TABLE XI-6

RADIOLOGICAL EFFECTS OF THE FUEL LOADING ACCIDENT[1]

External Passing Cloud Dose (rad)

Distance (miles)	Total Accident Exposure VS-2	MS-2	N-2	N-10	U-2	U-10	
1/2	2.0×10^{-2}	2.1×10^{-2}	2.1×10^{-2}	1.2×10^{-2}	2.1×10^{-2}	8.1×10^{-3}	
1	1.5×10^{-2}	1.9×10^{-2}	1.7×10^{-2}	6.9×10^{-3}	1.7×10^{-4}	4.7×10^{-3}	
5	1.7×10^{-3}	2.0×10^{-3}	1.4×10^{-3}	5.0×10^{-4}	5.0×10^{-4}	2.1×10^{-4}	
9	6.2×10^{-4}	7.6×10^{-4}	2.9×10^{-4}	1.5×10^{-4}	1.2×10^{-4}	5.7×10^{-5}	
12	3.1×10^{-4}	4.0×10^{-4}	1.2×10^{-4}	8.1×10^{-5}	4.3×10^{-5}	2.6×10^{-5}	
Lifetime Thyroid Dose (rad)							
1/2	a[2]	a	5.7×10^{-5}	2.5×10^{-3}	2.5×10^{-1}	1.5×10^{-2}	‡
1	a	a	1.6×10^{-2}	6.9×10^{-2}	2.3×10^{-1}	8.1×10^{-2}	‡
5	a	3.5×10^{-3}	1.3×10^{-1}	3.9×10^{-2}	2.1×10^{-1}	6.0×10^{-3}	‡
9	a	8.7×10^{-3}	3.9×10^{-2}	1.5×10^{-2}	7.4×10^{-3}	2.2×10^{-4}	‡
12	a	2.5×10^{-2}	2.8×10^{-2}	8.7×10^{-3}	3.9×10^{-3}	1.1×10^{-4}	‡
Fallout Dose (roentgen)							
1/2	a	a	1.3×10^{-8}	3.0×10^{-5}	9.7×10^{-4}	3.0×10^{-3}	‡
1	a	a	3.7×10^{-5}	7.6×10^{-4}	9.0×10^{-4}	1.6×10^{-4}	‡
5	a	5.7×10^{-6}	3.8×10^{-4}	4.6×10^{-4}	8.3×10^{-5}	1.2×10^{-5}	‡
9	a	1.4×10^{-6}	8.5×10^{-5}	1.7×10^{-5}	2.8×10^{-5}	4.4×10^{-5}	‡
12	a	3.9×10^{-5}	6.4×10^{-5}	9.9×10^{-5}	1.5×10^{-6}	2.2×10^{-6}	‡

Direct Radiation (roentgen/h)

Peak 2-hour dose rate at 1/2 mile is 6×10^{-6}

Fallout Dose - Washout (roentgen)

Distance (miles)		MS-2					
1/2		1.1×10^{-3}					‡
1		4.6×10^{-3}					‡
5		7.6×10^{-4}					‡
9		2.8×10^{-4}					‡
12		1.4×10^{-5}					‡

(1) Calculated using meteorological diffusion methods in HW-SA-2809, see Section XI-6.3.2h.

(2) The symbol "a" means less than 1×10^{-10}.

2.0 SITE AND ENVIRONS

The information presented in this section summarizes Volume III, Site and Environs.

2.1 Location of Site

The Dresden Nuclear Power Station consists of a land tract of approximately 953 acres located in the northeast quarter of the Morris 15′ quadrangle (as designated by the U. S. G. S.), County of Grundy, State of Illinois. The tract is situated in portions of Sections 25, 26, 27, 34, 35, and 36 of Aux Sable Township (T.34N., R.8E.).

The principal structures of DNPS Unit 2 will be located approximately on the boundary between Sections 26 and 35, several hundred feet west of the corner point of Sections 25, 26, 35 and 36. This location is approximately at latitude 41°23′20″ North, and longitude 88°16′20″ West. The character and contours of the site and immediate environs are shown in Exhibit III-2-1 (Aerial Photograph) and in Exhibit III-2-2 (Vicinity Map). These exhibits also show the location of Existing Unit 1, while Unit 2 will occupy a similar sized area immediately west of and adjacent to the principal structures of Unit 1. The existing site boundaries generally follow the rivers to the north and east, the railroad on the west, and the road from Divine extended eastward to the Kankakee River on the south as is shown on Exhibit III-5-1.

Paved county roads south of the site connect to state highways within several miles to the east, south, and west. A line of the Elgin, Joliet, and Eastern railroad forms the western boundary of the site, and a siding currently enters the site for service to Unit 1. There are no minor airports within about eight miles of the site, and no major airports within about forty miles.

2.2 Site Ownership and Control

The Commonwealth Edison Company is the sole owner of the entire property. The plant perimeter is fenced in part with agricultural type fencing and is posted at appropriate points. Control of access to the structures of Unit 2 will be by a six-foot chain link type fence surmounted by three-strand barbed wire, with any gates or gatehouses at appropriate locations either secured or attended by plant personnel. This security fencing is expected to be an extension of the existing fencing system for Unit 1.

An access road to the Dresden Island Lock and Dam (U. S. Corps of Engineers) crosses the owned tract from south to north at a distance of about 0.8 mile west of the location of Unit 2. The right of way (easement) for said road was provided to the United States government by the prior owners of the property and was made a condition of the sale to Commonwealth Edison Company.

A narrow strip of land (approximately 17 acres) located on the northeast corner of the property on the Illinois River, is leased by Commonwealth from the State of Illinois. This area is stipulated as a "buffer strip" in the lease which further directs that it remain idle.

2.3 Activities on the Site

New activities on the site will include power generation and associated operations at the proposed Unit 2. Current activities expected to be continued during operation of Unit 2 include power generation and associated operations at the existing Unit 1, some agricultural operations and some limited recreational activities.

Extant lease agreements cover use of a portion of the site for cattle grazing and field crop production. The activities have been performed by one leasee with the number of persons engaged in the work being less than five. Approximately 150 acres are used for grazing, with appropriate fencing provided in the pasture areas to control the approximately 75 head of cattle that may be present during the pasturage growing season. Field crop cultivation generally occupies about 300 acres.

Recreational activity in the form of hunting during the legally prescribed seasons occurs on the site outside the security fenced areas. Entry control of hunters is delegated to the agricultural leasee in recognition of his interest in preventing damage to livestock and crops.

No activities other than those enumerated are currently contemplated for the future.

2.4 Environs Occupancy

Residential occupancy in the immediate vicinity of the Dresden site continues to remain low. Inspection of the aerial photograph (Exhibit III-2-1) shows that within a 1-mile radius there are several residences at the Dresden Dam about 0.8 mile NW of the reactor locations, a few homes at about the same distance on top of the bluffs on the opposite shore of the river to the northeast, and several farm residences at 0.8 to 1.0 miles to the south and southwest. In addition, there is a cluster of about 20 cottages on the west shore of the Kankakee River about 0.7 mile from the reactor location. Most of these are occupied only part-time for recreational purposes. Comparison of the USGS map used in Exhibit III-2-2 which was based on aerial photographs taken in 1952, with the 1964 Aerial Photograph shows that only in this cottage area has there been any increase in the number of roofs visible.

