Effective Date:

TECHNICAL REVIEW	
Prepared by: ______________________	Date: __________
Reviewed by: ______________________ Independent Reviewer	Date: __________

PROCEDURE APPROVAL	
Approved by: ______________________ Manager, Emergency Planning	Date: __________
Reviewed by: ______________________ Operations Committee Chairman	Date: __________
Approved by: ______________________ Plant Manager, Nuclear	Date: __________
Authorized by: ______________________ Vice President, Nuclear	Date: __________

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1.0 PURPOSE

(1) This section describes the methods, systems and equipment currently available for assessing and monitoring actual or potential offsite consequences of a radiological emergency condition.

(2) The Nuclear Management Company (NMC) is assigned operational responsibility for the DAEC. However, IES maintains corporate accountability for activities at the DAEC and will participate when necessary in activities at the DAEC. The reference "IES/NMC" will be used throughout this procedure to signify this relationship. Further details regarding this relationship can be found in the "Nuclear Power Plant Operating Services Agreement" (NPPOSA) between IES and the NMC.

2.0 REQUIREMENTS

2.1 CHARACTERISTIC PLANT SYSTEM AND EFFLUENT PARAMETER VALUES

(1) Table D-1 identifies plant conditions, parameters, and potentially hazardous occurrences in the environment which enable definition of the emergency classification. Instrumentation, equipment status and parameter values associated with each condition are included in the EAL Tables located in the EPIP's.

2.2 ACCIDENT ASSESSMENT CAPABILITIES AND RESOURCES

(1) Systems or equipment which will be available during the course of an event to monitor and assess the magnitude of an actual or potential radiological release at the DAEC include the following, each of these is further described in the following paragraphs:

- • High Range Effluent Monitoring System
- • Containment High Range Radiation Monitoring System
- • Area Radiation Monitoring System
- Low Level Iodine Sampling and Analysis Equipment
- Dose Projection Program

(A) The Kaman Effluent Monitoring System consists of 11 monitor units installed in the Turbine Building vent stack, three Reactor Building vent stacks, Off-gas stack, and LLRSF vent. The Normal Range Monitor is capable of detecting gaseous activity ranging from 5×10^{-7} μCi/cc to 1×10^{-2} μCi/cc using a β scintillation detector.

(i) Each of the monitors has particulate and iodine collectors for laboratory sample analysis as well as a means for obtaining a gas grab sample.

(ii) The five Accident Range Monitors, consist of two Geiger-Mueller detectors within a shielded sample chamber and is capable of detecting gaseous activity ranging from 1×10^{-2} μCi/cc to 1×10^{5} μCi/cc. Each monitor, as well, includes three particulate/iodine shielded collection assemblies and associated Geiger-Mueller detectors. Sample collection is automatically initiated within one assembly, shifting to the next upon reaching a pre-set radiation level and minimum set amount of time until all assemblies reach the maximum radiation levels at which point the last assembly will continue to collect although assembly has met saturation conditions. Technicians can collect filter media and reset collection.

(iii) One microcomputer is provided for each radiation monitoring unit and provides for complete control over the monitor. Pulse inputs from the detectors are converted into counts per minute and based upon the sample flow rate is displayed in Ci/cc. Release rate calculations can be made using existing vent stack flow rate monitoring instrumentation. The microcomputer also calculates average radiation levels over a 1-minute, 10-minute, 1-hour, and 24-hour period. These averages can be displayed for the last 30 periods calculated; e.g., the last thirty 1-minute periods, 10-minute periods, etc.

(iv) Control and readout of units can be exercised from the Control Room and the Chemistry Laboratory through a minicomputer and associated peripheral equipment. Color CRT displays are available in both locations while a logger and CRT display printer are available in the Chemistry Laboratory.

(v) Alarm functions provided include alert and high level alarms, rate of change alarms, and equipment failure alarms. Automatic control functions provided include check source activities, purging, and sample flow control.

(B) The High Range Containment Monitoring System consists of four γ sensitive ion chambers, two in the torus area and the other two inside the drywell. The detectors are capable of measuring radiation levels up to 1 to 10^7 R/hr, and can be monitored in the Control Room.

