.0	5.56E+04
TE 129	3.01E+01	1.13E+01	7.34E+00	2.31E+01	1.27E+02	0.0	2.27E+01
TE 131M	1.66E+03	8.12E+02	6.77E+02	1.29E+03	8.23E+03	0.0	8.06E+04
TE 131	1.89E+01	7.90E+00	5.97E+00	1.55E+01	8.28E+01	0.0	2.68E+00
TE 132	2.42E+03	1.56E+03	1.47E+03	1.73E+03	1.51E+04	0.0	7.40E+04
I 130	2.88E+01	8.50E+01	3.35E+01	7.20E+03	1.33E+02	0.0	7.32E+01
I 131	1.59E+02	2.27E+02	1.30E+02	7.43E+04	3.89E+02	0.0	5.98E+01
I 132	7.74E+00	2.07E+01	7.24E+00	7.24E+02	3.30E+01	0.0	3.89E+00
I 133	5.41E+01	9.41E+01	2.87E+01	1.38E+04	1.64E+02	0.0	8.46E+01
I 134	4.04E+00	1.10E+01	3.93E+00	1.90E+02	1.75E+01	0.0	9.57E-03
I 135	1.69E+01	4.42E+01	1.63E+01	2.92E+03	7.09E+01	0.0	4.99E+01
CS 134	2.98E+05	7.09E+05	5.80E+05	0.0	2.29E+05	7.62E+04	1.24E+04
CS 136	3.12E+04	1.23E+05	8.86E+04	0.0	6.85E+04	9.39E+03	1.40E+04
CS 137	3.82E+05	5.22E+05	3.42E+05	0.0	1.77E+05	5.89E+04	1.01E+04
CS 138	2.64E+02	5.22E+02	2.5[illegible]E+02	0.0	3.84E+02	3.79E+01	2.23E-03
BA 139	1.14E+00	8.14E-04	3.35E-02	0.0	7.61E-04	4.62E-04	2.03E+00

TABLE C4.0-3

(3 of 3)

CATAWBA NUCLEAR STATION
ADULT $A_{ai\tau}$ DOSE PARAMETERS

(mrem/hr per μCi/ml)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LII
BA 140	2.39E+02	3.00E-01	1.57E+01	0.0	1.02E-01	1.72E-01	4.93E+02
BA 141	5.55E-01	4.19E-04	1.87E-02	0.0	3.90E-04	2.38E-04	2.62E-10
BA 142	2.51E-01	2.58E-04	1.58E-02	0.0	2.18E-04	1.46E-04	3.54E-19
LA 140	1.55E-01	7.82E-02	2.07E-02	0.0	0.0	0.0	5.74E+03
LA 142	7.94E-03	3.61E-03	9.00E-04	0.0	0.0	0.0	2.64E+01
CE 141	4.31E-02	2.91E-02	3.30E-03	0.0	1.35E-02	0.0	1.11E+02
CE 143	7.59E-03	5.61E+00	6.21E-04	0.0	2.47E-03	0.0	2.10E+02
CE 144	2.25E+00	9.39E-01	1.21E-01	0.0	5.57E-01	0.0	7.59E+02
PR 143	5.71E-01	2.29E-01	2.83E-02	0.0	1.32E-01	0.0	2.50E+03
PR 144	1.87E-03	7.76E-04	9.49E-05	0.0	4.38E-04	0.0	2.69E-10
ND 147	3.90E-01	4.51E-01	2.70E-02	0.0	2.64E-01	0.0	2.17E+03
W 187	2.96E+02	2.48E+02	8.65E+01	0.0	0.0	0.0	3.11E+04
NP 239	3.11E-02	3.06E-03	1.69E-03	0.0	9.54E-03	0.0	6.28E+02

C5.0 Radiological Environmental Monitoring

The Radiological Environmental Monitoring Program shall be conducted in accordance with Technical Specification, Section 3/4.12.

The monitoring program locations and analyses are given in Tables C5.0-1 through C5.0-3 and Figure C5.0-1.