Land usage and population in the environs is summarized in Volume III-3. It is noted that no new small village population nucleus has developed near Dresden within the past 15 years; and also that no small village of as many as 100 residents exists within 3 miles of the site. Within 5 miles, the largest center is Channahon (pop. 1, 200) 3-1/2 miles to the northeast; within 10 miles, the county seat of Morris (pop. 7, 935) 8 miles to the west represents the most heavily occupied octant of the compass. The total 10 mile radius population of about 23, 000 has increased less than 10% in the 1950 - 1960 census interval.

There are only two "population centers" within 25 miles of Dresden. Joliet, centered about 14 miles to the northeast, increased from 52, 000 to 67, 000 in the census interval, but apparently over one-half of this increase was due to annexation. Aurora, 25 miles to the north, increased from 51, 000 to 64, 000 but with similar significant contribution from annexation.

Within a 10-mile radius, the environs are used principally for agriculture, in abandoned strip mines, and for the large Joliet Arsenal reservation. No significant changes have occurred in 10 years, and none are currently known or foreseen.

2.5 Site Geology

The recent study of the geology of the Dresden site was made by Dames and Moore, Consultants in Applied Earth Sciences, Soil Mechanics, Engineering Geology, Geophysics. Work was performed by their San Francisco and Chicago offices, and some of the core testing was done in their New York laboratory.

The previously available geological and associated data and reports for the Dresden area were reviewed, additional background data were collected, and a field reconnaissance of the area was performed by a geologist. The results of the 69 previous borings on the Dresden site were studied, and two additional test borings to the approximate 100 foot depth were made in March 1965 in the immediate area of the Unit 2 principal structures. Samples of the overburden soils and continuous cores of the underlying rock were obtained. Representative cores of rock were subjected to unconfined compression tests, density tests, and laboratory dynamic tests to evaluate the compressional wave velocity and the shear modulus of the various rock strata encountered. Using small explosive charges, tests were performed in the test borings to measure the in-place compressional wave velocities of the various strata present.

The Dames and Moore report of the currently applicable portions of their work is presented as Volume III-2. The results of the Illinois State Geological Survey's analyses in 1957 of the previous records and cores from the previous 69 test borings and from other wells in nearby areas are summarized.

The generalized geologic column for the site consists of an upper layer of Pennsylvanian Pottsville sandstone of variable thickness which in the two new borings showed a thickness of 40 to 50 feet. Next below is a layer of about 15 to 35 feet of Ordovician Maquoketa Divine limestone based on a 65 foot layer of Maquoketa dolomitic shale. The Ordovician system has a total thickness approaching 1000 feet, with the Cambrian system next below. Brecciated rock is found on some cross sections and is indicative of ancient faulting. The geologic evidence indicates that these faults are inactive.

Laboratory tests showed that unconfined ultimate compressive strength on boring samples ranged from 2,000 to 15,000 pounds per square inch on most samples. Laboratory wave velocity propagation tests showed 4,000 to 15,000 feet per second, and the field testing in the two borings was generally consistent with the laboratory findings.

2.6 Hydrology

The Harza Engineering Company, Chicago, Consulting Engineers - River Projects was retained to advise on the characteristics of the river systems of interest. Their report of applicable findings is given in Volume III-5.

The Dresden site at the confluence of the Des Plaines and Kankakee Rivers is at the location considered to divide the upper and lower parts of the Illinois River system. The normal pool elevation due to the adjacent Dresden Island Lock and Dam is 505 feet, with a maximum historical elevation of 506.4. Nominal ground elevation is about 516 feet at the location for the principal structures of Unit 2.

River system flow data applicable to the Dresden site for the years 1961-1964 show that river flow exceeded 3,000 cubic feet per second (cfs) on 98% of the days, 3,600 cfs on 93% of the days, 4,000 cfs on 87% of the days, 5,000 cfs on 63% of the days, and 6,000 cfs on 48% of the days.

The principal usages of the water of the Des Plaines River below Lockport and of the Illinois River are for navigation, sewage disposal and dilution, and condenser cooling water for power plants. At and below Peoria, the Illinois River is also used for domestic water supply. The Kankakee River is not navigable and is used for domestic supply. Corps of Engineers future planning envisions a second lock at the Dresden Dam.

River system water temperatures fluctuate principally due to the seasons. The U. S. P. H. S. in a 1963 report said that due to river usage, the net rise in temperature in the upper portion of the waterway system was about 9°C. The chemical composition of the river waters was studied in detail during 1961 - 1962, as were the biological and bacteriological conditions. The over-all effect is that the lower river system is biologically degraded, and that most sampling stations on the upper and lower system showed evidence of excessive pollution.

2.7 Regional and Site Area Meteorology

Murray and Trettel, Certified Consulting Meteorologists, Northfield, Illinois, have been retained to advise on regional meteorology characteristics, and the summary of their recent studies is given in Volume III-6. Additional studies of site atmospheric diffusion characteristics by Nuclear Safety Engineering, General Electric Company are reported in Volume III-7.

The site is located in typical "rolling prairie" Illinois terrain. The only major topographic influence, meteorologically speaking, in the area is Lake Michigan, but this is 45 miles to the northeast and is considered to have an insignificant effect on the site climatology.

Maximum temperature in the area, based on the July, 1949 - June, 1955 Argonne National Laboratory data, is 97°F, and the minimum is -19°F.

Normal annual precipitation in the area is 33.18 inches. Within a 24 hour period a maximum of 6.24 inches has been recorded. Average yearly snowfall is 37.1 inches, with a maximum of 66.4 inches recorded in the 1929-30 winter season.

In the 50-year period, 1913-1963, four tornadoes have been reported in Grundy County. Of 140 tornadoes reported in the state as a whole, 52 are considered "destructive," i.e., caused $50,000 damage or more and/or at least one death. Average area covered by reported tornadoes is about 8 square miles. The shortest path is 1 mile, the longest 163 miles. Width of paths range from a minimum of 34 yards to 4 miles maximum. No tornado wind velocity information is available.

Annual wind frequencies show a rather uniform distribution of wind direction. The most frequent wind directions are from the west and south sectors (22-1/2 degrees). Average wind speed at the site at the 15-foot level is about 8 mph. Maximum wind velocity reported in the area of the site is 109 mph unofficially reported at Joliet on April 3, 1956, and on April 30, 1962 (the official Weather Bureau station closed in 1952). This is a fastest gust reported during heavy thunderstorms and scattered tornadic activity. The fastest mile of wind reported at various locations in the site area is 87 mph at Chicago and 75 mph at Peoria.