(i) Further information regarding how these monitor readings can be used to calculate offsite doses based on the potential for release are discussed in Section D and the Emergency Plan Implementing Procedures.

(ii) In addition to direct readout meter indications in the Control Room, a recorder is provided as well as several high level and inoperable alarms.

(C) In addition to the above mentioned high range radiation monitoring systems, additional process and area radiation monitoring capabilities are available which enable assessment of inplant radiological conditions, fuel clad deterioration and effluent releases. The area radiation monitors, their range and location are provided in Table I-1. Information regarding the process monitors is provided in Tables I-2 and I-3.

(i) (D) Under accident conditions, the normal sampling stations for obtaining representative Reactor Coolant System samples or primary containment atmospheric samples may be inaccessible or, if accessible, obtaining such samples may result in an individual receiving exposures in excess of 10 CFR 20 limits (10 CFR 50).

NOTE

Conditions may vary widely and change quickly during preparation for sampling and actual sampling during the period following an accident. The Site Radiation Protection Coordinator (SRPC)/Rad & EOF Manager must be conferred with prior to attempting to retrieve a sample. Assembly of temporary shielding may be necessary.

(i) Locations from which samples can be drawn include the following points listed below. Containment isolation logic circuitry modifications have been provided, where required, to permit obtaining samples under isolated conditions.

- A depressurized Reactor Coolant System sample from the RHR Heat Exchanger discharge line when RHR is in the shutdown cooling mode of operation.
- A torus sample from the RHR/Core Spray Fill Pump 1P-70 casing drain, if pump is running and RHR is in the LCPI, torus cooling, or test mode of operation.
- A torus sample from the RHR Heat Exchanger discharge line when RHR is in the LCPI, torus cooling, or test mode of operation.
- A drywell atmospheric sample from the Containment Atmosphere Monitoring System analyzer sample lines.
- A torus atmospheric sample from the Containment Atmospheric Monitoring system analyzer sample lines.

(ii) The lab is equipped with standard chemistry as well as special equipment used to handle high level samples, etc. Sample preparation and routine chemical analyses activities will be accomplished in a shielded hood provided in the lab.

(E) Radiological data from the Kaman Effluent Monitoring system and meteorological data from the met tower are sent to the SPDS computer and assembled into one-minute raw data averages. The raw data is then transferred to the MIDAS program via DecNet software. The MIDAS program then assembles these raw one-minute averages into 15-minute average raw data files. An internal quality control program either validates the data in the 15-minute average raw data files, or identifies the data as "questionable" and rejects it. The 15-minute raw data files are then used with preset, site-specific information and the 24 accident parameters to complete dose projections.

(i) An interactive computer code (MIDAS) has been developed to perform dose projection calculations. The code can calculate, print, and plot the plume dispersion results of a Class B model for a single release. The calculations produce results for each of 31 spatial intervals (or distances) using a time-dependent plume segment model. Plume trajectory is normally determined by changes in wind direction with time. The model is run assuming flat terrain.

(ii) The MIDAS program uses the plume segment model (CLASS B) repeatedly for each 15-minute release period to compute cumulative doses. Doses from each plume track are overlaid successively on a finely spaced radial grid. Contours of equal dose can be drawn through the doses calculated in the fine grid to produce isopleths over the integration time period. Doses are calculated for up to four projection periods. Results can be plotted on the graphics CRT and can utilize up to four release points (each one treated with a separate plume).

(iii) To support all types of dose calculations within the B model, both time-integrated and "snapshot" (for dose rates) processing will be used. Snapshot processing enables estimation of the plume location at the current time as well as dose rate estimates from deposited particulates (ground shine) after the plume has left.

2.3 RADIOLOGICAL SOURCE TERM AND MAGNITUDE DETERMINATION

(1) The ratio of iodine to total gaseous activity has been established in the program and companion procedures assuming a TID 14844 source term. Modifications to this source term can be input to the program based upon the results of isotopic analyses conducted on containment atmospheric sampling and effluent stream filter cartridges. The means available to obtain and analyze these samples is discussed in paragraph 2.2 preceding.