Site specific characteristics make groundwater sampling, special low-level I-131 analyses on drinking water, and food product sampling unnecessary. Groundwater recharge is from precipitation and the groundwater gradient is toward the effluent discharge area; therefore, contamination of groundwater from liquid effluents is highly improbable. Special low-level I-131 analyses in drinking water will not be performed routinely since the expected I-131 dose from this pathway is less than 1 mrem/year. Food products will not be sampled since lakewater irrigation is not practiced in the vicinity.

The laboratory performing the radiological environmental analyses shall participate in an interlaboratory comparison program which has been approved by the NRC. This program is the Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparsion Studies (crosscheck) Program, our participation code is CP.

The dates of the land-use census that was used to identify the controlling receptor locations was 10/26/82 - 10/28/82. These dates will not be changed unless a subsequent census changes a controlling receptor's location.

TABLE C5.0-1
(1 of 1)
CATAWBA RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS

(TLD LOCATIONS)

SAMPLING LOCATION DESCRIPTION			SAMPLING LOCATION DESCRIPTION		
200	SITE BOUNDARY	(0.7M NNE)	232	4-5 MILE RADIUS	(4.1M NE)
201	SITE BOUNDARY	(0.5M NE)	233	4-5 MILE RADIUS	(4.0M ENE)
202	SITE BOUNDARY	(0.6M ENE)	234	4.5 MILE RADIUS	(4.5M E)
203	SITE BOUNDARY	(0.5M SE)	235	4.5 MILE RADIUS	(4.0M ESE)
204	SITE BOUNDARY	(0.5M SSW)	236	4-5 MILE RADIUS	(4.2M SE)
205	SITE BOUNDARY	(0.6M SW)	237	4-5 MILE RADIUS	(4.8M SSE)
206	SITE BOUNDARY	(0.7M WNW)	238	4-5 MILE RADIUS	(4.2M S)
207	SITE BOUNDARY	(0.8M NNW)	239	4-5 MILE RADIUS	(4.6M SSW)
212	SPECIAL INTEREST	(2.7M ESE)	240	4-5 MILE RADIUS	(4.1M SW)
217	CONTROL	(10.0M SSE)	241	4-5 MILE RADIUS	(4.7M WSW)
222	SITE BOUNDARY	(0.7M N)	242	4-5 MILE RADIUS	(4.6M W)
223	SITE BOUNDARY	(0.5M E)	243	4-5 MILE RADIUS	(4.6M WNW)
224	SITE BOUNDARY	(0.7M ESE)	244	4-5 MILE RADIUS	(4.1M NW)
225	SITE BOUNDARY	(0.5M SSE)	245	4-5 MILE RADIUS	(4.2M NNW)
226	SITE BOUNDARY	(0.5M S)	246	SPECIAL INTEREST	(8.1M ENE)
227	SITE BOUNDARY	(0.5M WSW)	247	CONTROL	(7.5M ESE)
228	SITE BOUNDARY	(0.6M W)	248	SPECIAL INTEREST	(8.2M SSE)
229	SITE BOUNDARY	(0.9M NW)	249	SPECIAL INTEREST	(8.1M S)
230	4-5 MILE RADIUS	(4.4M N)	250	SPECIAL INTEREST	(10.3M WSW)
231	4-5 MILE RADIUS	(4.2M NNE)	251	CONTROL	(9.8M WNW)

TABLE C5.0-2

(1 of 1)

CATAWBA RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS

(OTHER SAMPLING LOCATIONS)

CODE:

W - Weekly Q - Quarterly
SM - Semimonthly SA - Semiannual
M - Monthly

	SAMPLING LOCATION DESCRIPTION	Air Radioiodines & Particulates	Surface Water	Drinking Water	Shoreline Sediment	Milk	Fish	Broadleaf Vegetation
200	Site Boundary (0.7m NNE)	W						
201	Site Boundary (0.5m NE)	W						M
205	Site Boundary (0.6m SW)	W						
208	Discharge Canal (0.5m S)		M		SA		SA	
209	Dairy (7.0m SSW)					SM		
210	Ebenezer Access (2.4m SE)				SA			
211	Wylie Dam (4.0m ESE)		M					
212	Tega Cay (2.7m ESE)	W						
213	Fort Mill Water Supply (7.5m ESE)			M				
214	Rock Hill Water Supply (7.3m SSE)			M				
215	Camp Steere-Hwy 49 (4.1m NNE) Control				SA			
216	Hwy 49 Bridge (4.0m NNE) Control		M				SA	
217	Rock Hill Substation (10 0m SSE) Control	W						M
218	Belmont Water Supply (13.5m N) Control			M				
219	Dairy (6.0m SW)					SM		
220	Dairy (8.0m WSW)					SM		
221	Dairy (13.0m NW) Control					SM		

TABLE C5.0-3
(1 of 1)
CATAWBA RADIOLOGICAL MONITORING PROGRAM ANALYSES

SAMPLE MEDIUM	ANALYSIS SCHEDULE	ANALYSES				
		GAMMA ISOTOPIC	TRITIUM	LOW LEVEL I-131	GROSS BETA	TLD
1. Air Radioiodine and Particulates	Weekly	X				
2. Direct Radiation	Quarterly					X
3. Surface Water	Monthly	X				
	Quarterly Composite		X			
4. Drinking Water	Monthly	X			X	
	Quarterly Composite		X			
5. Shoreline Sediment	Semiannually	X				
6. Milk	Semimonthly	X		X		
7. Fish	Semiannually	X				
8. Broadleaf Vegetation	Monthly	X				

