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TECHNICAL REPORT

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FIRE PROTECTION REVIEW
ROSS AVIATION
ALBUQUERQUE, NEW MEXICO

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Prepared for:

Assistant Secretary for Environment, Safety, and Health

U. S. Department of Energy

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FMRC J.I. 1T2N7.CY

February, 1991

P. H. Dobson
Project Manager
FMRC

MASTER

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DISCLAIMER

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ACKNOWLEDGEMENTS

The cooperation extended by personnel at this facility was excellent. Thanks are extended to Mr. Keith "Casey" Jones, General Manager; Mr. Richard Silver, Safety Director; Mr. Zef Banda, Ground Safety Officer, and Mr. Robert Steen, Aviation Safety Inspector. Also to Mr. William Cruickshank, DOE Albuquerque Operations Fire Protection Engineer and Mr. Darrell Fong, Albuquerque Operations Management Support Division.

Special thanks are extended to Ms. Louise Persico of Factory Mutual for preparation of the final report.

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PURPOSE

The purpose of this survey was to review the facility fire protection program and to make recommendations or to identify areas according to the following criteria established by the U.S Department of Energy:

1. Recommendations which would be made as the result of a Highly Protected Risk (HPR) fire inspection of an industrial insured facility. (This would include "human element" recommendations.)
2. Identification of areas where provision of automatic protection would limit a fire or explosion loss to \$1,000,000.
3. Identification of Maximum Foreseeable Loss (MFL) areas where loss potential exceeds \$50,000,000 assuming a failure of automatic protection systems and subsequent reliance only on separation, fire walls, or value limitations.

In private industry, the effect of insured losses on continuity of operations is referred to as Business Interruption and is usually expressed in monetary terms to cover continuing expense and loss of profit until such time as repairs are made and production is resumed. Loss of use of a facility of this type does not lend itself to expression in monetary terms. Surveys of other facilities resulted in a classification system for buildings which provide an indication of the importance of the building to the fulfillment of the mission of the facility. Recommendations in this report reflect to some degree the relative importance of the facility and the time to restore it to useful condition in the event a loss were to occur. The following classification system was used:

Critical

The loss of a critical facility would cause shutdown or serious interruption to several facilities housing vital, expensive, and/or hazardous operations.

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Vital

The loss of a vital facility would result in interruption of a major program. The equipment is usually specialized and expensive and would require many months or years to replace. The loss of this type of a facility would not significantly affect other programs. The fact that some of these facilities are provided backup from another facility permits them to be classified as vital rather than critical.

Important

The loss of this facility would not seriously impact other programs. It typically houses people, equipment or services involved in support activities.

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I

CONCLUSIONS

A Highly Protected Risk fire protection review was conducted on December 3 and 6, 1990 at Ross Aviation, on Kirtland Air Force Base, Albuquerque, New Mexico by John Sharland, Team Leader and Samuel Ramsey of Factory Mutual.

There were no loss potentials where the loss would exceed \$50,000,000 with protection out of service.

There is one major recommendation to reduce loss expectancies to below \$1,000,000. This recommendation is for improvement in reliability of protection for the hangar by providing a back up power supply for the electric driven fire pumps, or a diesel driven fire pump(s) capable of meeting the water demand for the hangar.

There are five additional recommendations that would be made during a Highly Protected Risk inspection. These recommendations identify improvements needed in inspection and testing of fire pumps and sprinkler control valves.

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II

OVERALL REVIEW OF SITE FIRE PROTECTION

2.1 RECOMMENDATIONS

90-1 Both fire pumps at the hangar should be performance test annually. The test should develop five flow and pressure points to establish a curve to compare to the manufacturer's performance curve.

Reason: Without such a program, the probability of fire pump performance problems at the time of a fire increase significantly. Annual performance tests are recommended by Factory Mutual Research Corporation and required by NFPA 20.

90-2 Both fire pumps should be started on pressure drop and run for ten minutes weekly. Currently, this is done quarterly by an outside contractor.

Reason: The weekly start in this manner assures the integrity of the automatic start function and prevents packing dry-out. Weekly starts are recommended by Factory Mutual Research Corporation.

90-3 As part of the response to an actual fire emergency in the Hangar or in the Maintenance Building, a person should be assigned and trained to respond to the outside Post Indicator Valve (PIV) that controls the fire area to make sure that this valve is wide open. If safe to do so, the person should stand by the valve and not allow anyone to shut it off until the fire department responds and takes command of the incident.

