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Appendix A

Crane Events at U.S. Nuclear Power Plants 1968 through 1999

Introduction

A review of crane documents in the NRC's Nuclear Document System (NUDOCS) for the period 1968 through 1999 resulted in 294 different issues. Depending on the severity of each issue, each issue may be discussed in several documents. Most are administrative (not following a procedure, load path issues, noncompliance with technical specifications, inadequate crane operational testing prior to use, etc.) and few relate to problems encountered when lifting loads of approximately 30 tons or more. The data and resultant sorting is shown on Table A1, *Reported crane issues at U.S. nuclear power plants*. Abbreviations for sorting categories are shown on Table A2, *Sorting category abbreviations*, and abbreviations for nuclear power plants are shown on Table A3, *Plant name abbreviations*. Abbreviations used in Tables A1, A2, and A3 are located at the end of this appendix.

Sorting of Crane Issues

To analyze crane issues recorded in NUDOCS, several general categories were established, most with several subcategories. Once this information was entered in the database, sorts were performed to look for trends and patterns.

- Category 1: Plant and event date

  Subcategories include; docket, plant name, event report year, and event report month.

- Category 2: Crane type

  Subcategories include; reactor building, polar, auxiliary, refueling/manipulator, spent fuel pool, tower, mobile, and other.

- Category 3: Crane component deficiency

  Subcategories include; structure, control, brakes, rails, fasteners, unknown, and none.

- Category 4: Reported administrative cause for event

  Subcategories include; not following procedures, poor procedures, test performance, load path inadequacy, ventilation inadequacy, maintenance, engineering, operations, unknown, and none.

- Category 5: Safety Implication of event

  Subcategories include; Death, injury, radiation release, load slip, load drop, equipment damage, loss or partial loss of power, and none.

- Category 6: Load description for slip or drop events

  Subcategories include; Load description (component and weight), and height of drop or slip.

Table A1: Reported crane issues at U.S. nuclear power plants

DOC	NAM	YR	MO	RB	PC	AUX	MC	SFP	OTHR	TOW	MOB	STR	CONT	BRK	RAIL	FAST	COMP	NON	UNK	NFP	PP	NT	LPI	VT	MT	ENG	OPS	NON	UNK	DTH	INJ	RAD	LS	LD	EQ	NON	LPL	LOAD	HEIGHT
247	IP2	68	5		1										1														1						1				
244	GIN	69	7						1					1															1					1	1			Core barrel	6 ft
247	IP2	69	9		1								1																1						1				
250	TP34	70	3							1		1																	1	1	1				1				
255	PAL	70	9			1											1			1														1	1			CRDM support tube hoist, sheave, hook	22 ft
286	IP3	71	2		1							1																	1						1				
286	IP3	71	2		1												1												1					1	1			Pressure vessel (443 tons)	Short
247	IP2	71	3		1							1														1									1				
247	IP2	71	3		1							1														1									1				
16	FER1	72	11						1							1				1														1	1			Fuel bundle	27 ft
213	HN	73	12						1									1		1										1									
271	VY	73	3				1										1									1									1				
312	RS	75	5		1											1													1						1				
286	IP3	75	4				1						1																1						1				
272	SAL12	75	1						1								1												1						1				
281	SUR2	75	5				1						1																1						1				
280	SUR1	75	11				1											1		1															1				
266	PB12	76	4						1						1														1		1				1				
445	CP12	76	5							1		1								1										1									
312	RS	76	5		1													1					1													1			
237	DRE23	76	6	1										1												1							1				2 slips, reactor head	15"
312	RS	76	4		1													1		1															1				
277	PB23	76	5						1									1		1										1									
213	HN	77	6						1				1																1						1				
263	MONT	77	9	1									1									1														1				
410	NMP2	78	2							1								1		1										1	1								
416	GG12	78	4							1		1																1							1				
454	BYR12	78	4						1								1												1						1				
320	TMI2	78	6		1								1							1																1			
483	CAL	78	8						1									1		1											1								
322	SHO	78	11		1							1														1									1				
302	CRY	78	6						1								1			1															1				
440	PER12	79	10								1							1		1										1									
293	PIL	79	12					1										1		1																1			
312	RS	79	5		1											1										1									1				
439	BELL	79	11								1	1																1							1				

Table A1: Reported crane issues at U.S. nuclear power plants (continued)

