Fire Protection and Fire Life Safety System Assessment

New Mexico State University
Las Cruces Campus
Las Cruces, NM

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Executive Summary

Aon Fire Protection Engineering (Aon FPE) has evaluated the existing fire protection and life safety systems serving approximately 40 buildings located on the Las Cruces campus of New Mexico State University (NMSU). The evaluations included a review of available documents and field surveys of existing conditions.

Criteria used for the evaluation was based on the current standards adopted by the New Mexico State Fire Marshal's Office (SFMO) who is the Authority Having Jurisdiction (AHJ) for the NMSU Las Cruces campus. Regulation and enforcement is delegated by the SFMO to the NMSU fire department.

The codes adopted by the SFMO that apply to this project are the International Fire Code (IFC) 2003 edition for new construction, and the 1997 editions of NFPA 101 and NFPA 1 for existing facilities. Federal standards that apply include the Americans with Disabilities Act (ADA).

The surveyed buildings were observed to have varied fire sprinkler equipment manufacturer types and configurations of the wet-pipe sprinkler systems. There were no sprinklers observed that were listed in any sprinkler manufacturers' recall notices.

A portion of the surveyed buildings had Class I (Fire Department use only) and Class II (occupant use only) standpipe systems installed. It was noted that all of the surveyed standpipe cabinets had the hoses removed and in some instances, fire extinguishers were placed inside the cabinets.

Due to the various ages of the buildings on the campus, many of the fire alarm systems surveyed were observed to be the second or third generation systems installed and in most cases, the replacement or upgrade of these systems was initiated as part of renovation projects or simply due to the failure of obsolete equipment. As these systems were replaced, many of the existing notification appliance device locations were re-used and replaced with newer devices that met the new ADA compliant visual signaling appliance requirements. While this may have corrected device specific compliance issues, it did not correct location, spacing, or audibility requirements. Many of the buildings surveyed did not have correct visual signaling for all designated public or common-use areas such as classrooms, restrooms, or break rooms. Visual signaling systems are required to meet the requirements of NFPA 72 and the ADA.

A number of the existing fire alarm control panels are no longer manufactured and replacement parts are very limited or unavailable. The failure of any one of these systems would require the NMSU to enact emergency measures such as fire watch or pay premiums for difficult to locate parts. Several of these panels are also incapable of providing programmable output functions for code-driven interlocks, such as HVAC or elevator controls, and would require replacement for any planned building upgrade projects.

As a result of the evaluation, recommendations are provided for the improvement of the fire protection and life safety systems. The recommendations have ranked by building into high, medium, and low priority categories. Ranking criteria included building occupancy type and the severity of deficiency. A complete list of the fire alarm and sprinkler deficiencies are provided in Appendix C.

Following is a summary of the buildings identified as high risk that require complete new or significant additions to the existing fire sprinkler systems:

Building Number	Building Name
79,80,185	Rhodes-Garrett-Hamiel Residence Hall
271	Greek Complex 100-199
272	Greek Complex 200-299
273	Greek Complex 300-399
274	Greek Complex 400-499
275	Garcia Residence Hall
414	Greek Complex 500-899
60	Dan W. Williams Hall
60A	Williams Annex
83	Milton Hall
187	Chemistry Complex (1955,1965,1995)
301	Thomas & Brown Hall
461	Zuhl Library
551	Skeen Hall
338	Educational Services Center
284	Pan American Center
363	Engineering Complex I
368	Knox Hall
391	Science Hall

Following is a summary of the buildings identified as high risk that require replacement or upgrades of the fire alarm system due to obsolete or inadequate control equipment and upgrades to meet ADA requirements for occupant notification:

Building Number	Building Name
271	Greek Complex 100-199
272	Greek Complex 200-299
273	Greek Complex 300-399
274	Greek Complex 400-499
414	Greek Complex 500-899
288	Guthrie Hall
301	Thomas & Brown Hall
389	Music Building
276	Walden Hall
338	Educational Services Center
368	Knox Hall
467	Housing & Bookstore Warehouse
461	Zuhl Library
321	James B. Delamater Activity Center
386	Business Complex Building
363	Engineering Complex I
391	Science Hall
278	Branson Library

The implementation of a corrective action plan to address the deficiencies found on the Las Cruces campus will require a planned approach. Based on the information complied as part of the Risk Assessment Study, the residential dormitories were determined to have the highest priority and would require approximately $850,000.00 to correct the fire alarm and sprinkler deficiencies observed. The remaining buildings surveyed would require approximately $1,900,000.00.

Options to consider include establishing a program that utilizes a pre-determined amount each year to address all deficiencies within a fixed period. Budgeting $500,000.00 a year for 7-10 years would provide required funding to correct the most serious deficiencies with the first 3-5 years. Coordination with the NMSU Master Plan and any other planned building or infrastructure improvements would be necessary to determine the best use of funding.

Other available options to consider would include utilizing a phased replacement approach for fire alarm system replacements in the larger buildings. With prior AHJ approval, upgrades or repairs would be done over an agreed upon period to minimize disruptions to the buildings occupants and allow available funding to be used for correcting more buildings per year.