Hourly wind direction variability at the site shows that an average direction range (angular change in direction) is 120 degrees in a 1-hour period, for all wind speed conditions combined. During 0 - 3 mph wind speeds, the average range in direction is 100 degrees. Approximately 87% of the time when the wind speed is 0 - 3 mph (or 98.3% of all wind speeds) the wind direction range is 60 degrees or more, which corresponds to a value of the diffusion parameter $\sigma_\theta \bar{u}$ of 20 degree-mph or 0.16 radian-meters/second.

2.8 Seismology

The Dresden site area is placed in Zone 1 (zone of minor damage) on the seismic probability map of the 1958 Uniform Building Code. The August 1958 Seismic Regionalization map by Richter gives general predictions of probable maximum intensity, and, recognizing that lines between the areas of differing intensity are approximations only, shows the Dresden region as Modified Mercalli 7 to 8.

Only several earthquakes of significant intensity in northern Illinois have been reported since 1800, and none has been accompanied by clear-cut surface faulting. A quake on May 26, 1909, caused moderate damage in Aurora, Bloomington, Chicago, and Joliet, and may have been of intensity MM7 in the Dresden area. A quake on January 2, 1912, had a reported intensity of MM6 at Aurora, Yorkville, and Morris, and probably was of similar intensity at Dresden. Consideration of an intensity of MM7 for the Dresden region appears appropriate.

The engineering consulting firm of John A. Blume and Associates, San Francisco, has been retained for advice on seismology, and they have consulted Dr. Perry Byerly, Oakland, California, on the seismicity of the site region. The consultant's findings are reported in Volume III-4.

2.9 Environs Radioactivity Monitoring

The natural-and-man-made radioactivity of the environs of the Dresden site is surveyed by several monitoring programs. The long-established and continuing program of the Argonne National Laboratory monitors a radius of the order of 100 miles, thus encompassing the Dresden area, and includes one monitoring point 3 miles north of Dresden. An initial series of river samples was analyzed in 1956-7 by the National Aluminate Company under contract to the General Electric Company. The monitoring program of the State of Illinois Department of Health includes sampling of air and water near the Dresden site starting in November 1959. The continuing program sponsored by the Commonwealth Edison Company was started in September 1958, and typically includes some 3000 to 4000 radioactivity analyses and survey instrument readings each year.

Particulate radioactive material in the air is dominated by fallout from weapons testing, reaching a beta emitter peak of 1.3×10^{-11} $\mu c/cc$ in June of 1963 compared to about 10^{-12} $\mu c/cc$ in late 1964.

External gamma radiation of 2 to 3 milliroentgens per week is from natural background cosmic and ground sources, and is not significantly altered by weapons testing.

River water concentrations show a natural background of 1 to 5×10^{-8} $\mu c/cc$ due to natural radium, uranium, and radio-potassium, and have shown an order of magnitude increase during the 1963 peak weapons testing fallout.

Biological samples from the river, and vegetation and milk samples also reflect trends ascribable to weapons testing.

The over-all findings have been in general agreement with other local programs and with the national fallout surveillance network results.

TABLE I-3 ‡

SUMMARY OF MAXIMUM OFFSITE DOSES FROM POSTULATED ACCIDENTS

ACCIDENT	QUANTITY OF FISSION PRODUCTS RELEASED	MAXIMUM TOTAL OFF-SITE EXPOSURE - RADS	
		Whole Body	Thyroid
Rod Drop	44×10^{3} curies noble gases 2.0 curies halogens released to condenser	4.6×10^{-5}	9.6×10^{-3}
Fuel Loading	1.1×10^{-4} curies noble gases 7.2×10^{3} curies halogens released to reactor water	1.9×10^{-2}	1.4×10^{-1}
Steam Line Rupture	12 curies noble gases 12 curies (principally) halogens released into air	3×10^{-7}	4×10^{-4}
Loss of Coolant 1% Melt*	4.7×10^{6} curies noble gases 0.82×10^{6} curies halogens 0.67×10^{6} curies volatile solids 0.10×10^{6} curies other solids airborne in drywell at 30 minutes	3.1×10^{-3}	2.1×10^{-2}

* The cooling systems are designed so that in the event of a loss-of-coolant accident, negligible fuel clad damage is obtained. However, for the purpose of this comparative analysis, it is assumed that 1% of the core melts. ‡

In order to meet this objective the following will be used in design:

In the event of reactor isolation and scrams from any expected power level, the isolation condenser heat exchangers will accommodate removal of decay heat before any water lost through operation of the pressure relief valves has impaired core cooling.

The system has the capacity for the removal of decay heat without addition of water for a reasonable time based on an estimate of the maximum time which might be required to restore pumping power for make-up even under most unusual conditions.

5.2.2 Bases

Interruption of power which drives the reactor feed pumps causes reactor scram due to low water level in the reactor vessel. The water level in the vessel continues to decrease after scram due to the boiloff, caused by fuel fission product decay heating, through either system relief or bypass valves. Since this water level decrease could ultimately cause uncovering of the core, a means must be provided to limit it until feed pumping power is restored. To accomplish this, an isolation condenser is provided. This condenser is connected to the reactor system and operates by natural circulation without the need for driving power other than that used to place the system in operation. This isolation condenser also serves as an alternate heat sink when the reactor is isolated from its normal heat sink (the main condenser).

5.2.3 Description

The isolation condenser system operates by natural circulation without the need for driving power other than the d-c electrical system used to place the system into operation. The system consists of two condensers and associated piping and valves. Piping and valves are provided connecting to the reactor vessel for each isolation condenser so that they act as independent sub-systems. Each condenser consists of two tube bundles immersed in a large water storage tank. Additional water tanks are provided for gravity make-up to the isolation condensers.

In operation of the isolation condenser, steam flows from the reactor, through the tubes of the heat exchangers; after condensing it returns by gravity to the reactor. The valves on the steam inlet lines are normally open so that the tube bundles are at reactor pressure. The isolation condenser is placed in operation by opening the condensate return valve to the reactor system. This is done automatically on high reactor pressure or it can be done at any time by manual control. The normally closed drain valves are d-c operated and remain available on a-c electrical power line failure. During operation, the water on the shell side of the condensers will boil and vent to the atmosphere while condensing steam inside the tube bundles.

Radiation monitors are provided on the shell vents so that in the event of abnormal radiation levels the tube side of the heat exchangers can be isolated from the reactor by closing valves.

The water stored in the shell of the isolation condensers is supplemented by gravity transferred make-up water from storage tanks. Make-up is provided to these tanks from the plant water storage systems. Demineralized water will be supplied to the isolation condenser shells for fill and normal make-up.