(2) As discussed in paragraph 2.2, the effluent monitoring system is capable of detecting and measuring a wide range of effluent activity concentrations up to those that could be present presuming the TID 14844 source term. In addition, the containment radiation monitors discussed in paragraph 2.2 will provide an indication of the quantity of radioactive material available for release using the relationship specified. A procedure has been developed to relate containment radiation monitor readings to offsite doses.

(A) Process monitors are available to provide an indication of radioactivity released in effluent water streams. An estimate of the magnitude of activity released can be made using installed plant instrumentation; e.g., tank levels and flow rates, and isotopic analyses of the source of activity. Further refinements can be made by sampling and analyses of effluent streams, aquatic biota, etc. The MIDAS source code can also be used to make dose projections for liquid releases.

2.4 EFFLUENT MONITOR READINGS VS. EXPOSURE AND CONTAMINATION LEVELS

(1) The MIDAS dose projection program discussed in paragraph 2.2 provides the mechanism to relate effluent monitor readings to onsite and offsite exposures.

(A) Due to the inherent inaccuracies in attempting to predict plume shape, downwind meteorological conditions, elevated atmospheric conditions and the like, field monitoring and analyses of airborne, waterborne, and environmental media provide the only real means of assessing the impact of radiological releases that may occur.

(2) If the MIDAS dose projection program is not operable, a PC-based program (laptop computer) is available in the TSC and EOF as a backup.

2.5 METEOROLOGICAL INFORMATION ACQUISITION/EVALUATION

(1) The DAEC onsite meteorological program was initiated January 10, 1971. New redundant instrumentation was added in November, 1984. In accordance with the regulatory position on Regulatory Guide 1.97, Revision 2, the meteorological system was designed in accordance with proposed Revision 1 to Regulatory Guide 1.23. Instrumentation is provided that is capable of measuring wind direction, wind speed, and ambient air temperature at two levels on the DAEC meteorological tower. Instrumentation is also provided for measuring the dewpoint at one level. For a discussion of the instrumentation, refer to Chapter 2 of the Updated Final Safety Analysis Report. Meteorological parameters monitored are also identified in Section H of this plan.

2.6 RELEASE RATE/PROJECTED DOSE METHODOLOGY FOR OFF-SCALE OR INOPERABLE INSTRUMENTS

(1) Emergency Plan Implementing Procedures exist for estimating release rate based on drywell and torus containment radiation monitor readings.

2.7 FIELD MONITORING

(1) Field monitoring is performed by DAEC personnel entailing, at a minimum, dose rate measurements and airborne sampling in the Plume Exposure Emergency Planning Zone. Results are reported to the Radiological Assessment Coordinator in the Emergency Operations Facility (or to the Site Radiation Protection Coordinator in the Technical Support Center if the EOF is not yet activated) where direction and control of the teams is exercised. Whereas DAEC personnel will most likely be the first radiation survey teams dispatched to monitor the environs surrounding the site, the State of Iowa is also responsible for offsite monitoring. State teams will be dispatched to conduct similar monitoring activities and DAEC personnel will continue to supplement the State efforts. IES/NMC will coordinate offsite monitoring efforts conducted by DAEC personnel with those conducted by the State of Iowa. Upon termination of the release, IES/NMC will coordinate as required with the State of Iowa in establishing a long term environmental monitoring program.

2.8 RADIOLOGICAL HAZARD ASSESSMENT

(1) Radiological hazard assessment offsite commences with activation of the emergency plan, for those events with actual or potential releases. Field monitoring teams are dispatched from the Operational Support Center along the probable plume path, to ascertain the magnitude and location of contamination and radiation areas.

(2) Teams will be dispatched and report locations by using reference locations or grid coordinates as shown on the DAEC Emergency Planning Zone map provided as Figure I-1.

(3) Teams will normally be dispatched in IES/NMC vehicles. The monitoring teams are equipped with portable radios (described in Section F), survey and dose rate instruments, airborne sampling equipment, protective clothing and respiratory protection equipment. A further delineation of emergency equipment carried by the Field Teams is specifically identified in the Emergency Plan Implementing Procedures.