DOC	NAM	YR	MO	RB	PC	AUX	MC	SFP	OTHR	TOW	MOB	STR	CONT	BRK	RAIL	FAST	COMP	NON	UNK	NFP	PP	NT	LPI	VT	MT	ENG	OPS	NON	UNK	DTH	INJ	RAD	LS	LD	EQ	NON	LPL	LOAD	HEIGHT
316	DCC2	79	12					1										1				1														1			
400	SH12	79	8								1	1								1											1				1			
320	TMI2	80	2								1	1																	1						1			
498	STP12	80	4		1											1													1						1			
482	WC	80	1		1										1														1						1			
272	SAL1	80	3				1											1				1													1			
455	BYR2	80	8							1								1		1										1								
482	WC	80	10						1			1								1											1							
400	SH12	80	5						1								1			1											1							
424	VOG	80	3						1			1																	1						1			
518	HART	80	5							1				1															1		1							
423	MILL3	80	6		1											1													1						1			
312	RS	80	2		1													1					1													1		
546	MH12	80	2								1	1								1										1								
546	MH12	80	2							1									1	1															1			
237	DRE23	81	8						1			1								1															1			
458	RB	81	5								1	1								1															1			
483	CAL	81	8						1			1																	1						1			
287	OCO3	81	1		1													1		1															1			
387	SUS1	81	4	1														1				1													1			
460	WNP14	81	2						1									1			1														1			
312	RS	82	7		1											1													1						1			
546	MH12	82	11		1							1																	1						1			
440	PER12	82	2		1							1																	1						1			
249	DRE3	83	10								1							1		1															1			
440	PER12	83	9		1							1													1										1			
336	MILL2	83	11					1										1					1													1		
320	TMI2	83	8								1							1		1																1		
458	RB	83	4							1		1																	1					1	1		Reactor shield building dome	30 ft
312	RS	84	3					1					1												1										1			
322	SHO	84	12					1					1																1						1			
322	SHO	84	12					1							1														1						1			
315	DCC1	84	11					1										1						1												1		
320	TMI2	84	7		1								1																1							1		
285	FTC	84	8		1													1						1												1		
346	DB	84	11		1													1		1																1		
346	DB	84	12					1										1						1												1		
374	LAS2	84	8						1									1				1														1		
361	SON2	84	11		1								1																1						1			

Table A1: Reported crane issues at U.S. nuclear power plants (continued)

DOC	NAM	YR	MO	RB	PC	AUX	MC	SFP	OTHR	TOW	MOB	STR	CONT	BRK	RAIL	FAST	COMP	NON	UNK	NFP	PP	NT	LPI	VT	MT	ENG	OPS	NON	UNK	DTH	INJ	RAD	LS	LD	EQ	NON	LPL	LOAD	HEIGHT
219	OC	84	6					1										1					1													1			
302	CRY	84	8					1					1							1																1			
320	TMI2	84	10								1							1		1																	1		
341	FER	84	7	1									1												1										1				
395	SUM1	84	9					1					1												1										1				
445	CP1	84	9		1							1														1								1				
315	DCC1	85	5			1												1					1												1			
440	PER	85	5		1							1														1								1				
260	BF2	85	3						1								1												1	1	1			1	1		Turbine building crane hook fell thru building	Many ft
295	MCG2	85	2				1											1		1										1							
289	TMI1	85	3		1													1		1															1			
295	ZIO1	85	2						1									1					1												1			
320	TMI2	85	12						1									1		1													1	1			Defueling canister support sleave (2200 lbs)	1-1/2 ft
321	HAT1	85	6						1									1		1														1				
413	CAT1	86	2			1												1		1															1			
445	CP12	86	10		1										1											1								1				
255	PAL	86	2		1													1		1															1			
348	FAR1	86	3	1														1		1															1			
369	MCG1	86	2					1										1						1											1			
482	WC	86	10					1					1												1										1			
311	SAL2	86	12				1											1				1													1			
320	TMI2	86	9		1									1												1								1				
416	GG	87	8						1									1		1														1				
445	CP12	87	9								1	1								1										1								
528	PV12	87	10					1										1				1													1			
302	CRY	87	8						1									1							1										1			
272	SAL12	87	10								1							1		1															1			
275	DIC1	87	5				1											1		1															1			
315	DCC1	87	9				1						1												1											1			
483	CAL	87	8					1										1		1															1			
445	CP12	87	7				1								1											1								1				
272	SAL12	87	4					1										1				1													1			
311	SAL2	87	5					1										1				1													1			
251	TP4	87	3					1							1										1										1			
277	PB2	87	9								1							1		1																1		
320	TMI2	88	2		1													1		1															1			