1. Introduction

Aon Fire Protection Engineering (Aon FPE) has been retained by New Mexico State University (NMSU) to perform an evaluation of the existing fire protection and life safety systems serving approximately 40 buildings located on the main campus in Las Cruces, New Mexico.

Site surveys were conducted from January 13, 2014, to February 21, 2014. The fire protection and life safety systems surveyed included building fire alarm and fire suppression systems.

2. Applicable Codes

The following are the applicable codes and standards that were used to prepare this report.

- International Fire Code (IFC), 2003 Edition
- National Fire Protection Association (NFPA) 1, “Fire Prevention Code,” 1997 Edition
- National Fire Protection Association (NFPA) 13, “Installation of Sprinkler Systems,” 1996 Edition
- National Fire Protection Association (NFPA) 13R “Sprinkler Standard,” 1996 Edition
- National Fire Protection Association (NFPA) 14 “Standpipe and Hose Systems,” 1996 Edition
- National Fire Protection Association (NFPA) 25 “Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,” 1992 Edition
- National Fire Protection Association (NFPA) 72, “National Fire Alarm Code,” 1996 Edition
- National Fire Protection Association (NFPA) 101 “The Life Safety Code,” 1997 Edition
- National Fire Protection Association (NFPA) 2001, “The Standard on Clean Agent Fire Extinguishing Systems,” 1996 Edition
- Americans with Disabilities Act Accessibility Guidelines (ADA), 1991 Edition with amendments through September 2010

3. Campus Description

Originally founded in 1880, the Las Cruces campus was officially designated as a as a Federal Land-Grant University in 1890. The campus includes approximately 293 buildings totaling over 5 million square feet. Buildings on the Las Cruces campus include administrative, educational, business, dormitories, storage, and residential type occupancies.

The following is a list of the buildings surveyed by Aon FPE as part of this evaluation.

Building Number	Building Name	Building Number	Building Name
60	Dan W. Williams Hall	338	Educational Services Center
60A	Williams Annex	363	Engineering Complex I
79,80,185	Rhodes-Garrett-Hamiel Hall	368	Knox Hall
83	Milton Hall	386	Business Complex Building
172	Hadley Hall	389	Music Building
187	Chemistry Buildings	391	Science Hall
244	Gerald Thomas Hall	461	Zuhl Library
248	Regents Row	414	Greek Complex 500-899
248A	Roberts Hall	467	Housing & Bookstore Warehouse
271	Greek Complex 100-199	551	Skeen Hall
272	Greek Complex 200-299	387-A100	Myrna's Children Center
273	Greek Complex 300-399	387-A200	Myrna's Children Center
274	Greek Complex 400-499	387-A300	Myrna's Children Center
275	Garcia Residence Hall	387-A400/A500	Myrna's Children Center
276	Walden Hall	387-A600	Myrna's Children Center
278	Branson Library	387-A700	Myrna's Children Center
284	Pan American Center	387-A800	Myrna's Children Center
288	Guthrie Hall	387-C100	Myrna's Children Center
301	Thomas & Brown Hall	387-C200	Myrna's Children Center
321	James B. Delamater Activity Center	387-C300	Myrna's Children Center

4. Code Approach

The New Mexico Public Regulation Commission is responsible for regulating public services and safety to the public, through the offices of the New Mexico State Fire Marshalls Office (SFMO). The SFMO is the Authority Having Jurisdiction (AHJ) for the Las Cruces campus; regulation and enforcement is provided through an agreement with the NMSU fire department.

The two codes adopted by the SFMO that apply are the International Fire Code (IFC) 2003 edition for new construction, and the 1997 edition of NFPA 101 for existing facilities. Federal standards that apply include the Americans with Disabilities Act (ADA).

Prior to beginning the evaluation, the code approach was established. Options available include utilizing the code in affect at the time of original construction (i.e. the code of record), the current code in affect at the time of the evaluation, or provisions that are applied specifically to existing buildings such as those outlined in NFPA 101.

The application of the code of record concept for the buildings on the Las Cruces campus was determined to be impractical due to the number of buildings and difficulty in finding permit information and documentation. Aon FPE recommendation was to use the provisions of NFPA 101 for existing buildings. These provisions are in place to reduce unreasonable hardships or unnecessary inconveniences with the normal use and occupancy of a building, while providing a level of fire safety that is consistent with public interest.