TABLE XI-1

RADIOLOGICAL EFFECTS OF THE ROD DROP ACCIDENT[1]

External Passing Cloud Dose (rad)

Distance (miles)	Total Accident Exposure VS-2	MS-2	N-2	N-10	U-2	U-10
1/2	1.5×10^{-6}	1.6×10^{-6}	1.6×10^{-6}	9.2×10^{-7}	1.6×10^{-6}	6.1×10^{-7}
1	1.1×10^{-6}	1.4×10^{-6}	1.3×10^{-6}	5.2×10^{-7}	1.3×10^{-6}	3.5×10^{-7}
5	1.3×10^{-7}	1.0×10^{-7}	1.0×10^{-7}	3.7×10^{-8}	3.7×10^{-8}	1.6×10^{-8}
9	4.6×10^{-8}	5.6×10^{-8}	2.1×10^{-8}	1.1×10^{-8}	8.7×10^{-9}	4.3×10^{-9}
12	2.3×10^{-8}	2.9×10^{-8}	8.7×10^{-9}	6.0×10^{-9}	3.2×10^{-9}	1.9×10^{-9}

Lifetime Thyroid Dose (rad)

Distance (miles)	VS-2	MS-2	N-2	N-10	U-2	U-10
1/2	a[2]	a	9.3×10^{-7}	1.9×10^{-5}	9.6×10^{-3}	2.8×10^{-3}
1	a	a	5.0×10^{-4}	5.2×10^{-4}	8.8×10^{-3}	2.1×10^{-3}
5	a	4.2×10^{-5}	2.4×10^{-3}	5.0×10^{-4}	1.1×10^{-3}	2.1×10^{-4}
9	a	1.8×10^{-4}	1.1×10^{-3}	2.1×10^{-4}	4.3×10^{-4}	9.2×10^{-5}
12	a	3.4×10^{-4}	7.1×10^{-4}	1.4×10^{-4}	2.6×10^{-4}	5.2×10^{-5}

Fallout Dose (roentgen)

Distance (miles)	VS-2	MS-2	N-2	N-10	U-2	U-10
1/2	a	a	4.4×10^{-9}	9×10^{-8}	4.6×10^{-5}	1.3×10^{-5}
1	a	a	2.4×10^{-6}	2.5×10^{-6}	4.3×10^{-5}	1.0×10^{-5}
5	a	2.0×10^{-7}	1.1×10^{-5}	2.4×10^{-6}	4.8×10^{-6}	9.6×10^{-7}
9	a	8.4×10^{-7}	5.4×10^{-6}	1.0×10^{-6}	1.8×10^{-6}	4.2×10^{-7}
12	a	1.6×10^{-6}	3.4×10^{-6}	6.6×10^{-7}	1.2×10^{-6}	2.5×10^{-7}

Fallout Dose - Washout (roentgen)

Distance (miles)	VS-2	MS-2	N-2	N-10	U-2	U-10
1/2		1.1×10^{-3}				
1		4.2×10^{-4}				
5		3.9×10^{-5}				
9		1.6×10^{-5}				
12		9.6×10^{-6}				

(1) Calculated using meteorological diffusion methods described in Section XI-6.3.2 to XI-6.3.2f.

(2) The symbol "a" means less than 1×10^{-10}.

TABLE XI-2

RADIOLOGICAL EFFECTS OF THE ROD DROP ACCIDENT[1]

Distance (miles)	Total Accident Exposure					
	VS-2	MS-2	N-2	N-10	U-2	U-10
External Passing Cloud Dose (rad)						
1/2	1.5×10^{-6}	1.6×10^{-6}	1.6×10^{-6}	9.2×10^{-7}	1.6×10^{-6}	6.1×10^{-7}
1	1.1×10^{-6}	1.4×10^{-6}	1.3×10^{-6}	5.2×10^{-7}	1.3×10^{-6}	3.5×10^{-7}
5	1.3×10^{-7}	1.5×10^{-7}	1.0×10^{-7}	2.7×10^{-8}	3.7×10^{-8}	1.6×10^{-8}
9	4.7×10^{-8}	5.7×10^{-8}	2.1×10^{-8}	1.1×10^{-8}	9.2×10^{-9}	4.3×10^{-9}
12	2.4×10^{-8}	3.0×10^{-8}	9.2×10^{-9}	6.0×10^{-9}	3.3×10^{-9}	1.9×10^{-9}
Lifetime Thyroid Dose (rad)						
1/2	a[2]	a	2.1×10^{-6}	8.4×10^{-5}	8.4×10^{-3}	4.9×10^{-3}
1	a	a	5.5×10^{-4}	2.3×10^{-3}	7.7×10^{-3}	2.7×10^{-3}
5	a	1.2×10^{-4}	4.1×10^{-3}	1.3×10^{-3}	6.9×10^{-4}	2.0×10^{-4}
9	a	2.9×10^{-4}	1.3×10^{-3}	5.0×10^{-4}	2.4×10^{-4}	7.3×10^{-5}
12	a	9.2×10^{-4}	9.2×10^{-4}	3.0×10^{-4}	1.3×10^{-4}	3.6×10^{-5}
Fallout Dose (roentgen)						
1/2	a	a	4.2×10^{-9}	1.0×10^{-6}	3.2×10^{-5}	9.2×10^{-5}
1	a	a	1.2×10^{-6}	2.6×10^{-5}	3.0×10^{-5}	5.2×10^{-5}
5	a	1.9×10^{-7}	9.2×10^{-6}	1.6×10^{-5}	2.8×10^{-6}	3.9×10^{-6}
9	a	4.7×10^{-7}	2.8×10^{-6}	5.7×10^{-6}	9.2×10^{-7}	1.4×10^{-6}
12	a	1.3×10^{-6}	2.1×10^{-6}	3.3×10^{-6}	5.0×10^{-7}	7.2×10^{-7}
Fallout Dose - Washout (roentgen)						
1/2		3.6×10^{-4}				
1		1.4×10^{-4}				
5		2.5×10^{-5}				
9		9.2×10^{-6}				
12		4.8×10^{-6}				

(1) Calculated using meteorological diffusion methods in HW-SA-2809, see Section XI-6.3.2h.

(2) The symbol "a" means less than 1×10^{-10}.

TABLE XI-5

RADIOLOGICAL EFFECTS OF THE FUEL LOADING ACCIDENT[1]

External Passing Cloud Dose (rad)

