


UFSAR Revision 30.0


 <p>INDIANA MICHIGAN POWER <small>An AEP Company</small></p>	<p>INDIANA MICHIGAN POWER</p> <p>D. C. COOK NUCLEAR PLANT</p> <p>UPDATED FINAL SAFETY ANALYSIS REPORT</p>	<p>Revised: 28.0</p> <p>Table: 14.2.1-2</p> <p>Page: 1 of 2</p>
--	--	---

Parameters Used for the Control Room Radiological Consequence Analysis of a Fuel Handling Accident

Parameter	Value
Core Power Level	3480 MWt
Radial Peaking Factor	1.65
Number of Damaged Assemblies	1
Decay Time	120 hours
Core Fractions Released from Damaged Rods	
I-131	0.08
Other Halogens	0.05
Kr-85	0.10
Other Noble Gases	0.05
Alkali Metals	0.12
Core Release Fraction Multiplier for High Burnup Fuel	2.0
Depth of Water Above Damaged Fuel	23 ft
Pool Decontamination Factors	
Elemental Iodine	285
Organic Iodine	1
Noble Gases	1
Particulates	Infinite
Release Duration	2 hours
Iodine Chemical Form	
Elemental	99.85%
Organic	0.15%
Particulate	0%
Fuel Handling Area Ventilation Filter Efficiency ¹	
Elemental Iodine	89.1%
Organic Iodine	89.1%
Particulates	98.01%
Release Location	
Containment Offsite	Unit 1 Containment Surface
Containment Onsite	Unit 2 Containment Closest Point
Auxiliary Building	Unit 1 Vent

¹ Includes 1% filter bypass leakage


UFSAR Revision 30.0

 An AEP Company	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.1-2 Page: 2 of 2
---	---	--

Parameters Used for the Control Room Radiological Consequence Analysis of a Fuel Handling Accident

Parameter	Value
Offsite Breathing Rate	
0 - 8 hours	3.5E-04 m ³ /sec
8 - 24 hours	1.8E-04 m ³ /sec
24 - 720 hours	2.3E-04 m ³ /sec
Control Room Parameters	
Volume	50,616 ft ³
Normal Ventilation Makeup Flow Rate	880 cfm
Emergency Ventilation Makeup Flow Rate	880 cfm
Emergency Ventilation Recirculation Flow Rate	4520 cfm
Emergency Ventilation Filter Efficiency ¹	
Elemental Iodine	94.05%
Organic Iodine	94.05%
Particulates	98.01%
Delay to Switch to Emergency Mode	20 minutes (manual)
Unfiltered Inleakage	40 cfm
Occupancy Factors	
0 - 24 hours	1.0
24 - 96 hours	0.6
96 - 720 hours	0.4
Breathing Rate	3.5E-04 m ³ /sec


UFSAR Revision 30.0

 <p>INDIANA MICHIGAN POWER <small>An AEP Company</small></p>	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.4-1 Page: 1 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Steam Generator Tube Rupture

Parameter	Value
Core Power Level	3480 MWt
Fuel Clad Failure	0%
Primary Coolant Limit for Normal Operation Iodines Non-Iodines	1.0 $\mu\text{Ci/gm D.E. I-131}$ 100/E-bar (215.1 $\mu\text{Ci/gm D.E. Xe-133}$)
Pre-Accident Spike RCS Iodine Concentration	60.0 $\mu\text{Ci/gm D.E. I-131}$
Concurrent Iodine Spike Appearance Rates Appearance Rate Multiplier Spike Duration	Table 14.A.3-5 335 8 hours
Secondary Coolant Limit for Normal Operation	0.1 $\mu\text{Ci/gm D.E. I-131}$
Primary Coolant Mass	466,141.5 lbm
Secondary System Mass	97,515.7 lbm/SG (minimum) 161,000 lbm/SG (maximum)
Ruptured Tube Break Flow	146,704 lbm
Duration of Ruptured Tube Break Flow	30 minutes
Primary-to-Secondary Leak Rate	0.25 gpm to each steam generator
Initial Intact Steam Generator Mass 0 – 30 minutes 30 min – 2 hours 2 – 8 hours 8 – 24 hours	198,515 lbm 314,432 lbm 1,367,475 lbm 1,347,000 lbm
Ruptured Steam Generator Steam Release	66,171 lbm
Pre-Trip Steam Flow to Condenser	17,153,800lbm/hr
Time of Reactor Trip	101 seconds
Break Flow Flashing Fractions	Pre-Trip: 0 – 100 seconds: 19% Post-Trip: 100-500 seconds: 8% 500-1000 seconds: 6% 1000-1800 seconds: 5.5%