Reason: Factory Mutual Research Corporation loss experience shows that frequently a person will want to shut off sprinklers prematurely to "prevent water damage". Also, the initial checking of the valve to make sure it is wide open prevents the possible false impression that sprinkler protection is in service when it may not be.

90-4 The PIV and the sprinkler system for the Maintenance Building should be added to the weekly check that is performed and documented by Ross Aviation and to the quarterly documented checks that are done under contract by Southwest Fire Protection. In addition, all PIV's should be bump tested once per month.

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Reason: All sprinkler systems and control valves on the property should be inspected. Currently, just the fire pump and deluge valves and control valves for the Hangar systems are checked by recorded inspection.

90-5 The OS&Y valves on the suction side of the fire pumps and the indicating butterfly valves on the discharge side of the fire pumps should be locked open with padlocks keyed the same as the existing padlocks and with substantial welded link chain.

Reason: Current procedures indicate that the security guard must be contacted before entering the pump room. The pump room is not locked though. Locking of the valves will help ensure that unauthorized personnel do not tamper with the control valves.

90-6 An emergency diesel driven generator should be provided to power the fire pumps during power outages. An alternative would be to provide a diesel driven fire pump.

Reason: The West Area of Kirtland Air Force Base is subject to frequent power outages. Also, both electric driven fire pumps are needed to meet the deluge systems demand. Further, both pump controllers are fed power from a single transformer. The alternative would be to provide a diesel driven fire pump which could meet the 6025 gpm demand of the two deluge systems flowing simultaneously. The loss expectancy is \$23,000,000.

2.2 WATER SUPPLIES

The water supply to this site is provided by 500,000 gallon elevated Tank 2474 which is located just across Aberdeen Drive from Ross Aviation. When the fire pumps were installed in 1983, a new 14 inch underground main from this tank to Ross was provided. The tank has a normal static pressure of 55 psig. The tank is utilized for both domestic and fire protection water for the West Area of Kirtland Air Force Base. Whenever the tank level falls such that there is only 250,000 gallons in the tank, base Civil Engineering Operations opens a City of Albuquerque connection at the Carlisle gate. This connection can theoretically provide 2,500,000 gallons per day at 70 psi to Tank 2474. In June 1990, the West Area of the base averaged about 1,500,000 gallons/day water use. The normal supply of water to Tank 2474 is from three wells on the base; two at 750 gpm and one at 1500 gpm.

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The maximum fire protection water demand at Ross Aviation would be from both Hangar deluge systems operating simultaneously at 3025 gpm each plus 500 gpm for hose streams for a period of 45 minutes. This would draw 294,000 gallons from Tank 2474. The water supply is considered adequate and reliable for this facility.

Performance tests conducted on each pump, at 150% of rated flow, resulted in 85% of rated pressure which is excellent. Pump test results are contained in Appendix B.

Fire pump running and deluge flow alarms from the hangar are transmitted to Kirtland Air Force Base Fire Department over supervised lines into a Honeywell Delta 1000 computer based alarm system.

The Maintenance Building is adequately protected with an ordinary hazard pipe schedule sprinkler system. There is no flow alarm to the Fire Department on this small system. This is acceptable, since the audible water motor gong can be heard by Ross Aviation security personnel.

2.3 TESTING AND INSPECTION OF FIRE PROTECTION EQUIPMENT

An inspection program is in place at this facility. The overall responsibility for the program is with Mr. Zef Banda, Ground Safety Officer. Inspections are conducted "in-house" and by outside contractors.

2.3.1 Test Frequency

In-house inspections are conducted on a weekly basis and include the following:

1. Fire hoses and equipment
2. Fire extinguishers
3. UV/IR Detectors to ensure unobstructed view of hangar floor areas
4. Housekeeping
5. Visual inspection of fire pump room, including valves, controller, foam tanks, etc.

Full functional tests (no foam-water flow) of the deluge systems are done on a quarterly basis by an outside contractor.

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2.3.2 Fire Protection Impairment Procedures

There is a policy in effect for supervising all impairments to fire protection systems. This procedure is outlined on Ross Form SA-106. The procedure involves a tag system. Copies of the tag are sent to the fire marshal's office and Ross Maintenance Control. A copy is taken by the requestor and affixed to the impaired protection. This procedure is excellent. The procedure includes the following steps:

1. Permission must be obtained from the fire marshal (Director of Safety) or assistant fire marshal (Ground Safety Officer).
2. A "fire protection impairment log" Ross Form SA-106 must be filled out.
3. Notify base fire department.
4. Take appropriate precautions.
5. Close valve (count turns to close) or impair fire protection and affix tag.
6. After work is finished, reopen valve (count turns to open) or put protection back in service.
7. Clear impairment.