Table A1: Reported crane issues at U.S. nuclear power plants (continued)

DOC	NAM	YR	MO	RB	PC	AUX	MC	SFP	OTHR	TOW	MOB	STR	CONT	BRK	RAIL	FAST	COMP	NON	UNK	NFP	PP	NT	LPI	VT	MT	ENG	OPS	NON	UNK	DTH	INJ	RAD	LS	LD	EQ	NON	LPL	LOAD	HEIGHT
370	MCG2	88	7					1										1		1															1			
311	SAL2	88	11					1										1						1											1			
445	CP12	88	2		1										1											1								1			
285	FTC	88	6		1													1		1														1			
423	MILL3	89	7		1								1							1														1			
400	SHO	89	9					1										1						1											1			
423	MILL3	89	7					1										1						1											1			
397	WNP2	89	3								1							1					1												1			
254	QC1	89	10					1					1							1													1			Fuel bundle	Short
280	SUR12	89	2								1	1								1														1			
206	SON1	90	4						1					1												1								1			
254	QC1	90	1	1														1									1						1	1		Lowered reactor building crane hook until it hit fuel	Many ft
316	DCC2	90	11		1											1												1					1			
369	MCG1	90	6					1										1						1											1			
320	TMI2	90	6		1													1		1															1			
338	NA1	90	2					1									1											1					1		1	Fuel bundle in pool	Many ft
285	FTC	90	5		1													1			1												1	1		Reactor head align pins bent, flange scratched	Short
508	WNP3	90	5							1		1																1						1			
423	MILL3	90	5						1									1		1														1			
269	OCO12	90	1		1													1		1															1			
287	OCO3	90	3		1													1		1															1			
338	NA1	90	2					1										1						1											1			
338	NA1	90	2	1														1						1											1			
275	DIC1	91	9					1										1						1											1			
443	SEA	91	1		1											1												1						1			
482	WC	91	12					1										1									1								1			
445	CP1	91	12				1											1				1													1			
275	DIC1	91	10					1										1									1								1			
247	IP2	91	9		1											1									1									1			
498	STP1	91	3					1										1						1											1			
286	IP3	91	1		1											1												1						1			
323	DIC2	91	6					1										1						1											1			
341	FER	92	2								1							1		1																1		
482	WC	92	1					1										1						1											1			
267	FSV	92	6					1										1						1											1			

Table A1: Reported crane issues at U.S. nuclear power plants (continued)

Table A1: Reported crane issues at U.S. nuclear power plants (continued)

DOC	NAM	YR	MO	RB	PC	AUX	MC	SFP	OTHR	TOW	MOB	STR	CONT	BRK	RAIL	FAST	COMP	NON	UNK	NFP	PP	NT	LPI	VT	MT	ENG	OPS	NON	UNK	DTH	INJ	RAD	LS	LD	EQ	NON	LPL	LOAD	HEIGHT
336	MILL2	95	5					1										1						1												1			
282	PI12	95	5			1							1												1											1			
336	MILL2	95	2					1										1						1												1			
456	BRA1	95	12					1										1					1													1			
282	PI12	95	5					1										1							1											1			
423	MILL3	95	12					1										1		1																1			
250	TP34	95	12						1									1			1															1			
275	DIC1	95	11					1										1						1												1			
255	PAL	95	7								1							1					1												1				
298	COO	95	2	1														1		1																1			
344	TRO	95	5					1				1																1								1			
315	DCC1	95	10					1										1						1												1			
344	TRO	95	11		1										1					1															1			
272	SAL12	95	9					1										1						1												1			
286	IP3	95	3								1							1		1																	1		
327	SEQ12	95	6			1							1													1										1			
213	HN	96	10					1										1						1												1			
346	DB	96	11		1													1					1													1			
313	ANO12	96	12				1						1								1															1			
250	TP3	96	8						1									1					1													1			
313	ANO1	96	5					1										1					1													1			
295	ZIO1	96	12					1										1						1												1			
323	DIC2	96	5					1										1						1												1			
346	DB	96	5		1													1					1													1			
282	PI1	97	6					1										1						1												1			
282	PI1	97	5					1										1						1												1			
245	MILL12	97	6						1									1		1																1			
306	PI2	97	3		1													1					1													1			
261	ROB	97	11						1									1		1																1			
293	PIL	97	3	1														1					1													1			
261	ROB	97	5						1									1						1												1			
282	PI12	97	2								1							1					1													1			
261	ROB	97	6						1									1		1																1			
311	SAL2	97	8						1							1									1										1				
315	DCC12	97	3						1									1		1																1			
364	FAR2	97	4					1										1						1												1			
247	IP2	97	7					1										1		1																1			
286	IP3	97	7					1						1						1																1			
255	PAL	97	12		1								1													1										1			
336	MILL2	97	5						1									1		1																1			
220	NMP12	97	11		1										1													1							1			