Distance (miles)	Total Accident Exposure					
	VS-2	MS-2	N-2	N-10	U-2	U-10
1/2	1.8×10^{-2}	1.9×10^{-2}	1.9×10^{-2}	1.1×10^{-2}	1.9×10^{-2}	7.3×10^{-3}
1	1.3×10^{-2}	1.7×10^{-2}	1.5×10^{-2}	6.2×10^{-3}	1.5×10^{-2}	4.2×10^{-3}
5	1.5×10^{-3}	1.8×10^{-3}	1.2×10^{-3}	4.4×10^{-4}	4.4×10^{-4}	1.9×10^{-4}
9	5.5×10^{-4}	6.7×10^{-4}	2.5×10^{-4}	1.3×10^{-4}	1.0×10^{-4}	5.1×10^{-5}
12	2.8×10^{-4}	3.5×10^{-4}	1.0×10^{-4}	7.2×10^{-5}	3.9×10^{-5}	2.3×10^{-5}
Lifetime Thyroid Dose (rad)						
1/2	a[2]	a	1.3×10^{-5}	2.7×10^{-4}	1.4×10^{-1}	4.0×10^{-2}
1	a	a	7.2×10^{-3}	7.4×10^{-3}	1.3×10^{-1}	3.1×10^{-2}
5	a	5.9×10^{-4}	3.6×10^{-2}	7.6×10^{-3}	1.4×10^{-2}	3.1×10^{-3}
9	a	2.5×10^{-3}	1.8×10^{-2}	3.4×10^{-3}	6.1×10^{-3}	1.3×10^{-3}
12	a	4.9×10^{-3}	1.1×10^{-2}	2.3×10^{-3}	3.6×10^{-3}	8.5×10^{-4}
Fallout Dose (roentgen)						
1/2	a	a	3.0×10^{-8}	3.0×10^{-6}	5.4×10^{-4}	7.7×10^{-4}
1	a	a	1.6×10^{-5}	8.5×10^{-5}	4.9×10^{-4}	6.0×10^{-4}
5	a	9.9×10^{-7}	8.1×10^{-5}	8.5×10^{-5}	6.0×10^{-5}	6.0×10^{-5}
9	a	4.5×10^{-6}	4.0×10^{-5}	3.8×10^{-5}	2.1×10^{-5}	2.6×10^{-5}
12	a	8.1×10^{-6}	2.4×10^{-5}	2.2×10^{-5}	1.4×10^{-5}	1.7×10^{-5}

Direct Radiation (roentgen/h)

Peak 2 hour dose rate at 1/2 mile is 6×10^{-6}

Fallout Dose - Washout (roentgen)

1/2	5.7×10^{-3}
1	2.1×10^{-4}
5	1.9×10^{-4}
9	7.8×10^{-5}
12	4.8×10^{-5}

(1) Calculated using meteorological diffusion methods described in Sections XI-6.3.2 to XI-6.3.2f.

(2) The symbol "a" means less than 1×10^{-10}.

TABLE XI-12

RADIOLOGICAL EFFECTS OF THE COOLANT LOSS ACCIDENT[1]

Distance (miles)	First 2-Hour Exposure VS-2	MS-2	N-2	N-10	U-2	U-10	Total Accident Exposure VS-2	MS-2	N-2	N-10	U-2	U-10
External Passing Cloud Dose (rad)												
1/2	5.4×10^{-5}	5.7×10^{-5}	5.7×10^{-5}	3.2×10^{-5}	5.7×10^{-5}	2.2×10^{-5}	2.9×10^{-3}	3.1×10^{-3}	3.1×10^{-3}	1.8×10^{-3}	3.1×10^{-3}	1.2×10^{-3}
1	4.0×10^{-5}	5.0×10^{-5}	4.7×10^{-5}	1.9×10^{-5}	4.7×10^{-5}	1.3×10^{-5}	2.2×10^{-3}	2.7×10^{-3}	2.6×10^{-3}	1.0×10^{-3}	2.6×10^{-3}	7.0×10^{-3}
5	-	-	-	1.3×10^{-6}	-	5.7×10^{-7}	2.6×10^{-4}	2.9×10^{-4}	2.0×10^{-4}	7.3×10^{-5}	7.3×10^{-5}	3.1×10^{-5}
9	-	-	-	4.0×10^{-7}	-	1.5×10^{-7}	9.2×10^{-5}	1.1×10^{-4}	4.2×10^{-5}	2.2×10^{-5}	1.7×10^{-5}	8.4×10^{-6}
12	-	-	-	2.2×10^{-7}	-	7.1×10^{-8}	4.6×10^{-5}	5.9×10^{-5}	1.7×10^{-5}	1.2×10^{-5}	6.4×10^{-6}	3.8×10^{-6}
Lifetime Thyroid Dose (rad)												
1/2	a[2]	a	1.1×10^{-7}	2.2×10^{-6}	1.1×10^{-3}	3.2×10^{-4}	a	a	2.0×10^{-6}	4.2×10^{-5}	2.1×10^{-2}	6.2×10^{-3}
1	a	a	5.8×10^{-5}	5.9×10^{-5}	1.0×10^{-3}	2.4×10^{-4}	a	a	1.1×10^{-3}	1.1×10^{-3}	2.0×10^{-2}	4.8×10^{-3}
5	-	-	-	5.8×10^{-5}	-	2.3×10^{-5}	a	9.2×10^{-5}	5.3×10^{-3}	1.1×10^{-3}	2.2×10^{-3}	4.5×10^{-4}
9	-	-	-	2.4×10^{-5}	-	1.0×10^{-5}	a	3.9×10^{-4}	2.5×10^{-3}	4.8×10^{-4}	8.4×10^{-4}	2.0×10^{-4}
12	-	-	-	1.6×10^{-5}	-	5.9×10^{-6}	a	7.6×10^{-4}	1.6×10^{-3}	3.1×10^{-4}	5.6×10^{-4}	1.1×10^{-4}
Lifetime Lung Dose (rad)												
1/2							a	a	3.2×10^{-9}	6.5×10^{-8}	3.3×10^{-5}	9.5×10^{-6}
1							a	a	1.7×10^{-6}	1.8×10^{-6}	3.0×10^{-5}	7.3×10^{-6}
5							a	1.4×10^{-7}	8.6×10^{-6}	1.8×10^{-6}	3.7×10^{-6}	7.3×10^{-7}
9							a	6.5×10^{-7}	4.3×10^{-6}	8.2×10^{-7}	1.5×10^{-6}	3.1×10^{-7}
12							a	1.2×10^{-6}	2.6×10^{-6}	5.6×10^{-7}	9.0×10^{-7}	7.0×10^{-7}
Lifetime Bond Dose (Rem)												
1/2							a	a	4.0×10^{-9}	8.1×10^{-8}	4.1×10^{-5}	1.2×10^{-5}
1							a	a	2.2×10^{-6}	2.3×10^{-6}	3.8×10^{-5}	9.2×10^{-6}
5							a	1.9×10^{-7}	1.1×10^{-5}	2.3×10^{-6}	4.6×10^{-6}	9.2×10^{-7}
9							a	8.1×10^{-7}	5.4×10^{-6}	1.0×10^{-6}	1.8×10^{-6}	3.9×10^{-7}
12							a	1.5×10^{-6}	3.2×10^{-6}	7.0×10^{-7}	1.1×10^{-6}	2.5×10^{-7}
Fallout Dose (roentgen)												
1/2							a	a	4.6×10^{-9}	4.7×10^{-7}	8.3×10^{-5}	1.2×10^{-4}
1							a	a	2.5×10^{-6}	1.3×10^{-5}	7.6×10^{-5}	9.2×10^{-5}
5							a	1.5×10^{-7}	1.2×10^{-5}	1.3×10^{-5}	9.3×10^{-6}	9.2×10^{-6}
9							a	6.5×10^{-7}	5.6×10^{-6}	5.9×10^{-6}	3.7×10^{-6}	4.0×10^{-6}
12							a	1.3×10^{-6}	3.5×10^{-6}	3.4×10^{-6}	2.3×10^{-6}	2.6×10^{-6}
Direct Radiation (roentgen/h)												
Peak dose rate at 1/2 miles is 3×10^{-6}												
Fallout Dose - Washout (roentgen)												
1/2								8.8×10^{-4}				
1								3.2×10^{-4}				
5								3.0×10^{-5}				
9								1.2×10^{-5}				
12								7.4×10^{-6}				

(1) Calculated using meteorological diffusion methods described in Sections XI-6.3.2 to XI-6.3.2f.