2.4 FIRE RESPONSE

Incipient fire response is provided by personnel at the facility. Fire department response is from an Air Force Fire Station 2 min. away.

2.4.1 Emergency Response Team

Personnel at this facility have been trained in incipient fire fighting and evacuation. Training includes basic fire prevention and the use of fire extinguishers. Employees are instructed in notification of the base fire department with a strong emphasis on evacuation, rather than trying to fight a large or potentially dangerous fire. Training also includes explanation of the UV/IR detection devices and the audible alarms.

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2.4.2 Base Fire Department Response

Response to a fire alarm at Ross Aviation would be from Station No. 2 which has both crash rescue and structural fire fighting capability. Response time is two minutes, and would include two pumpers with eight fire fighters, two crash vehicles with six fire fighters, and one rescue vehicle with three personnel.

Preplanning by the Fire Department is adequate. Air Force Form 1028 is used. The preplan diagrams for all base areas are being put into a computer system for immediate call up at the time of a response.

2.5 FIRE PREVENTION INSPECTIONS

A fire prevention inspection program, in addition to the equipment inspection and testing, is in place. A safety group meets on a regular basis to discuss subjects relating to life safety and property conservation. Mr. Zef Banda is chairman of this committee. Items such as fuel handling, outdoor storage and general housekeeping are satisfactorily addressed.

2.6 HOT WORK PERMITS

Hot work is supervised by use of a permit system (Ross Form SA-104). Written permission from the Ross Fire Marshal is required as part of the permit. This system is adequate.

2.7 PCB FILLED EQUIPMENT

There is no PCB filled electrical equipment at this location.

2.8 MAXIMUM FORESEEABLE LOSS

Maximum Foreseeable Loss (MFL) is the maximum dollar loss which would be expected from a fire with fire protection systems out of service. The dollar values used are replacement values of buildings and equipment.

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The MFL for the Ross Aviation property is 80% damage to the hangar and loss of five aircraft. The MFL is \$23,000,000. The MFL was determined using Factory Mutual Research Corporation information on hangar values and the used aircraft value guide, with the assistance of Mr. Robert Steen of Ross Aviation.

2.9 BUILDING DESCRIPTION

The site consists of Hangar Building 00481, a Maintenance Building and a small modular Training Building. The site houses the operations of Ross Aviation. The mission of Ross Aviation is to transport DOE cargo and personnel to DOE sites around the United States. The loss of a single aircraft, or multiple aircraft, from fire either in the hangar or on the apron would not result in a significant interruption to the mission due to the availability of used aircraft.

Hangar 00481

This hangar has outside dimensions of 202 by 221 ft. It has concrete block exterior walls and a concrete plank roof (with built-up cover) on arched steel truss. The trusses span the entire width of the structure. The office and support areas on the sides of the hangar are cut off from the hangar area by masonry walls and self closing doors, all in accordance with the fire resistance requirements in NFPA 409. The steel trusses are not fireproofed.

The hangar area for aircraft storage and service is 30,000 sq ft. The entrance doors are 28 ft 2-1/2 in. high. This latter dimension puts the hangar just barely into NFPA Type I. There are no pits. Aircraft fuel tanks are not drained of fuel or purged prior to entry into the hangar. Although it could not be determined at this visit, Mr. Banda was quite sure that the hangar door opening motors are wired ahead of hangar power in the electrical distribution system. This should be confirmed and corrected if not so.

The hangar floor drainage system would not be capable of draining away the deluge systems water flow as is recommended by Factory Mutual Research Corporation. However, this is mitigated by the fact that the fire protection system is designed for rapid extinguishment of a fuel spill fire (see Site Fire Protection section below).

The hangar heating system is in accordance with NFPA 409.

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The 30,000 sq ft hangar area is protected by two foam-water deluge systems covering 15,000 sq ft each. The systems are the non-aspirating open head type which calls for a demand of 0.16 gpm per sq ft over the 15,000 sq ft area of each system. The demand at the base of the riser is approximately 88 psig for the north system. These demands are based on calculations done during this visit. It is fully anticipated that both deluge systems will operate from a spill fire due to the lack of adequate floor drainage. However, it is expected that quick fire extinguishment will occur.

The deluge systems are tripped by any one of 12 combination infra-red/ultraviolet detectors that are mounted at about the 8 ft height along the long dimension of the hangar; six on each side. There is a thirty second time delay after detection before the deluge valves open. Dead man abort switches can be used to prevent discharge within this period. NFPA 409 states that heat detection should be used to trip hangar deluge systems. However, the arrangement in this hangar is considered tolerable.