After determining the code approach, Aon FPE met with the NMSU stakeholders to discuss project goals and objectives. The following goals and objectives were established:

- Provide acceptable level of fire protection/life safety for building occupants and first responders
- Minimize NMSU exposure
- Select codes/standards that facilitate future expansion

Specific code parameters and minimum protection guidelines were also established:

- All existing fire protection systems that are identified as requiring replacement or repairs are to be upgraded to meet current adopted design codes and standards (i.e., NFPA 13, 13R, 14 and 72)
- Utilize NFPA 101 – Life Safety Code for existing building requirements (1997 edition as adopted by 2003 IBC)
- All assembly, educational, business, storage, and residential dormitory occupancies will have, at a minimum, manual fire alarm systems
- All residential dormitory buildings are to be protected with complete automatic sprinkler systems, and include supervised smoke detection and notification within each sleeping unit

5. Survey Information

The systems evaluated for each building included automatic sprinkler systems, standpipes, and fire alarm and detection systems. The evaluations included the review of available information for each building such as drawings, test records, and other information provided by the University, and site surveys to document existing conditions. Copies of the field survey forms and notes for each building are located in Appendix A. Information documented for each building included the following:

5.1. General Building Information

- The occupancy type(s)
- Number of stories
- General construction type

5.2. Fire Sprinkler and Standpipe Systems

- Sprinkler system design type (i.e., pipe schedule or hydraulic design methods)
- System hydraulic placard data (if any)
- Sprinkler spacing, type, manufacturer, and temperature rating
- Riser gauge pressure(s)
- Location of water motor gong or horn/strobe
- Sprinkler obstruction and/or damage
- Sprinkler/standpipe valve installation
- Sprinkler/standpipe waterflow and valve monitoring
- Number and type of spare sprinklers
- General pipe hanging and bracing requirements
- Type and design capacity of standpipe systems (if known)
- Standpipe system types and locations
- Damaged hoses or hose storage devices on standpipe systems
- Signs of leakage or damage, evidence of corrosion, hose caps, damaged or missing on standpipe systems

5.3. Fire Alarm Systems

- The type of fire alarm system (automatic, manual or both types)
- Fire alarm panel information (including battery condition, current display status and monitoring information)

- Locations of control equipment such as remote annunciator panels and power supplies
- The type of fire alarm circuits used for initiating and notification circuits, including the general condition of wiring, conductors, and conduit or cabling systems
- The type and location of alarm and detection devices used for initiation such as smoke or heat detectors
- Compliance with current ADA mounting height's for wall or ceiling mounted fire alarm audible devices and/or appliances
- Compliance with current ADA visual signaling device requirements
- The type and location of notification appliances used for audible and visual occupant notification such as horns, speakers, and strobes
- Interlocks for elevator control, mechanical shutdown, or door releasing service
- Monitoring of suppression systems
- Device locations, spacing, and mounting heights
- Correct application and condition of initiating devices

5.4. Code Compliance Summary

Utilizing the applicable sprinkler and fire alarm codes and standards, the Code Compliance Summary form provides a list of items reviewed by the relevant code section, along with the referenced code or standard. Copies of the code compliance forms for each building are provided in Appendix A.

6. Existing Fire Suppression System Descriptions

6.1. Fire Suppression Water Supply

A reliable water source is provided to the Las Cruces campus through a combination of water wells and storage tanks. Domestic water is supplied to the campus buildings by an underground utility tunnel distribution system.

The main water system includes two large water storage tanks, 4 and 5 million gallons each, for a total storage capacity of 9 million gallons. There is also one small 250,000-gallon tank which provides water to the driving range, rodeo area, club house, president's residence, and various other facilities on the east side of the campus..

The University also has various small, independent distribution systems with storage tanks on or near the main campus, which are used mainly for providing water to the experiment facilities. The University owns several ground water wells for both irrigation and domestic water use.

The Pan American Center is provided with an electric motor driven fire pump which is rated at 3000 gpm at 100 psi. The electric service is designed to automatically transfer the fire pump to generator power if

normal electrical power is interrupted. The fire pump takes suction from a 12-inch underground connection from the campus water mains. The supply piping in the pump room has a 12-inch backflow preventer. The fire pump discharge feeds four sprinkler risers, also located in the pump room. A normally closed flow meter loop connects the fire pump discharge piping to the suction piping. The fire pump is set to start automatically when system pressures fall to 115 psi, and then run until manually shut down. The jockey pump starts at 125 psi and shuts off at 135 psi. Analysis of the fire pump capacity shows that the pump is oversized for the available public water supply. If the pumps runs beyond 3,000 gpm, possible cavitation of the impeller pump housing may occur which would reduce the performance, operability, and reliability of the pump.

6.2. Fire Sprinkler System

The campus automatic wet-pipe fire sprinkler systems are a combination of pipe schedule and hydraulically designed systems. A majority of the facilities with non-upgraded sprinkler systems constructed prior to 1981 were observed to be protected with pipe-schedule designed sprinkler systems.

The noted sprinkler system equipment manufacturers were Victaulic, Grinnell (Gem), Viking, Reliable/Rasco, and Central/CSC. The surveyed building sprinklers include, glass bulb, chemical pellet, fusible link upright, pendent, recessed, and sidewall types. The majority of the sprinklers were observed to be ordinary temperature standard-response spray sprinklers. There were no sprinklers observed that were listed in any sprinkler manufacturers' recall notices.

It was noted that supply-side sprinkler riser gauges registered pressures ranging from 45 to 100 psi. The sprinkler gauges did not have date stamps to indicate whether they had been replaced and/or calibrated within a 5-year period, as required by NFPA 25.