(2) The symbol "a" means less than 1×10^{-10}.

TABLE XI-13

RADIOLOGICAL EFFECTS OF THE COOLANT LOSS ACCIDENT[1]

Distance (miles)	First 2-Hour Exposure						Total Accident Exposure					
	VS-2	MS-2	N-2	N-10	U-2	U-10	VS-2	MS-2	N-2	N-10	U-2	U-10
External Passing Cloud Dose (rad)												
1/2	5.4×10^{-5}	5.7×10^{-5}	5.7×10^{-5}	3.2×10^{-5}	5.7×10^{-5}	2.2×10^{-5}	1.5×10^{-2}	1.6×10^{-2}	1.6×10^{-2}	9.0×10^{-3}	1.6×10^{-2}	6.2×10^{-3}
1	4.0×10^{-5}	5.0×10^{-5}	4.7×10^{-5}	1.9×10^{-5}	4.7×10^{-5}	1.3×10^{-5}	1.1×10^{-2}	1.4×10^{-2}	1.3×10^{-2}	5.2×10^{-3}	1.3×10^{-2}	3.5×10^{-3}
5	-	-	-	1.3×10^{-6}	-	5.7×10^{-7}	1.3×10^{-3}	1.5×10^{-3}	1.1×10^{-3}	3.7×10^{-4}	3.7×10^{-4}	1.6×10^{-4}
9	-	-	-	4.0×10^{-7}	-	1.5×10^{-7}	4.7×10^{-4}	5.7×10^{-4}	2.1×10^{-4}	1.1×10^{-4}	8.9×10^{-5}	4.3×10^{-5}
12	-	-	-	2.2×10^{-7}	-	7.1×10^{-8}	2.3×10^{-4}	3.0×10^{-4}	8.9×10^{-5}	6.1×10^{-5}	3.3×10^{-5}	2.0×10^{-5}
Lifetime Thyroid Dose (rad)												
1/2	a[2]	a	2.2×10^{-7}	9.8×10^{-6}	9.3×10^{-4}	5.6×10^{-4}	a	a	2.8×10^{-5}	1.3×10^{-3}	1.2×10^{-1}	7.3×10^{-2}
1	a	a	6.2×10^{-5}	2.6×10^{-4}	8.8×10^{-4}	3.0×10^{-4}	a	a	7.7×10^{-3}	3.4×10^{-2}	1.1×10^{-1}	3.9×10^{-2}
5	-	-	-	1.6×10^{-4}	-	2.1×10^{-5}	a	1.7×10^{-3}	6.1×10^{-2}	2.1×10^{-2}	1.0×10^{-2}	3.0×10^{-3}
9	-	-	-	5.8×10^{-5}	-	8.3×10^{-6}	a	4.3×10^{-3}	1.7×10^{-2}	7.5×10^{-3}	3.5×10^{-3}	1.1×10^{-3}
12	-	-	-	3.3×10^{-5}	-	4.2×10^{-6}	a	1.2×10^{-2}	1.4×10^{-2}	4.3×10^{-3}	1.9×10^{-3}	5.4×10^{-4}
Lifetime Lung Dose (rad)												
1/2							a	a	1.1×10^{-8}	4.8×10^{-7}	4.6×10^{-5}	2.7×10^{-5}
1							a	a	3.0×10^{-6}	1.3×10^{-5}	4.3×10^{-5}	1.5×10^{-5}
5							a	6.4×10^{-7}	2.3×10^{-5}	7.7×10^{-6}	3.9×10^{-6}	1.1×10^{-6}
9							a	1.6×10^{-6}	7.0×10^{-8}	2.8×10^{-6}	1.3×10^{-6}	4.1×10^{-7}
12							a	4.4×10^{-6}	5.3×10^{-8}	1.6×10^{-6}	7.0×10^{-7}	2.0×10^{-7}
Lifetime Bone Dose (rem)												
1/2							a	a	2.7×10^{-8}	1.2×10^{-6}	1.2×10^{-4}	7.0×10^{-5}
1							a	a	7.7×10^{-6}	3.4×10^{-5}	1.1×10^{-4}	3.8×10^{-5}
5							a	1.7×10^{-6}	6.1×10^{-5}	2.0×10^{-5}	1.0×10^{-5}	3.1×10^{-6}
9							a	4.1×10^{-6}	2.0×10^{-5}	7.9×10^{-6}	3.6×10^{-6}	1.1×10^{-6}
12							a	1.1×10^{-5}	4.5×10^{-6}	4.5×10^{-6}	2.0×10^{-6}	5.9×10^{-7}
Fallout Dose (roentgen)												
1/2							a	a	1.0×10^{-7}	1.4×10^{-5}	4.7×10^{-4}	1.4×10^{-3}
1							a	a	1.8×10^{-5}	3.7×10^{-4}	4.4×10^{-4}	7.6×10^{-4}
5							a	2.8×10^{-6}	1.4×10^{-4}	2.3×10^{-4}	4.0×10^{-5}	5.8×10^{-5}
9							a	7.1×10^{-6}	4.2×10^{-5}	8.3×10^{-5}	1.4×10^{-5}	2.1×10^{-5}
12							a	1.9×10^{-5}	3.1×10^{-5}	4.8×10^{-5}	7.3×10^{-6}	1.0×10^{-5}
Direct Radiation (roentgen/h)												
Peak 2-hour dose rate at 1/2 mile is 3×10^{-6}												
Fallout Dose - Washout (roentgen)												
1/2								5.1×10^{-3}				
1								2.2×10^{-3}				
5								3.7×10^{-4}				
9								1.4×10^{-4}				
12								7.1×10^{-5}				

(1) Calculated using meteorological diffusion methods in HW-SA-2809, see Section XI-6.3.2h.

(2) The symbol "a" means less than 1×10^{-10}.

time period. That is, the values used, as discussed in Section XI-6.3.2b, are for 1-hour periods, and thus are somewhat conservative when applied to the 2-hour period dose calculation and are markedly conservative for the total accident (15-hour) calculation. Lack of data at this time for the longer time period does not permit more precise estimates to be made.

f. Precipitation Washout

Cloud depletion as a result of precipitation washout could cause ground deposition of an otherwise elevated cloud. The dose from this type of fallout on the ground was calculated for each accident. Washout rates[1] commonly used give the same results as from the dry deposition rates[2] used in Section XI-6.3.2 b for a ground release in the stable case. Thus, the calculation of deposited concentrations was made using the same diffusion conditions as in the other dose calculations, but assuming a ground release.

g. Calculated Air Concentrations

The methods described in the previous sections were used to calculate integrated air concentrations (μc-sec/cc) from a unit release of 1 curie. The following table shows the values calculated for the six different meteorological conditions assumed and for the effective stack heights calculated.