The foam agent is Aqueous Film Forming Foam (AFFF) used at 3% concentration. There are two 2000 gal foam concentrate tanks in the Fire Pump/Deluge Valve Room. This arrangement provides at least 10 min of foam concentrate to the systems.

The water supply from elevated tank 2474 is boosted in pressure by two 2500 gpm at 75 psig pumps, one for each deluge system. The pumps, deluge valves and foam concentrate tanks are located in a room constructed of reinforced concrete. A single transformer feed provides power to each pump. The pumps start automatically on release of the solenoid valve for each deluge system.

Aircraft storage outside is set up so that there is a minimum of 75 ft clear space to the hangar.

Cargo is not stored on the premises of Ross Aviation.

Maintenance Building

This building is 40 ft by 100 ft, one story, steel panel on steel frame. This building houses the maintenance shops necessary to maintain the aircraft. This building is adequately protected with an ordinary hazard pipe schedule sprinkler system. There is no flow alarm to the Fire Department on

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this system. This is acceptable since the water motor gong can be heard by Ross Aviation security personnel.

Aircraft

The following aircraft are owned by the DOE and operated by Ross Aviation:

- 3 - DeHavilland Dash 7's
- 3 - McDonald Douglas DC-9's; Model 10
- 2 - DeHavilland Otters
- 2 - Beech King Air BE-200's
- 1 - Cessna L-19

All wing areas are less than 1000 sq ft and do not need supplemental underwing foam fire protection.

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APPENDIX A

FINAL CONFERENCE ATTENDEES

Thursday, December 6, 1990

Zef Banda	Ross Aviation
H. Bucci	Westinghouse/Hanford
William Cruickshank	DOE/AL/SPD
Darrell Fong	DOE/AL/MSD
Keith Jones	Ross Aviation
Dennis Kubicki	DOE/Headquarters
Sam Ramsey	FM
John Sharland	FM
Richard Silver	Ross Aviation
Robert Steen	Ross Aviation

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APPENDIX B

FIRE PUMP TEST RESULTS

PUMP ACCEPTANCE TEST DATA

Refer to P&P F(A)-512.12 & DS 3-7N

PROPERTY OF:

Ross Aviation "South Pump 1"

CITY & STATE

Kirtland Air Force Base, Albuquerque, NM

CONFERRED WITH

TITLE

ACCT. NO.

INDEX NO -A/C

INSURANCE COMPANY

FMEA DO

TESTED BY

DATE

December, 1990

PUMP	SHAFT ☒ HORIZONTAL ☐ VERTICAL		MANUFACTURER Aurora		APPROVED ☒ YES ☐ NO		SHOP OR SERIAL NO. 84-66789		MODEL OR TYPE 8-481-17B	
	RATED GPM 2500		RATED HEAD-FT (psi) 173 (75 psi)		RATED RPM 1770		SUCTION FROM Gravity Tank		TANK SIZE 500,000 G	
IF VERTICAL TYPE	VERTICAL DISCH GAUGE TO WATER LEVEL		STATIC FT		RIGHT ANGLE GEAR DRIVE		SHOP OR SERIAL NO.		APPROVED ☐ YES ☐ NO	
	PUMPING FT		MODEL OR TYPE		PERFORMANCE ☐ SMOOTH ☐ ROUGH		TANK HEIGHT (55 psi)			
DRIVER	MANUFACTURER Lincoln		APPROVED ☒ YES ☐ NO		SHOP OR SERIAL NO. 2764579		MODEL OR TYPE 444TS		RATED H P 150	
	ELECTRIC MOTOR ☒		RATED VOLT 460		OPERATING VOLT 460		RATED FL AMPS 169		AMPS AT 150% 169	
	DIESEL ENGINE ☐		GASOLINE ENGINE ☐		GAS ENGINE ☐		STEAM TURBINE ☐		PRESS. GOVERNOR ☐ BUILT IN ☐ INDEPENDENT ☐ TURBINE STEAM PRESS	
	RATED RPM 1780		SERVICE FACTOR 1.15		PHASE 3		CYCLES 60			

CONTROLLER	MANUFACTURER Sylvania		APPROVED ☒ YES ☐ NO		START Deluge Trip		STOP _____ psi		JOCKEY PUMP DNA	
	SHOP OR SERIAL NO. 388071-1-1		MODEL OR TYPE C5B224-4		☐ MANUAL ☐ PRESS DROP		☒ MANUAL		☐ YES ON _____ psi	
					☒ AUTO ☐ WATER FLW		☐ AUTO		☐ NO OFF _____ psi	