Table A1: Reported crane issues at U.S. nuclear power plants (continued)

DOC	NAM	YR	MO	RB	PC	AUX	MC	SFP	OTHR	TOW	MOB	STR	CONT	BRK	RAIL	FAST	COMP	NON	UNK	NFP	PP	NT	LPI	VT	MT	ENG	OPS	NON	UNK	DTH	INJ	RAD	LS	LD	EQ	NON	LPL	LOAD	HEIGHT
213	HN	97	9					1					1							1															1			
266	PTB12	97	11					1										1		1															1			
416	GG	97	11						1									1		1															1			
213	HN	97	2					1										1						1											1			
333	FITZ	97	11	1														1		1															1			
309	MY	97	7					1					1									1													1			
286	IP3	97	5					1										1						1											1			
309	MY	97	3					1										1				1													1			
334	BV1	97	12					1										1				1													1			
334	BV1	97	9					1										1				1													1			
412	BV2	97	12					1										1				1													1			
483	CAL	97	5	1														1		1															1			
250	TP34	97	4						1									1		1														1					
387	SUS12	97	10								1	1								1															1			
387	SUS12	97	5								1	1								1															1			
325	BRU1	97	6						1									1		1																1			
295	ZIO2	97	7					1										1						1												1			
395	SUM1	97	6						1									1		1																1			
461	CLI	97	2						1					1															1						1			
482	WC	97	10					1										1				1														1			
254	QC12	97	4	1									1																1						1			
324	BRU12	97	5				1										1								1										1			
387	SUS12	97	6	1													1					1												1	1		Toolbox (4000 lbs)	8 ft
250	TP34	97	10				1											1		1																1			
368	ANO2	97	7					1										1						1												1			
454	BYR12	97	12		1										1										1										1			
315	DCC1	98	9		1													1		1															1			
275	DIC1	98	7		1													1		1															1			
412	BV2	98	9					1										1				1													1			
528	PV12	98	3						1									1			1													1			New fuel container	2"
346	DB	98	6		1													1		1														1	1		Ball, hook	200 ft
346	DB	98	6		1												1											1						1	1		Cable, pendant	140 ft
266	PTB1	98	5				1											1				1														1			
346	DB	98	6	1														1		1																1			
443	SEA	98	11					1										1						1												1			
440	PER	98	5						1									1		1																1			
250	TP3	98	12					1										1		1																1			
255	PAL	98	2		1									1												1										1			
346	DB	98	6	1													1			1															1			
361	SON23	98	3		1													1		1																1			

Table A1: Reported crane issues at U.S. nuclear power plants (continued)