TABLE XI-17
UNIT INTEGRATED AIR CONCENTRATIONS (μc-sec/cc per curie released)
(By Methods Described In Journal of Applied Meteorology)

Distance, miles		V S - 2* (H = 170m)	M S - 2 (H = 170m)	N - 2 (H = 180m)	N - 10 (H = 110m)	U - 2 (H = 180m)	U - 10 (H = 110m)
1/2	Noble Gases	1.8×10^{-120}	4.6×10^{-22}	7.4×10^{-10}	1.5×10^{-8}	7.6×10^{-6}	2.2×10^{-6}
	Particulates	1.8×10^{-120}	4.6×10^{-22}	7.4×10^{-10}	1.5×10^{-8}	7.6×10^{-6}	2.2×10^{-6}
	Halogens	1.8×10^{-120}	4.6×10^{-22}	7.4×10^{-10}	1.5×10^{-8}	7.6×10^{-6}	2.2×10^{-6}
1	Noble Gases	3.1×10^{-95}	1.6×10^{-16}	4.0×10^{-7}	4.2×10^{-7}	7.1×10^{-6}	1.7×10^{-6}
	Particulates	3.1×10^{-95}	1.6×10^{-16}	4.0×10^{-7}	4.2×10^{-7}	7.0×10^{-6}	1.7×10^{-6}
	Halogens	3.1×10^{-95}	1.6×10^{-16}	4.0×10^{-7}	4.1×10^{-7}	7.1×10^{-6}	1.7×10^{-6}
5	Noble Gases	3.3×10^{-32}	3.3×10^{-8}	2.0×10^{-6}	4.2×10^{-7}	8.6×10^{-7}	1.7×10^{-7}
	Particulates	3.3×10^{-32}	3.3×10^{-8}	2.0×10^{-6}	4.2×10^{-7}	8.5×10^{-7}	1.7×10^{-7}
	Halogens	3.3×10^{-32}	3.3×10^{-8}	1.9×10^{-6}	4.0×10^{-7}	8.0×10^{-7}	1.6×10^{-7}
9	Noble Gases	1.4×10^{-22}	1.5×10^{-7}	1.0×10^{-6}	2.0×10^{-7}	3.5×10^{-7}	7.4×10^{-8}
	Particulates	1.4×10^{-22}	1.5×10^{-7}	1.0×10^{-6}	1.9×10^{-7}	3.4×10^{-7}	7.3×10^{-8}
	Halogens	1.4×10^{-22}	1.4×10^{-7}	9×10^{-7}	1.7×10^{-7}	3.0×10^{-7}	7.0×10^{-8}

Continued

1. Theoretical Possibilities and Consequences Of Major Accidents In U 233 and PU 239 Fuel Fabrication and Radioisotope Processing Plants, ORNL 3441, April 1964
2. Environmental Radioactive Contamination As A Factor In Nuclear Plant Siting Criteria, E. C. Watson, C. C. Gamertsfelder, February 14, 1963, HW-SA-2809

TABLE XI-17 (Continued)

UNIT INTEGRATED AIR CONCENTRATIONS

Distance, miles		V S - 2* (H = 170m)	M S - 2 (H = 170m)	N - 2 (H = 180m)	N - 10 (H = 110m)	U - 2 (H = 180m)	U - 10 (H = 110m)
12	Noble Gases	1.5×10^{-17}	2.8×10^{-7}	6.1×10^{-7}	1.3×10^{-7}	2.2×10^{-7}	4.8×10^{-8}
	Particulates	1.5×10^{-17}	2.8×10^{-7}	6.0×10^{-7}	1.3×10^{-7}	2.1×10^{-7}	4.7×10^{-8}
	Halogens	1.5×10^{-17}	2.7×10^{-7}	5.6×10^{-7}	1.1×10^{-7}	2.0×10^{-7}	4.1×10^{-8}

*Symbols refer to stability and wind speed conditions, i.e. V S, M S, N, and U means very stable, moderately stable, neutral and unstable, respectively; 2 and 10 means 2 miles per hour and 10 miles per hour respectively. The diffusion parameter $\sigma_\theta \bar{u}$ assumed is 20 degree-mph (0.16 rad-m/sec) for the 2 mph cases and 130 degree-mph (1.0 rad-m/s) for the 10 mph cases.

TABLE XI-18

UNIT INTEGRATED AIR CONCENTRATION - GROUND SOURCE**

Moderately Stable 2 mph $\sigma_\theta \bar{u}$ 20 degree-mph

(By Methods In Journal Of Applied Meteorology)

Distance, miles	μc-sec/cc per curie released Halogens	Particulates
1/2	1.9×10^{-4}	2.2×10^{-4}
1	7.0×10^{-5}	8.9×10^{-5}
5	6.5×10^{-6}	1.2×10^{-5}
9	2.6×10^{-6}	6.8×10^{-6}
12	1.6×10^{-6}	4.5×10^{-6}

**Used to calculate fallout doses from precipitation washout case.

h. Comparison to Other Calculational Methods

As a point of comparison, the technique of calculating cloud growth (or spreading), in terms of its standard deviation of width (i.e. σ_y and σ_z) described in HW-SA-2809[1] were also used. This technique does not consider wind direction variability and uses diffusion parameters for calculating cloud spreading derived from experimental work involving short term (10 minute) release and sampling times. Presumably this technique is more appropriate for near instantaneous or puff releases rather than the longer time periods of interest in the hypothetical accidents described. Values of σ_y and σ_2 calculated by this technique were used in the gaussian equation for air concentration determination. The integrated air concentrations per unit amount released (μc-sec/cc per curie released) calculated by this technique are shown in the table below. It should be noted that unit air concentrations calculated by this technique give values which are quite similar to those calculated by the previous method described in Section XI-6.3.2 through XI-6.3.2f

(1) Environmental Radioactive Contamination As A Factor In Nuclear Plant Siting Criteria, E.C. Watson, C.C. Gamertsfelder, February 14, 1963 - HW-SA-2809.

using the values of the various parameters described. However, in the text of this report, following each accident description, are tables of radiological effects using the two cloud dispersion calculational techniques discussed here. These tables show the difference in doses calculated using the two different methods.