A portion of the surveyed buildings had standpipe systems installed. A majority of the standpipe systems were observed to be Class II (occupant use only) systems. All of the surveyed standpipe cabinets had the hoses removed and in some instances, fire extinguishers were located inside the cabinets. There was a combination of wet and dry pipe standpipe systems.

The Las Cruces campus is geographically located as such that no sprinkler system seismic bracing is required by code or by the New Mexico SFMO. Sprinkler pipe hangers are provided and installed in accordance with the spacing requirements NFPA 13. Fastener type was not evaluated.

All of the surveyed sprinkler systems were monitored by the building's fire alarm system, which in turn is monitored by the campus police dispatch center.

6.3. Clean-Agent Fire Suppression Systems

Total flooding clean-agent fire suppression systems are installed in data server rooms located in Milton Hall and the Science Hall buildings. The detection and control equipment for both systems are provided by listed releasing panels manufactured by Ansul. Each system is also monitored by the building fire alarm system. The systems also include interlocks for shutting down mechanical and electrical service within each protected hazard. Existing Fire Alarm System Descriptions

Fire alarm systems in service on the Las Cruces campus include equipment manufactured by Ademco (ADT), Fire-Lite, Notifier, Silent Knight, and Gamewell-FCI.

Activation of the fire alarm systems are either from manually activated devices such as manual fire alarm boxes, automatic smoke or heat detectors, or from automatic sprinkler waterflow switches. Activation of the fire alarm systems initiates occupant notification appliances that include both audible and visual appliances.

Typical notification appliances include audible and visual appliances. Audible devices included horns or speakers and visual devices included strobes. Due to the difference in ages of the buildings, the application and use of notification appliances varies from building to building.

Alarm, trouble, and supervisory signals for the fire alarm systems are monitored by central station receivers located in the Milton Hall data center. All incoming signals are then sent to a third party graphics monitoring platform located at the Campus Police Department Dispatch Center.

6.4. Control equipment

The following is a description of the fire alarm control equipment surveyed by Aon FPE. Copies of product data sheets for the fire alarm control equipment described below are provided in Appendix B.

6.4.1. ADT Focus 200 Panel

Manufactured by Ademco and branded by ADT, the Focus 200 panel is a microprocessor based system that was UL listed for commercial fire, security, and access control use in 2000. The system provides up to 255 addressable input/output points and has two supervised notification appliance outputs. The system will support up to 32 two-wire smoke detectors without the use of expansion modules.

The primary roles of these panels were for intrusion and security monitoring or access control. The main control panel has no visual display and all controls and information are connected through a separate keypad. The system is capable of providing simple basic outputs for control interlocks, but has limitations for providing complex programming and the notification circuits are not capable of providing synchronized outputs. Most of the ADT systems installed on the campus activate separate dedicated power supplies for the notification appliances. The ADT panels are not capable of networked communication and include a built in Digital Alarm Communicator/Transceiver (DACT) for off-premises monitoring.

ADT Focus Panels are installed in the following buildings:

Building Number	Building Name
272	Greek Complex 200-299
273	Greek Complex 300-399
274	Greek Complex 400-499
276	Walden Hall
288	Guthrie Hall
301	Thomas & Brown Hall
338	Educational Services Center
368	Knox Hall
389	Music Building
414	Greek Complex 500-899

6.4.2. Fire-Lite MS9200

The Fire-Lite MS9200 is a non-proprietary fire alarm control panel manufactured by Honeywell that is capable of supporting up to 99 input/output modules and 99 detectors for a total of 198 point-addressable devices. The panel has a built in display on the main control panel that provided the ability to view events and make program changes to the operating system.

The panel provides four synchronized notification appliance output circuits and a DACT for off-premises monitoring. The panel is capable of providing programmable output control functions to support required life-safety interlocks and is capable of remote uploading or downloading. The Fire-Lite panels are also capable of supporting upgrades that would allow for Internet Protocol (IP) based communication. The Fire-Lite addressable product line is still in production and supported by the manufacturer.

Fire-Lite MS9200 Fire Alarm panels are installed in the following buildings:

Building Number	Building Name
60	Dan W. Williams Hall
60A	Williams Annex
79,80,185	Rhodes-Garrett-Hamiel Hall
83	Milton Hall
172	Hadley Hall
187	Chemistry Buildings (1955,1965,1995)
248	Regents Row
248A	Roberts Hall
244	Gerald Thomas Hall

Building Number	Building Name
363	Engineering Complex I
386	Business Complex Building
391	Science Hall
387-A100	Myrna's Children Center
387-A200	Myrna's Children Center
387-A300	Myrna's Children Center
387-A400/A500	Myrna's Children Center
387-A600	Myrna's Children Center
387-A700	Myrna's Children Center
387-A800	Myrna's Children Center
387-C100	Myrna's Children Center
387-C200	Myrna's Children Center
387-C300	Myrna's Children Center

Fire-Lite MS9600

The Fire-Lite MS9600 is an expanded version of the MS9200 platform. The MS9600 panel includes the features for the MS9200 and is capable of supporting up to 159 input/output modules and 159 detectors, for a total of 318 point-addressable devices. The MS9600 also provides the ability to add a second SLC to increase the number of addressable points to 636.