DOC	NAM	YR	MO	RB	PC	AUX	MC	SFP	OTHR	TOW	MOB	STR	CONT	BRK	RAIL	FAST	COMP	NON	UNK	NFP	PP	NT	LPI	VT	MT	ENG	OPS	NON	UNK	DTH	INJ	RAD	LS	LD	EQ	NON	LPL	LOAD	HEIGHT
416	GG	98	5		1													1									1						1					Tool ring, (1490 lbs)	
416	GG	98	12		1													1			1														1			
423	MIL3	98	7					1										1				1													1			
245	MIL1	98	5				1											1		1															1			
331	DA	98	5						1										1										1		1							
213	HN	98	12					1										1						1											1			
369	MCG1	98	7			1												1				1													1			
369	MCG1	98	8			1												1				1													1			
247	IP2	98	6						1									1		1															1			
482	WC	98	9		1													1				1													1			
352	LIM12	98	5						1									1		1														1				
346	DB	98	6		1													1					1												1			
247	IP2	98	5		1													1		1															1			
286	IP3	98	9						1					1											1										1			
397	WNP2	98	10				1											1		1														1			
397	WNP2	98	7	1														1		1															1			
309	MY	98	5					1										1				1													1			
344	TRO	99	3					1										1		1															1			
482	WC	99	5					1										1		1															1			
344	TRO	99	5			1												1		1															1			
361	SON1	99	4		1													1		1															1			
395	SUM	99	5				1											1				1													1			
282	PI	99	5		1													1		1															1			
397	WNP2	99	9					1										1				1													1			
220	NMP1	99	8	1													1										1								1			
282	PI	99	5						1									1		1															1			
346	DB	99	1	1														1		1															1			
445	CP1	99	10			1											1								1								1		1		Unit 1 reactor coolant pump motor (22 tons)	15-20 ft
483	CAL	99	9	1														1					1												1			
	TOTALS			24	70	9	22	85	50	9	25	30	27	9	11	11	24	179	3	108	10	32	19	39	17	16	5	8	40	10	14	0	4	17	100	167	8		

Table A2: Sorting category abbreviations

AUX	Auxiliary crane
BRK	Crane brake
COMP	Crane component other than specific components listed
CONT	Electrical control part of crane
DOC	Docket number
DTH	Event included one or more deaths
ENG	Engineering personnel
EQ	Equipment damage
FAST	Fasteners
HEIGHT	Approximate drop height for drop events
INJ	Event included one or more injuries
LD	Load drop (equipment damage or impact)
LOADDESC	Description of load for slip or drop events
LPI	Load path inadequacy
LPL	Loss or partial loss of off-site power
LS	Load slip (equipment damage not incurred)
MC	Manipulator crane
MO	Month of event record
MOB	Mobile crane
MT	Maintenance personnel
NAM	Plant name
NFP	Not following procedure
NON	None or nothing effected
NT	No test or failed to test
OTHR	Other crane (not specifically identified)
OPS	Operations personnel
PC	Polar crane
PP	Poor procedure
RAIL	Rail (for truck or trolley)
RB	Reactor building crane
SFP	Spent fuel pool crane
STR	Structural part of crane
TOW	Tower crane
UNK	Unknown
VT	Ventilation or ventilation test inadequacy
Year	Year of event record

Table A3: Plant name abbreviations

ANO	Arkansas Nuclear One	NA	North Anna
		NMP	Nine Mile Point
BELL	Bellefonte		
BF	Brown's Ferry	OC	Oyster Creek
BRA	Braidwood	OCO	Oconee
BRU	Brunswick		
BV	Beaver Valley	PAL	Palisades
BYR	Byron	PB	Peach Bottom
		PER	Perry
CAL	Callaway	PI	Prairie Island
CAT	Catawba	PIL	Pilgrim
CC	Calvert Cliffs	PTB	Point Beach
CLI	Clinton	PV	Palo Verde
COO	Cooper		
CP	Comanche Peak	QC	Quad Cities
CRY	Crystal River		
		RB	River Bend
DA	Duane Arnold	ROB	H. B. Robinson
DB	Davis-Besse	RS	Rancho Seco
DCC	D.C. Cook		
DIC	Diablo Canyon	SAL	Salem
DRE	Dresden	SEA	Seabrook
		SEQ	Sequoyah
FAR	Joseph M. Farley	SH	Shearon Harris
FER	Fermi	SHO	Shoreham
FITZ	James A. FitzPatrick	SON	San Onofre
FSV	Fort St. Vrain	STP	South Texas Project
FTC	Fort Calhoun	SUM	Summer
		SUR	Surry
GG	Grand Gulf	SUS	Susquehanna
GIN	Ginna		
		TMI	Three Mile Island
HART	Hartsville	TP	Turkey Point
HAT	Edwin I. Hatch	TRO	Trojan
HN	Haddam Neck		
		VOG	Vogtle
IP2	Indian Point 2	VY	Vermont Yankee
IP3	Indian Point 3		
		WC	Wolf Creek
LAS	La Salle County	WNP	Washington Nuclear
MCG	McGuire	ZIO	Zion
MH	Marble Hill		
MIL	Millstone		
MONT	Monticello		
MY	Maine Yankee		