SPEED R P M	DISCHARGE PRESSURE PSI	SUCTION PRESSURE PSI	NET HEAD PSI	STREAMS			GALLONS PER MINUTE	PERCENT OF RATED CAPACITY	VOLTS	AMPS	STEAM PRESSURE	
				NO	SIZE	PITOT PRESSURE					THROTTLE	CHEST
152	54	98	0	-	-	-	0	0				
145	54	91	2	1-3/4	60/62	1385	55					
132	51	81	4	1-3/4	54/56	2668	107					
125	50	75	5	1-3/4	50/50/58	3144	126					
112	48	64	6	1-3/4	44/48/50	3579	143					
105	47	58	7	6/1-3/8	38/44/48/44	3802	152					

Readings marked + in suction column are heads above atmosphere, those marked — are lifts. For vertical shaft pumps, convert distance from pumping water level to discharge gage to psi and treat as negative (—) suction pressure.

PUMP ACCEPTANCE TEST DATA

Refer to P&P F(A)-512.12 & DS 3-7N

PROPERTY OF Ross Aviation "North Pump 2"		ACCT. NO.	INDEX NO. -A/C
CITY & STATE Kirtland Air Force Base, Albuquerque, NM		INSURANCE COMPANY	FMEA D.O.
CONFERRED WITH		TITLED BY	DATE December, 1990

PUMP	SHAFT ☒ HORIZONTAL ☐ VERTICAL		MANUFACTURER Aurora		APPROVED ☒ YES ☐ NO		SHOP OR SERIAL NO 84-66789		MODEL OR TYPE 8-481-17B		
	RATED GPM 2500		RATED HEAD-FT (psi) 173 (75 psi)		RATED RPM 1770		SUCTION FROM Gravity Tank		TANK SIZE 500,000 G		
IF VERTICAL TYPE	VERTICAL DISCH. GAUGE TO WATER LEVEL		STATIC FT		PUMPING FT		MANUFACTURER		SHOP OR SERIAL NO		
	RIGHT ANGLE GEAR DRIVE		MODEL OR TYPE		PERFORMANCE ☐ SMOOTH ☐ ROUGH		APPROVED ☐ YES ☐ NO				
DRIVER	MANUFACTURER Lincoln		APPROVED ☒ YES ☐ NO		SHOP OR SERIAL NO 2617147		MODEL OR TYPE 444TS		RATED H P 150		
	ELECTRIC MOTOR ☒ DIESEL ☐ GASOLINE ☐ GAS ☐ STEAM ☐ TURBINE		RATED VOLT 460		OPERATING VOLT 460		RATED F L AMPS 169		AMPS AT 150% 169		
		PRESS. GOVERNOR ☐ BUILT IN ☐ INDEPENDENT		TURBINE ☐ STEAM PRESS		PHASE 3		CYCLES 60		SERVICE FACTOR 1.15	

CONTROLLER	MANUFACTURER Sylvania		APPROVED ☒ YES ☐ NO		START Deluge Trip		STOP _____ psi		JOCKEY PUMP DNA		
	SHOP OR SERIAL NO 388072-1-1		MODEL OR TYPE C5B22-4		☐ MANUAL ☐ PRESS DROP		☒ MANUAL		☐ YES ON _____ psi		
		☒ AUTO ☐ WATER FLW		☐ AUTO		☐ NO OFF _____ psi					

SPEED R. P. M.	DISCHARGE PRESSURE PSI	SUCTION PRESSURE PSI	NET HEAD PSI	STREAMS			GALLONS PER MINUTE	PERCENT OF RATED CAPACITY	VOLTS	AMPS	STEAM PRESSURE	
				NO	SIZE	PITOT PRESSURE					THROTTLE	CHEST
	155	55	100	0	-	-	0	0				
	147	54	93	2	1-3/4	62/60	1407	56				
	135	51	84	4	1-3/4	58/54	2733	109				
	127	49	78	5	1-3/4	52/50/58	3204	128				
	117	49	68	6	1-3/4	48/42/50	3619	145				
	108	47	61	7	1-3/4	40/48/22/46	3979	159				

Readings marked + in suction column are heads above atmosphere, those marked — are lifts. For vertical shaft pumps, convert distance from pumping water level to discharge gage to psi and treat as negative (—) suction pressure.

END

DATE FILMED

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