Fire-Lite MS9600 fire alarm panels are installed in the Branson Library, Building No. 278

6.4.3. Notifier 500

The Notifier 500 panel is a small conventional-type fire alarm panel that is capable of supporting up to 16 hard-wired initiating zones. The operating system is field programmable and is capable of programmed bypass events from the main panel. This panel was available in the late 1990s. Production of this panel has been discontinued and is no longer supported by the manufacturer. The panels are not capable of IP based communication and require a separate dedicated DACT for communication with the campus' central station receiver.

Notifier 500 fire alarm panels are installed in the following buildings:

Building Number	Building Name
271	Greek Complex 100-199
467	Housing & Bookstore Warehouse

6.4.4. Notifier 5000

The Notifier 5000 panel is a multi-zone addressable-type fire alarm panel that is capable of supporting up to 120 alarm-initiating circuits. The main control unit is capable of supporting both conventional (hard-wired) and addressable-type devices. The operating system is field programmable and is capable of programmed by-pass events from the main panel. This panel was available through 2005. Production of this panel has been discontinued and is no longer supported by the manufacturer. Signals are sent to the central station through a separate DACT and IP based communication is not possible with this panel.

Notifier 5000 fire alarm panels are installed in the Zuhl Library, Building No. 461.

6.4.5. Notifier AFP200

The Notifier AFP200 is very similar in features and functions as the Fire-Lite MS9200. It is also manufactured by the parent company Honeywell, but sold and distributed under the Notifier brand. It is a programmable fire alarm control panel that is capable of supporting up to 99 input/output modules and 99 detectors for a total of 198 point-addressable devices. The panel has an optional DACT module for off-premises monitoring and provides 4- synchronized notification appliance output circuits. The panel has a built in display on the main control panel that provided the ability to view events and program the system. The AFP 200 is no longer in production but is still supported by the manufacturer.

Notifier AFP200 fire alarm panels are installed in the James B. Delamater Activity Center, Building No. 321.

6.4.6. Notifier AFP400

The Notifier AFP400 is also manufactured by Honeywell and distributed under the Notifier brand. It is a programmable fire alarm control panel that is capable of supporting up to 396 point-addressable intelligent devices. The AFP400 is listed for releasing service and is also capable of providing voice evacuation messaging and two-way fire fighters telephone service and smoke control. The panel has an optional DACT module for off-premises monitoring and provides four synchronized notification appliance output circuits. The panel has a built in display on the main control panel that provides the ability to view events and program the system.

The AFP400 is no longer in production but is still supported by the manufacturer. Notifier AFP400 fire alarm panels are installed in the following buildings:

Building Number	Building Name
275	Garcia Residence Hall
284	Pan American Center
551	Skeen Hall

6.5. Central Station Monitoring

Currently, all of the fire alarm systems are monitored by two UL listed Silent Knight 9800 central station receivers located in Milton Hall. One receiver is designated as a primary receiver and the second one provides backup in accordance with the requirements for central station service located in NFPA 72. Alarm trouble or supervisory signals from each monitored system are then sent to a third party graphics monitoring platform located in the Campus Police Dispatch Center. The Silent Knight 9800 product line has been discontinued, but product support is still provided by the manufacturer.

7. Maintenance and Testing

NMSU has dedicated alarm technicians who are responsible for the testing, maintenance, and repair of the fire alarm systems on the Las Cruces campus. The technicians work under the supervision of the facilities electrical department, and have the ES-3J Sound and Intercommunication and Electrical Alarm Systems license certification that is required by the State of New Mexico. The testing and maintenance of the fire sprinkler systems is being conducted on a quarterly basis under a contract with Accent Fire Protection located in Santa Fe, New Mexico. No documentation was observed to indicate the clean-agent suppression systems were being tested and inspected annually as required by NFPA 72 and NFPA 2001.

Testing frequencies of the fire alarm and suppression systems is coordinated with campus schedules and the majority of the testing work is completed during breaks in the academic calendar. The fire alarm systems serving Skeen Hall and the Pan-American Center supervise and control engineered smoke-control systems. The annual fire alarm testing does not include testing of the campus smoke-control systems.

Currently, NMSU facilities does not have a formal record system in place to document the results of the fire alarm testing as required by the inspection, testing, and maintenance guidelines found in NFPA 72. Sprinkler test and inspection forms provided by Accent Fire Protection were found to comply with NFPA 25 requirements.

No testing documentation was available for the clean-agent suppression systems. NFPA 2001 requires annual testing of the alarm and detection systems, and visual inspections of the barriers for each protected hazard.