UFSAR Revision 30.0


 <p>INDIANA MICHIGAN POWER <small>An AEP Company</small></p>	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.4-1 Page: 2 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Steam Generator Tube Rupture

Parameter	Value
Duration of Intact SG Tube Recovery After Reactor Trip	40 minutes
Intact Tube Leakage Flashing Fraction During Uncovery	0-100 seconds: 19% 100-500 seconds: 8% 500-1000 seconds: 6% 1000-1800 seconds: 5.5% 1800 seconds – 40 min.: 4%
Partition Coefficients Iodines Alkali Metals Noble Gases Condenser (Iodines & Particulates)	100 500 1 100
Iodine Chemical Form Elemental Organic Particulate	97% 3% 0%
Release Location Offsite Pre-Trip Offsite Post-Trip Onsite Pre-Trip Onsite Post-Trip	Unit 1 Turbine Building Unit 1 Main Steam Enclosures Unit 1 Steam Jet Air Ejector Unit 2 PORVs/MSSVs
Offsite Breathing Rates 0-8 hours 8-24 hours 24-720 hours	3.5E-04 m ³ /sec 1.8E-04 m ³ /sec 2.3E-04 m ³ /sec
Control Room Parameters Volume Normal Ventilation Makeup Flow Rate Emergency Ventilation Makeup Flow Rate Emergency Ventilation Recirculation Flow Rate Emergency Ventilation Filter Efficiency ¹ Elemental Iodine Organic Iodine Particulates	50,616 ft ³ 880 cfm 880 cfm 4520 cfm 94.05% 94.05% 98.01%

¹ Includes 1% filter bypass leakage

UFSAR Revision 30.0

 An AEP Company	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.4-1 Page: 3 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Steam Generator Tube Rupture


Parameter	Value
Delay to Switch to Emergency Mode	394.74 seconds (Safety Injection)
Unfiltered Inleakage	40 cfm
Occupancy Factors	
0-24 hours	1.0
24-96 hours	0.6
96-720 hours	0.4
Breathing Rate	3.5E-04 m ³ /sec

 An AEP Company	<p align="center">INDIANA MICHIGAN POWER</p> <p align="center">D. C. COOK NUCLEAR PLANT</p> <p align="center">UPDATED FINAL SAFETY ANALYSIS REPORT</p>	Revised: 27.0 Table: 14.2.5-1 Page: 1 of 1
---	---	--

Rupture of a Steam Pipe Limiting Statepoints

	Time sec	Pressure psia	Heat Flux Fraction	Inlet Cold °F	Temp. Hot °F	Flow Fraction	Boron ppm	Reactivity Percent	Density gm / cc
Hot zero power (double ended rupture downstream of the flow restrictor with offsite power available)	76.2	709.49	.223	372.8	443.4	1.0	.19	.043	.848
Full power (0.89 ft2 rupture, largest break size to trip on OPΔT)	25.4	2,197.10	1,260	524.1	530.3	1.0	0.0	.011	.722


UFSAR Revision 30.0

 An AEP Company	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 27.0 Table: 14.2.5-2 Page: 1 of 1
---	--	--

Rupture of a Steam Pipe Time Sequence of Events

Case	Event	Time (sec)
Hot Zero Power (double ended rupture downstream of the flow restrictor with offsite power available)	Steam line rupture occurs	0.00
	Low steam line pressure reached	0.80
	Steamline Isolation (Loops 2, 3, and 4)	11.80
	Pressurizer empties	14.00
	Criticality attained	14.20
	SI flow starts	27.80
	Boron from SI reaches the core	38.40
	Feedwater Isolation (All loops)	68.80
	Peak heat flux attained	72.60
	Core becomes subcritical	134.6
Full Power (0.89 ft ² rupture, largest breaks size to trip on OPΔT)	Steam line rupture occurs	0.0
	OPΔT reactor trip setpoint reached (all loops)	22.6
	Rod motion initiated	24.6
	Peak core heat flux attained	25.2
	Minimum DNBR occurs	25.4


UFSAR Revision 30.0

 <p>INDIANA MICHIGAN POWER <small>An AEP Company</small></p>	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.5-3 Page: 1 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Main Steam Line Break