2.9 DETECTION AND MEASUREMENT OF RADIOIODINE CONCENTRATIONS

(1) Field teams dispatched are capable of measuring radioiodine concentration in air in the Plume Exposure EPZ as low as 10^{-7} μCi/cc. Estimates of airborne concentrations made using a survey meter with pancake probe on contact with a Silver Zeolite cartridge are provided to the Radiological Assessment Coordinator in the EOF. Filters and cartridges will be retained and a more accurate estimate of airborne concentrations obtained using laboratory counting equipment available at the DAEC or offsite laboratory facilities. A further discussion of additional laboratory facilities is contained in Section C.

2.10 RELATIONSHIP OF MEASURED PARAMETERS TO DOSE RATES

(1) Various radiological parameters (contamination levels, water activity concentrations, air activity concentrations, etc.) measured in the field following an incident may be related to dose rates through the identification of key isotopes and gross radioactivity measurements. As discussed in paragraph 2.2, the MIDAS dose projection computer program incorporates the use of real time meteorological information, effluent release data and appropriate plant status inputs to calculate Deep Dose Equivalent (whole body dose) rates and estimate both Deep Dose Equivalent (whole body) and Committed Dose Equivalent (thyroid dose) commitments.

(2) The results of analysis of environmental media and calculations related to total population exposure through the inhalation and ingestion pathways will be accomplished in accordance with the existing Appendix I Program.

3.0 <u>ATTACHMENTS</u>

(1) TABLE I-1, "AREA RADIATION MONITORS"

(2) TABLE I-2, "PROCESS RADIATION MONITORS"

(3) TABLE I-3, "PROCESS RADIATION MONITORS FOR HIGH RANGE EFFLUENT MONITORING SYSTEM"

(1) FIGURE I-1, "DAEC EMERGENCY PLANNING ZONE"

TABLE I-1

AREA RADIATION MONITORS

Monitor Designator	Monitor Location	Range
RE-9151	RW Control Room (786’)	0.1-10^3 mr/hr
RE-9152	RW Centrifuge Hallway	0.1-10^3 mr/hr
RE-9153	RB New Fuel Storage Area (855')	0.1-10^3 mr/hr
RE-9154	RW Drumming Area (757'-6")	0.1-10^3 mr/hr
RE-9155	RB Jungle Room (812')	1-10^6 mr/hr
RE-9156	RB Water Clean-up Recirc Pump Area(786')	1-10^6 mr/hr
RE-9157	RB Water Clean-up Heat Exch. (786')	1-10^6 mr/hr
RE-9158	TB Condensate Pumps Area (734')	0.1-10^3 mr/hr
RE-9159	TB Reactor Feed Pump Area (734)	0.1-10^3 mr/hr
RE-9160	TB Turbine Lube Oil Area (734')	0.1-10^3 mr/hr
RE-9161	TB Machine Shop Area (757'-6")	0.01-10^2 mr/hr
RE-9162	AB Control Room Area (786')	0.1-10^3 mr/hr
RE-9163	RB Refueling Floor - North End (855')	0.01-10^2 mr/hr
RE-9164	RB Refueling Floor - South End (855')	0.01-10^2 mr/hr
RE-9165	AB OSC Hallway (757'-6")	0.01-10^2 mr/hr
RE-9166	RB SW Corner Room (716'-9")	0.1-10^3 mr/hr
RE-9167	RB Rx Bldg Railroad Access (757'-6")	0.1-10^3 mr/hr
RE-9168	RB North CRD Module Area (757'-6")	0.1-10^3 mr/hr
RE-9169	RB South CRD Module Area (757'-6")	0.1-10^3 mr/hr
RE-9170	RB CRD Repair Room (757'-6")	0.1-10^3 mr/hr
RE-9171	RB Exhaust Fan Room (812')	0.1-10^3 mr/hr
RE-9172	AB Rad. Chem. Lab (786')	0.1-10^3 mr/hr
RE-9173	RB Spent Resin Tank Room (786')	0.1-10^3 mr/hr
RE-9174	TB Sump Area Entrance (734')	0.1-10^3 mr/hr
RE-9175	RB Cond. Phase Tank & Corridor Area (833'-6")	0.1-10^3 mr/hr
RE-9176	RB TIP Drive Room (757'-6")	1-10^4 mr/hr
RE-9177	RB Outside Cleanup Phase Separators Tank Room (786')	1-10^4 mr/hr
RE-9178	RB Spent Fuel Storage Area (855')	1-10^4 mr/hr