8. Evaluations

8.1. Fire Suppression Systems

8.1.1. Fire Sprinkler Systems

The evaluation of the fire sprinkler systems serving the Las Cruces campus was based on requirements found in the 1997 Edition of NFPA 101, the 1996 Edition of NFPA 13, the 1996 Edition of NFPA 13R, and the 1996 Edition of NFPA 14. Deficiencies for each building were noted on the code compliance forms located in Appendix A.

Basement only sprinklers were found in the Science Hall, Chemistry Building Complex (1965 wing), and the Thomas and Brown Hall. This complies with the code of record for the buildings. The fire sprinkler systems were evaluated for hydraulic adequacy. The 2009 NMSU Water Master Plan report was used as the source of the water supply data. Appendix F provides detailed information regarding each buildings hydraulic adequacy.

The following buildings have partial sprinkler coverage and/or are deficient in their existing sprinkler coverage.

Building Number	Building Name
275	Garcia Residence Hall
60A	D. Williams Hall Annex
79,80,185	Rhodes-Garrett-Hamiel (RGH) Hall
83	Milton Hall
60	D. Williams Hall
187	Chemistry Building Complex (1955,1965,1995)
244	Gerald Thomas Hall
363	Engineering Complex I
386	Business Complex Building
391	Science Hall

The following buildings have full area coverage sprinkler systems, but still require additional sprinkler coverage in unprotected areas.

Building Number	Building Name
60	Dan W. Williams Hall
60A	Williams Annex
79,80,185	Rhodes-Garrett-Hamiel Hall
83	Milton Hall
187	Chemistry Building Complex (1955,1965,1995)
244	Gerald Thomas Hall
363	Engineering Complex I
386	Business Complex Building
391	Science Hall

The following buildings have no sprinkler system installed:

Building Number	Building Name
100-400	Greek Complex
500-800	Greek Complex Quads

Buildings not requiring sprinkler/standpipe systems in accordance with current code requirements were not listed in the aforementioned tables.

The following buildings have Class I and Class II standpipe systems installed. All of the standpipe systems had hoses removed.

Building Number	Building Name	Standpipe Classification
187	Chemistry Building Complex	I
284	Pan American Center	I
83	Milton Hall	II
278	Branson Library	II
244	Gerald Thomas Hall	II
391	Science Hall	I
321	J.B. Delamater	II
389	Music Building	II
301	Thomas and Brown Hall	I & II
288	Guthrie Hall	II
386	Business Complex	II
276	Walden Hall	II

8.1.2. Clean-Agent Fire Suppression Systems

The primary purpose of the clean-agent fire suppression systems is to protect critical function equipment serving the campus IT network. The systems are monitored and controlled by dedicated releasing panels that are supervised by the fire alarm systems serving each building. Each protected hazard has automatic detection and manual release capabilities along with audible and visual notification.

The system located in the basement of Milton Hall was observed to be incorrectly set up for proper cylinder actuation and Aon FPE notified NMSU facilities for corrective action. Other deficiencies noted for this system included unsealed penetrations within the protected hazard and improperly supported distribution piping. The second floor system serving Science Hall was observed not to include detection throughout the protected hazard under the raised floor.

No documentation for both systems was available during the survey and Aon FPE recommends further evaluations of both of the clean-agent suppression systems should be performed to ensure compliance with NFPA 2001. This also would include a complete review of each protected hazard to ensure that required design concentrations would be achieved in the event of a discharge. Several unsealed penetrations were observed in the Milton Hall protected hazard that should be properly sealed.

Other recommendations include providing detailed training and instruction to all personnel who have access to these areas. The failure to properly train personnel in the safe operation and maintenance of these systems may result in injury or loss of critical campus equipment and data. Additional safeguards would include limiting access to these areas and securing keys to panels and bypass switches to key personnel.

8.2. Fire Alarm Systems

The evaluation of the fire alarm systems serving the Las Cruces campus were based on requirements found in the 1997 Edition of NFPA 101, the 1997 Edition of NFPA 1, the 1996 Edition of NFPA 72, and The Americans with Disabilities Act (ADA). Deficiencies for each building were noted on the code compliance forms found in Appendix A.

Due to the various ages of the buildings on campus, many of the fire alarm systems surveyed were observed to be the second or third generation systems installed for each building. Many of the original fire alarm systems were simple, manually activated systems that provided local only notification to the building occupants. In most cases, the replacement or upgrade of these systems was initiated as part of renovation projects or simply due to the failure of obsolete equipment.

The current NMSU Engineering and Construction Guidelines for fire alarm systems specify addressable type fire alarm systems, and the majority of the control equipment surveyed were Fire-Lite addressable systems. The only non-addressable (conventional-type) systems surveyed were hard-wired Notifier 500 panels located at the Greek Complex, and the Housing and Bookstore warehouse building. Current life-safety code requirements often require the fire alarm systems to be capable of performing output control functions for the control of elevators, HVAC shutdown, or complex smoke-control control interlocks.

Many of the fire alarm systems provide no provisions for performing these code required interlocks. Systems, such as the ADT and Notifier 500 systems, are not capable of providing the programming logic required and would not support current code requirements if these buildings were remodeled. Other examples included systems that were upgraded with new control equipment capable of performing these functions but the detection and control required for elevator or HVAC control was never included as part of the replacement.