Parameter	Value
Core Power Level	3480 MWt
Fuel Clad Failure	0%
Primary Coolant Limit for Normal Operation	
Iodines	1.0 µCi/gm D.E. I-131
Non-Iodines	100/E-bar (215.1 µCi/gm D.E. Xe-133)
Pre-Accident Spike RCS Iodine Concentration	60.0 µCi/gm D.E. I-131
Concurrent Iodine Spike	
Appearance Rates	Table 14.A.3-5
Appearance Rate Multiplier	500
Spike Duration	8 hours
Secondary Coolant Limit for Normal Operation	0.1 µCi/gm D.E. I-131
Primary Coolant Mass	466,141.5 lbm
Secondary System Mass	97,515.7 lbm/SG (minimum) 161,000 lbm/SG (maximum)
Primary-to-Secondary Leak Rate	0.25 gpm to each steam generator
Intact Steam Generator Steam Release	
0-2 hours	456,000 lbm
2 - 8 hours	1,186,000 lbm
8 - 24 hours	1,347,000 lbm
Duration of Intact SG Tube Uncovery After Reactor Trip	40 minutes
Intact Tube Leakage Flashing Fraction During Uncovery	0-400 seconds: 8% 400-900 seconds: 6% 900-1700 seconds: 5.5% 1700 seconds-40 min: 4%

UFSAR Revision 30.0


 <p>INDIANA MICHIGAN POWER <small>An AEP Company</small></p>	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.5-3 Page: 2 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Main Steam Line Break

Parameter	Value
Partition Coefficients	
Iodines	100
Alkali Metals	500
Noble Gases	1
Iodine Chemical Form	
Elemental	97%
Organic	3%
Particulate	0%
Release Location	
Offsite	Unit 1 Turbine Building
Onsite Faulted SG	Unit 2 Turbine Building
Onsite Intact SGs	Unit 2 PORVs/MSSVs
Offsite Breathing Rates	
0-8 hours	3.5E-04 m ³ /sec
8-24 hours	1.8E-04 m ³ /sec
24-720 hours	2.3E-04 m ³ /sec
Control Room Parameters	
Volume	50,616 ft ³
Normal Ventilation Makeup Flow Rate	880 cfm
Emergency Ventilation Makeup Flow Rate	880 cfm
Emergency Ventilation Recirculation Flow Rate	4520 cfm
Emergency Ventilation Filter Efficiency ¹	
Elemental Iodine	94.05%
Organic Iodine	94.05%
Particulates	98.01%
Delay to Switch to Emergency Mode	70 seconds (Safety Injection)

¹ Includes 1% filter bypass leakage

UFSAR Revision 30.0

 An AEP Company	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.5-3 Page: 3 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Main Steam Line Break

Parameter	Value
Unfiltered Inleakage	40 cfm
Occupancy Factors	
0-24 hours	1.0
24-96 hours	0.6
96-720 hours	0.4
Breathing Rate	3.5E-04 m ³ /sec

UFSAR Revision 30.0


 An AEP Company	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revision: 18.1 Table: 14.2.6-1 Page: 1 of 1
---	---	---

PARAMETERS USED IN THE ANALYSIS OF THE ROD CLUSTER CONTROL ASSEMBLY EJECTION ACCIDENT

TIME IN LIFE	HZP BEGINNING	HFP BEGINNING	HZP END	HFP END
Power Level (%) ¹	0	102	0	102
Ejected Rod Worth (%Δk)	0.65	0.15	0.75	0.19
Delayed Neutron Fraction (%)	0.0050	0.0050	0.0040	0.0040
Feedback Reactivity Weighting	2.071	1.30	2.755	1.30
Trip Reactivity (%Δk)	2.	4.	2.	4.
F _q Before Rod Ejection	2.50	2.50	2.50	2.50
F _q After Rod Ejection	12.	6.8	19.	7.1
Number of Operational Pumps	2	4.	2.	4.
Maximum Fuel Pellet Average Temperature (°F)	2764	4056	2963	3969
Maximum Fuel Center Temperature(°F)	3120	4968	3258	4872
Maximum Clad Average Temperature (°F)	2130	2299	2322	2245
Maximum Fuel Stored Energy (cal/gm)	112.7	177.3	122.2	172.7
Fuel Melt in Hot Pellet, %	0	<10	0	<10

¹ Power level based upon a core power of 3250 MWt.