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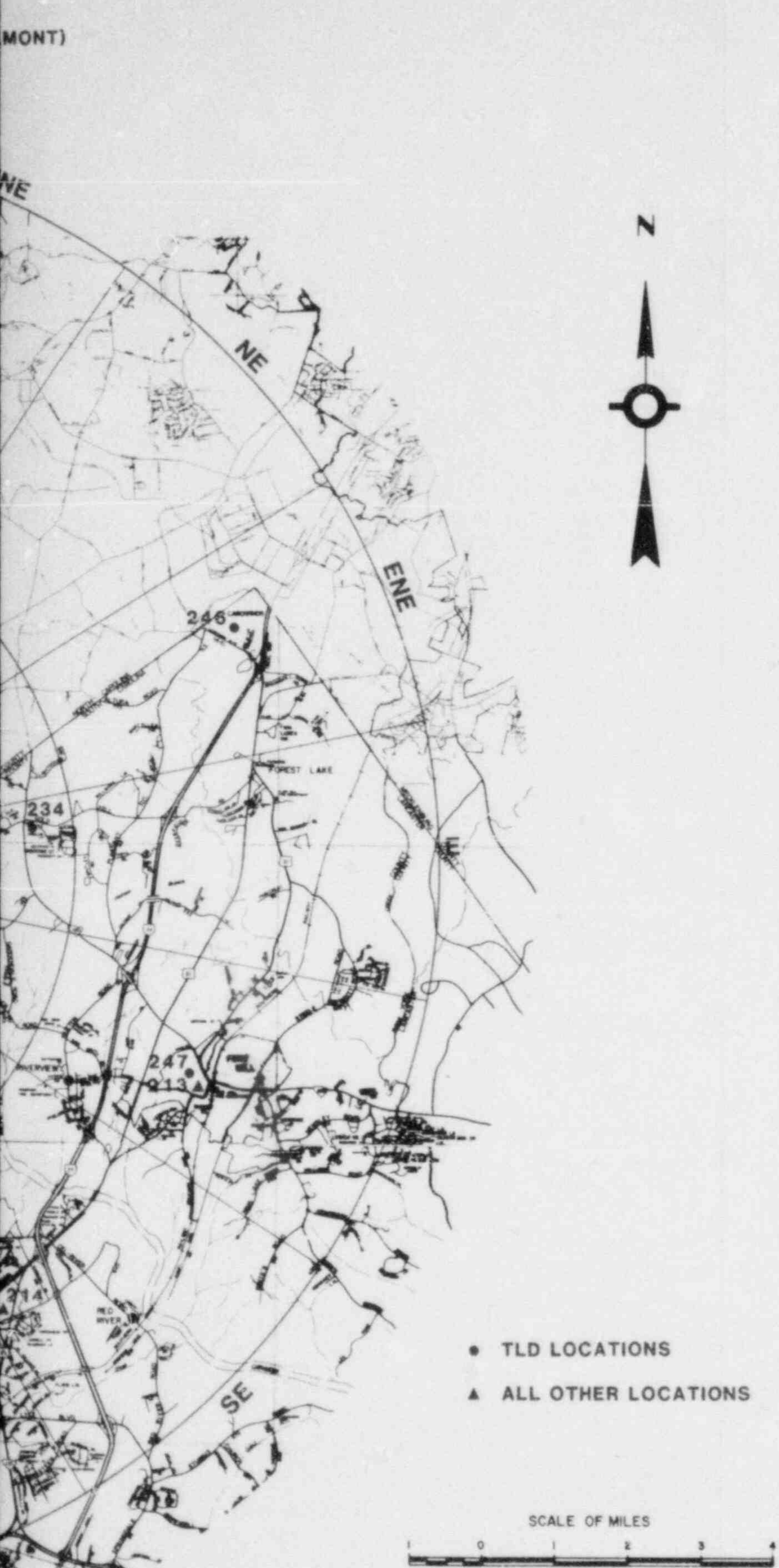
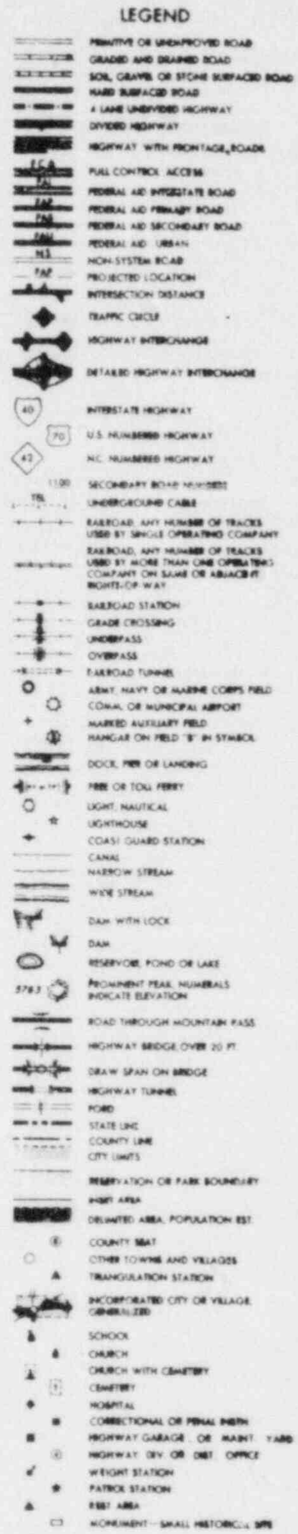
APERTURE
CARD





CATAWBA NUCLEAR STATION

MONITORING PROGRAM LOCATIONS

FIGURE C5.0-1

(1 OF 2)