The ADA maximum height for manual fire alarm boxes ranges from 48 inches for forward reaching locations where a disabled person will reach forward, to a maximum of 54 inches to reach the box from the side. In contrast, the installation height requirements of NFPA 72, The National Fire Alarm Code, range from 42 to 54 inches with most jurisdictions standardizing on 48 inches to the operable part of the device. Many manual fire alarm boxes were observed to be mounted at heights that exceeded 54-inches above the finished floor. Other compliance issues observed for manual fire alarm boxes included obstructed or blocked devices. Examples included lobby areas near exits where chairs were placed under the devices. While not a specific code requirement, some buildings were observed to have multiple types or manufacturers of manual fire alarm boxes within each building. All devices connected to a common system should be the same model or brand and have the same appearance or look to avoid any confusion by occupants.

Most of the fire alarm systems also included automatic initiating devices such as smoke and heat detectors and input modules for monitoring suppression systems. Common code compliance issues observed included no smoke or heat detection for the protection of the control equipment, incorrect spacing and locations, and incorrect application of devices for HVAC shutdown. This included the use of sampling-tube type duct detectors for damper or fan control installed outside of mechanical ductwork or in

front of fire smoke dampers. Other deficiencies noted included incorrect spacing due to room or area use changes from remodeling work for buildings with full area detection.

At the time of many of the original fire alarm installations, occupant notification was limited to bells or mechanical horns located centrally in corridors or hallways, and visual coverage was not yet a code-driven requirement. Subsequently, as these systems were replaced, many of the existing notification appliance device locations were re-used and replaced with newer devices that met the new ADA compliant visual signaling appliance requirements. While this may have corrected device specific compliance issues, it did not correct location and spacing requirements. Many of the buildings surveyed did not have correct visual signaling for all designated public or common-use areas such as classrooms, restrooms, or break rooms. Strobes should be installed throughout several of the buildings to meet the requirements of NFPA 72 and ADAAG. Since most of the appliances are located in original device locations, the current audibility level may not meet the current code requirements in all locations as well. The sound levels for the appliances in the corridors may be very loud, but may be very low in surrounding areas and some building occupants have indicated that they could not hear the audible devices.

The following fire alarm systems were found to be in general compliance with the applicable codes and standards and do not require any corrective action:

Building Number	Building Name
387-A100	Myrna's Children Center
387-A200	Myrna's Children Center
387-A300	Myrna's Children Center
387-A400/A500	Myrna's Children Center
387-A600	Myrna's Children Center
387-A700	Myrna's Children Center
387-A800	Myrna's Children Center
387-C100	Myrna's Children Center
387-C200	Myrna's Children Center
387-C300	Myrna's Children Center

The following buildings have obsolete control equipment and noncompliant notification and detection systems and are recommended for a complete system replacement:

Building Number	Building Name
278	Branson Library
271	Greek Complex 100-199
272	Greek Complex 200-299
273	Greek Complex 300-399
274	Greek Complex 400-499
288	Guthrie Hall
301	Thomas & Brown Hall
321	James B. Delamater Activity Center
338	Educational Services Center
363	Engineering Complex I
368	Knox Hall
386	Business Complex Building
389	Music Building
391	Science Hall
461	Zuhl Library
414	Greek Complex 500-899
467	Housing & Bookstore Warehouse
276	Walden Hall

The following buildings have adequate addressable control equipment, but require upgrades to correct non-compliant detection, notification, and control interlock deficiencies.

Building Number	Building Name
60 & 60A	Dan W. Williams Hall & Williams Annex
83	Milton Hall
79,80,185	Rhodes-Garrett-Hamiel Hall
172	Hadley Hall
187	Chemistry Buildings (1955,1965,1995)
248	Regents Row
248A	Roberts Hall
244	Gerald Thomas Hall
275	Garcia Residence Hall

9. Recommendations

The following are Aon FPE's general recommendations for the fire suppression and fire alarm systems serving the Las Cruces campus. Specific recommendations for each building are provided on the evaluation forms in Appendix A.

9.1. Fire Suppression Systems

Sprinkler System Riser Components

- Repair/replace all inoperable sprinkler system waterflow/pressure switches.
- Replace/recalibrate water pressure gauges every 5 years.
- Repair leaks on fittings in and around sprinkler risers.
- Provide control valve supervision.
- Provide valve and/or hydraulic nameplate labels.

Sprinkler System Devices

- Provide adequate number and type of spare sprinklers and wrenches.
- Replace painted/damaged/leaking sprinklers.
- Add additional sprinklers to areas lacking adequate coverage.
- Repair/replace inoperable sprinkler alarm bells.
- Remove foreign objects attached to sprinkler pipes.
- Relocate obstructed sprinklers.
- Replace missing sprinkler escutcheons.
- Clean/replace dirty sprinklers.