UFSAR Revision 30.0

 <p>INDIANA MICHIGAN POWER <small>An AEP Company</small></p>	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.6-2 Page: 1 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Rod Ejection Accident

Parameter	Value
Core Power Level	3480 MWt
Fuel Clad Failure	10%
Core Fuel Melt	0.25%
Core Fractions Released from Damaged Rods	
Iodines	0.10
Noble Gases	0.10
Alkali Metals	0.12
Fuel Rod Peaking Factor	1.65
Core Release Fraction Multiplier for High Burnup Fuel	1.0104
Release Fractions for Melted Fuel	
Containment Leakage Release Path	
Iodines	25%
Noble Gases	100%
Secondary System Release Path	
Iodines	50%
Noble Gases	100%
Secondary Coolant Limit for Normal Operation	0.1 μ Ci/gm D.E. I-131
Containment Leakage Release Path Parameters	
Containment Volume	1,066,352 ft ³
Containment Leakage Rate	
0 - 24 hours	0.18 %/day
24 hours - 30 days	0.09
Containment Leakage Filtration	0%
Iodine Chemical Form	
Elemental	4.85%
Organic	0.15%
Particulate	95%
Natural Deposition	
Elemental Iodine	None


UFSAR Revision 30.0

 <p>INDIANA MICHIGAN POWER <small>An AEP Company</small></p>	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.6-2 Page: 2 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Rod Ejection Accident

Parameter	Value
Organic Iodine	None
Particulate	0.1 hr ⁻¹ after 24 hours
Iodine/Particulate Removal by Containment Sprays	None
Release Location	
Offsite	Unit 1 Containment Surface
Onsite	Unit 2 Containment Surface
Secondary Leakage Path Parameters	
Primary Coolant Mass	466,141.5 lbm
Secondary System Mass	97,515.7 lbm/SG (minimum) 161,000 lbm/SG (maximum)
Primary-to-Secondary Leak Rate	1 gpm to all steam generators
Steam Generator Steam Release	
0-2 hours	460,000 lbm
2-8 hours	1,256,000 lbm
8-24 hours	1,347,000 lbm
Partition Coefficients	
Iodines	100
Alkali Metals	500
Noble Gases	1
Duration of Intact SG Tube Uncovery After Reactor Trip	40 minutes
Intact Tube Leakage Flashing Fraction During Uncovery	0-400 seconds: 8% 400-900 seconds: 6% 900-1700 seconds: 5.5% 1700 seconds-40 min: 4%
Iodine Chemical Form	
Elemental	97%
Organic	3%
Particulates	0%

UFSAR Revision 30.0

 <p>INDIANA MICHIGAN POWER <small>An AEP Company</small></p>	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revised: 28.0 Table: 14.2.6-2 Page: 3 of 3
--	---	--

Parameters Used for the Radiological Consequence Analysis of a Rod Ejection Accident

Parameter	Value
Release Location	
Offsite	Unit 1 Main Steam Enclosure
Onsite	Unit 2 PORVs/MSSVs
Offsite Breathing Rates	
0-8 hours	3.5E-04 m ³ /sec
8-24 hours	1.8E-04 m ³ /sec
24-720 hours	2.3E-04 m ³ /sec
Control Room Parameters	
Volume	50,616 ft ³
Normal Ventilation Makeup Flow Rate	880 cfm
Emergency Ventilation Makeup Flow Rate	880 cfm
Emergency Ventilation Recirculation Flow Rate	4520 cfm
Emergency Ventilation Filter Efficiency ¹	
Elemental Iodine	94.05%
Organic Iodine	94.05%
Particulates	98.01%
Delay to Switch to Emergency Mode	120 minutes (Safety Inspection)
Unfiltered Inleakage	40cfm
Occupancy Factors	
0-24 hours	1.0
24-96 hours	0.6
96-720 hours	0.4
Breathing Rate	3.5E-04 m ³ /sec

¹ Includes 1% filter bypass leakage

UFSAR Revision 30.0

 An AEP Company	INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT	Revision: 16.1 Table: 14.2.7-1 Page: 1 of 1
--	---	---

LOSS OF A.C. POWER TO THE PLANT AUXILIARIES STEAM RELEASE

	0-2 HOURS	2-8 HOURS
Steam release from 4 S.G.'s, lbs	443,000	1,000,000
Feedwater flow to 4 S.G.'s, lbs	643,000	1,128,000