Also Available On Aperture Card

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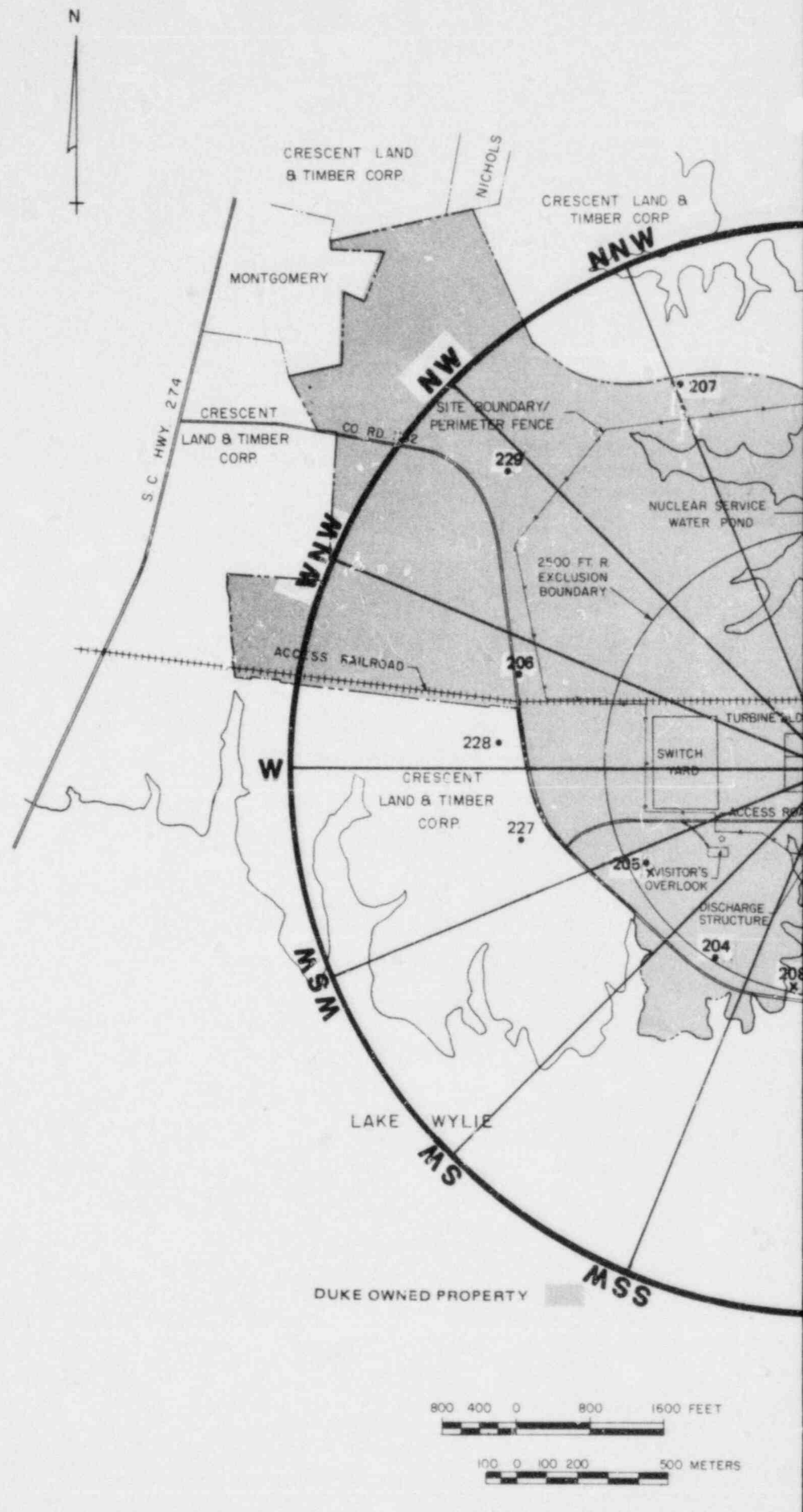
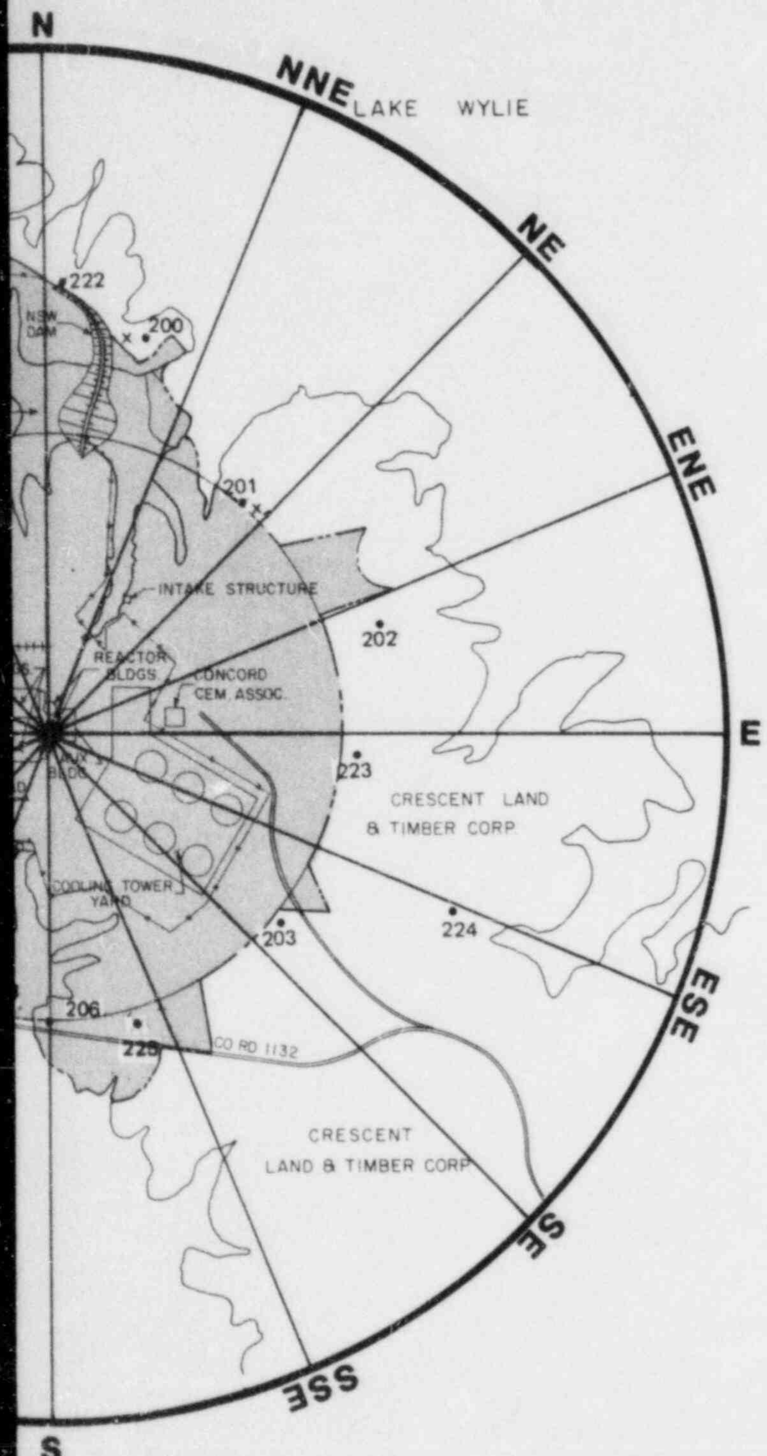


N
CRESCENT LAND
& TIMBER CORP.
NICHOLS
CRESCENT LAND &
TIMBER CORP.
NNW
MONTGOMERY
NW
207
SITE BOUNDARY/
PERIMETER FENCE
CRESCENT
LAND & TIMBER
CORP.
S.C. HWY. 274
229
NUCLEAR SERVICE
WATER POND
WNW
2500 FT. R.
EXCLUSION
BOUNDARY
ACCESS RAILROAD
206
228
W
SWITCH
YARD
CRESCENT
LAND & TIMBER
CORP.
227
205
VISITOR'S
OVERLOOK
DISCHARGE
STRUCTURE
WSW
204
LAKE WYLIE
SW
SSW
DUKE OWNED PROPERTY
800 400 0 800 1600 FEET
100 0 100 200 500 METERS



• TLD LOCATIONS
× ALL OTHER LOCATIONS

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MONITORING PROGRAM LOCATIONS
FIGURE C5.0-1
(2 OF 2)
CATAWBA NUCLEAR STATION

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