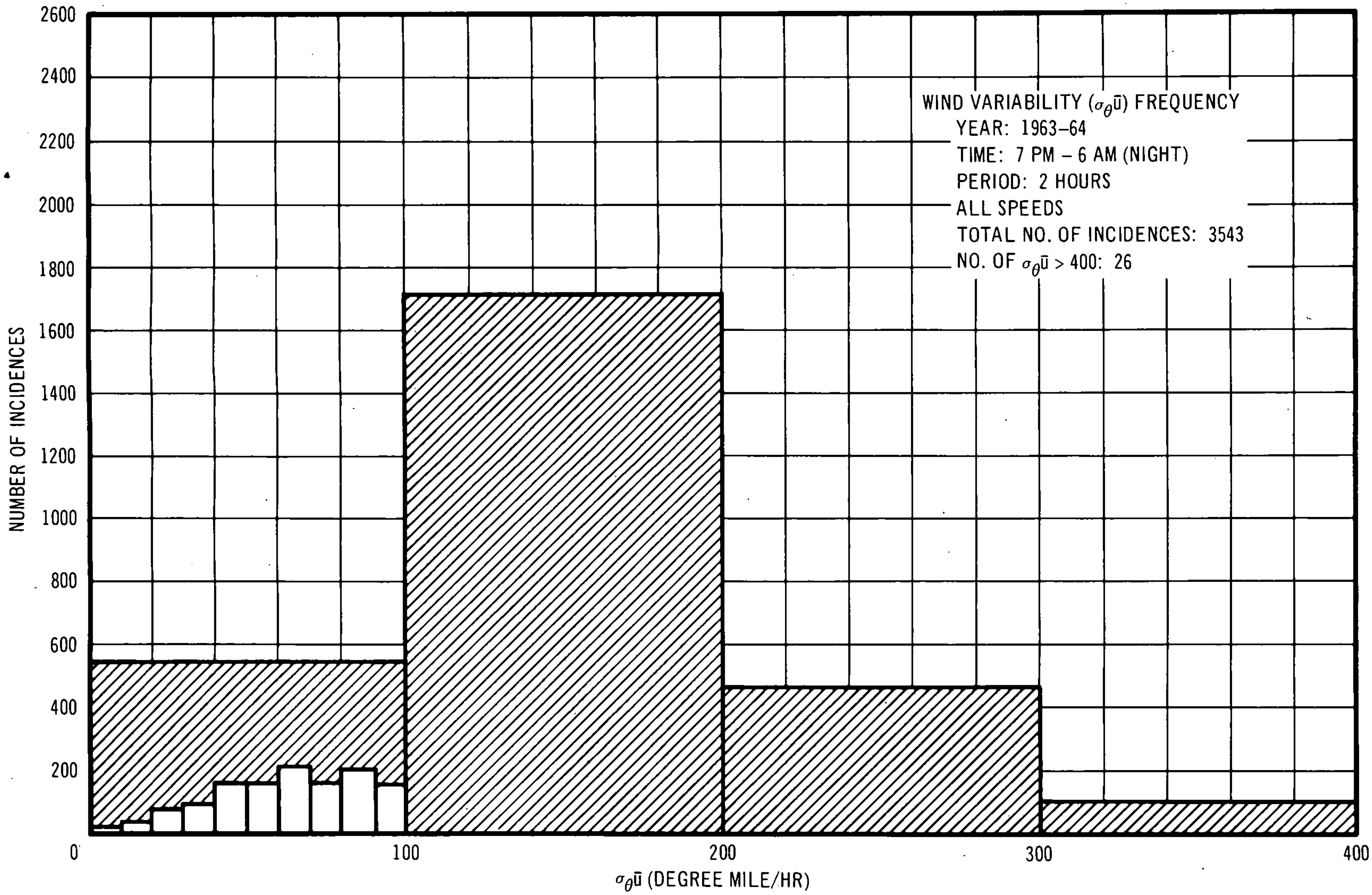
TABLE XI-19

UNIT INTEGRATED AIR CONCENTRATIONS (μc-sec/cc per curie released)

(Calculated By Methods In HW-SA-2809)

Distance, miles		V S - 2 (H = 170m)	M S - 2 (H = 170m)	N - 2 (H = 180m)	N - 10 (H = 110m)	U - 2 (H = 180m)	U - 10 (H = 110m)
1/2	Noble Gases	5.0×10^{-120}	1.3×10^{-21}	1.5×10^{-9}	6.8×10^{-8}	6.5×10^{-6}	3.9×10^{-6}
	Particulates	5.0×10^{-120}	1.3×10^{-21}	1.5×10^{-9}	6.8×10^{-8}	6.5×10^{-6}	3.9×10^{-6}
	Halogens	5.0×10^{-120}	1.3×10^{-21}	1.5×10^{-9}	6.8×10^{-8}	6.5×10^{-6}	3.9×10^{-6}
1	Noble Gases	1.1×10^{-94}	8.3×10^{-16}	4.3×10^{-7}	1.9×10^{-6}	6.2×10^{-6}	2.2×10^{-6}
	Particulates	1.1×10^{-94}	8.3×10^{-16}	4.3×10^{-7}	1.9×10^{-6}	6.2×10^{-6}	2.2×10^{-6}
	Halogens	1.1×10^{-94}	8.3×10^{-16}	4.3×10^{-7}	1.8×10^{-6}	6.1×10^{-6}	2.1×10^{-6}
5	Noble Gases	9.4×10^{-32}	9.3×10^{-8}	3.4×10^{-6}	1.2×10^{-6}	5.9×10^{-7}	1.7×10^{-7}
	Particulates	9.4×10^{-32}	9.2×10^{-8}	3.4×10^{-6}	1.1×10^{-6}	5.8×10^{-7}	1.7×10^{-7}
	Halogens	9.4×10^{-32}	9.2×10^{-8}	3.3×10^{-6}	1.1×10^{-6}	5.5×10^{-7}	1.6×10^{-7}
9	Noble Gases	3.2×10^{-20}	2.3×10^{-7}	1.1×10^{-6}	4.5×10^{-7}	2.1×10^{-7}	6.0×10^{-8}
	Particulates	3.2×10^{-20}	2.3×10^{-7}	1.1×10^{-6}	4.4×10^{-7}	2.0×10^{-7}	5.9×10^{-8}
	Halogens	3.2×10^{-20}	2.3×10^{-7}	1.0×10^{-6}	4.0×10^{-7}	1.9×10^{-7}	5.8×10^{-8}
12	Noble Gases	3.4×10^{-17}	6.4×10^{-7}	8.1×10^{-7}	2.6×10^{-7}	1.2×10^{-7}	3.4×10^{-8}
	Particulates	3.4×10^{-17}	6.4×10^{-7}	8.0×10^{-7}	2.5×10^{-7}	1.1×10^{-7}	3.3×10^{-8}
	Halogens	3.4×10^{-17}	6.3×10^{-7}	7.5×10^{-7}	2.3×10^{-7}	1.0×10^{-7}	2.9×10^{-8}

*Symbols refer to stability and wind speed conditions, i.e. V S, M S, N, U, means very stable, moderately stable, neutral and unstable, respectively; 2 and 10 means 2 miles per hour and 10 miles per hour, respectively.



Wind Variability ($\sigma_\theta\bar{u}$) Frequency

Exhibit III-7-12