Monitor Designator	Monitor Location	Range
RE-9179	TB Turbine Standard Area (780')	1-10^4 mr/hr
RE-9180	RB 1T-70, 73 Waste Collector/Floor Drain Tank Room	1-10^4 mr/hr
RE-9184A	Drywell	1-10^7 R/hr
RE-9184B	Drywell	1-10^7 R/hr
RE-9185A	Torus	1-10^7 R/hr
RE-9185B	Torus	1-10^7 R/hr

CODE

RW Radwaste Bldg.

RB Reactor Bldg.

TB Turbine Bldg.

AB Administrative Bldg.

TABLE I-2

PROCESS RADIATION MONITORS

Monitor Designator	Monitor Location	Range
RE-4448A	Main Steamline	1-10^6 mr/hr
RE-4448B	Main Steamline	1-10^6 mr/hr
RE-4448C	Main Steamline	1-10^6 mr/hr
RE-4448D	Main Steamline	1-10^6 mr/hr
RE-3972	Radwaste Effluent	0.1-10^6 cps
RE-1997	RHR and Emergency Service Water	0.1-10^6 cps
RE-4820	Reactor Building Closed Cooling Water	0.1-10^6 cps
RE-4767	Service Water Effluent	0.1-10^6 cps
RE-4104	Off-Gas Pre-Treatment	1-10^6 mr/hr
RE-4105	Off-Gas Linear Flux Tilt	0-125 units
RE-4101A	Off-Gas Post-Treatment	0.1-10^6 cps
RE-4101B	Off-Gas Post-Treatment	0.1-10^6 cps
RE-4131A	Reactor Building Refueling Ventilation Exhaust	0.01-100 mr/hr
RE-4131B	Reactor Building Refueling Ventilation Exhaust	0.01-100 mr/hr
RE-7606A	Reactor Building (Mezzanine)	0.05-50 mr/hr
RE-7606B	Reactor Building (Mezzanine)	0.05-50 mr/hr
RE-6101A	Control Building Intake	0.05-50 mr/hr
RE-6101B	Control Building Intake	0.05-50 mr/hr
RE-7722A	Technical Support Center Building Intake (Left)	0.1-10^4 mr/hr
RE-7722B	Technical Support Center Building Intake (Right)	0.1-10^4 mr/hr
RE-7722C	Technical Support Center Working Area	0.1-10^4 mr/hr
RE-4138	Carbon Bed Vault (Off-Gas Building)	1-10^6 mr/hr
RE-4268	RHRSW/ESW Effluent	0.1-10^6 cps
RE-4116A	Offgas	0.1-10^6 cps
RE-4116B	Offgas	0.1-10^6 cps

TABLE I-3

PROCESS RADIATION MONITORS FOR HIGH RANGE EFFLUENT MONITORING SYSTEM

Monitor Designator	Monitor Location	Range
RE-5945	Turbine Building Ventilation Exhaust	5×10^{-7} - $1E^{-1}$ µCi/cc
RE-5946	Turbine Building Ventilation Exhaust	0.01 - 10^{5} µCi/cc
RE-7645	Reactor Building Ventilation Exhaust	5×10^{-7} - $1E^{-1}$ µCi/cc
RE-7644	Reactor Building Ventilation Exhaust	0.01 - 10^{5} µCi/cc
RE-7647	Reactor Building Ventilation Exhaust	5×10^{-7} - $1E^{-1}$ µCi/cc
RE-7646	Reactor Building Ventilation Exhaust	0.01 - 10^{5} µCi/cc
RE-7649	Reactor Building Ventilation Exhaust	5×10^{-7} - $1E^{-1}$ µCi/cc
RE-7648	Reactor Building Ventilation Exhaust	0.01 - 10^{5} µCi/cc
RE-4176	Off-Gas Stack Discharge	5×10^{-7} - $1E^{-1}$ µCi/cc
RE-4175	Off-Gas Stack Discharge	0.01 - 10^{5} µCi/cc

FIGURE I-1
DAEC EMERGENCY PLANNING ZONE