Standpipe System Devices/Components

- Replace missing/damage standpipe caps on Siamese connections.
- Provide accessibility to Fire Department Connections (FDCs).
- Remove/decommission non-maintained and non-code required standpipe systems.

Clean-Agent Suppression Systems

- Record documents should be available for each system and a review done to confirm compliance with NFPA 2001 and NFPA 72.
- Correct cylinder activation for the Milton Hall system.
- Seal all penetrations within each protected enclosure.

- Add systems to a scheduled maintenance and inspection program.
- Provide training for all personnel that may work in protected areas. Training should include proper procedures for securing the system from unwanted discharges during maintenance work within each area.
- Secure control panel keys or limit access to protected areas to reduce malicious or accidental activation.
- Develop maintenance and testing program in accordance with NFPA 2001.

9.2. Fire Alarm Systems

- Replace non-addressable and obsolete fire alarm system control equipment (i.e., ADT and hard-wired Notifier systems).
- Upgrade occupant notification to meet ADA and NFPA requirements for visual and audible coverage.
- Upgrade detection to full area coverage for buildings that are not protected with sprinklers.
- Add supervised detection with built in-sounder bases to the dorm rooms.
- Correct mounting heights and locations for manual fire alarm boxes.
- Provide control interlocks for HVAC and elevator controls.
- Standardize equipment that can be purchased and maintained by NMSU alarm techs and does not rely on proprietary software.
- Develop maintenance and testing program in accordance with NFPA 72.

10. Risk Assessment Summary

The risk assessment of the buildings surveyed on the Las Cruces Campus was based on a combination of observed code deficiencies and the application of the code strategy approach. These deficiencies were then classified by building into high, medium, and low risk categories for both fire alarm and sprinkler systems. The list was then complied based on the occupancy and use for each building, with the residential dormitories as having the highest priority.

High-risk items included complete system replacements and corrective action for significant deficiencies required to meet current code requirements. Medium risk categories were deficiencies that still required corrective action, but were not as significant as those deemed to be considered high risk. Low risk items were deficiencies that required minimal amount of corrective action or adoption of recommendations for improvement. A complete list of the fire alarm and sprinkler deficiency lists are provided in Appendix C.

The following buildings were noted as requiring complete new or significant additions to existing systems that were defined as the high-risk categories for fire suppression systems:

Building Number	Building Name
79,80,185	Rhodes-Garrett-Hamiel Residence Hall
271	Greek Complex 100-199
272	Greek Complex 200-299
273	Greek Complex 300-399
274	Greek Complex 400-499
275	Garcia Residence Hall
414	Greek Complex 500-899
60	Dan W. Williams Hall
60A	Williams Annex
83	Milton Hall
187	Chemistry Complex (1955,1965,1995)
301	Thomas & Brown Hall
461	Zuhl Library
551	Skeen Hall
338	Educational Services Center
284	Pan American Center
363	Engineering Complex I
368	Knox Hall
391	Science Hall

The following building fire alarm systems were categorized as high-risk systems requiring complete replacement or upgrades due to obsolete or inadequate control equipment and upgrades to meet ADA requirements for occupant notification:

Building Number	Building Name
271	Greek Complex 100-199
272	Greek Complex 200-299
273	Greek Complex 300-399
274	Greek Complex 400-499
414	Greek Complex 500-899
288	Guthrie Hall
301	Thomas & Brown Hall
389	Music Building
276	Walden Hall
338	Educational Services Center
368	Knox Hall
467	Housing & Bookstore Warehouse
461	Zuhl Library
321	James B. Delamater Activity Center
386	Business Complex Building
363	Engineering Complex I
391	Science Hall
278	Branson Library

11. Cost Opinion Summaries

Using information compiled from the field surveys, detailed cost opinions were created for each building surveyed using current manufacturer list pricing for equipment and through the use of RSMeans Construction Cost Data, which is based upon current national labor and equipment averages. The cost opinions are based on pricing information for equipment and labor rates known at the time of the survey and are to be used as guides for budgetary purposes only.

Additional cost considerations for budgeting purposes not included in these opinions also include any ancillary work that could be required as part of these corrections. This would include restoration or repair of finishes, or costs associated with equipment upgrades such as HVAC or elevator modernization requirements.

The following is a summary of the cost opinions for the buildings surveyed by Aon FPE as part of this evaluation with the residential occupancies listed first. A complete list of the fire alarm and sprinkler cost opinion summaries for each surveyed building are located in Appendix D.

Cost Opinion Summary

Bldg#	Building Name	Other Work	Fire Alarm	Sprinkler	Total
79,80,185	Rhodes-Garrett – Hamiel Hall	$0.00	$78,832.50	$60,400.00	**$139,232.50**
271	Greek Complex 100-199	$0.00	$28,276.50	$35,000.00	**$63,276.50**
272	Greek Complex 200-299	$0.00	$28,276.50	$36,000.00	**$64,276.50**
273	Greek Complex 300-399	$0.00	$28,276.50	$35,000.00	**$63,276.50**
274	Greek Complex 400-499	$0.00	$28,276.50	$35,000.00	**$63,276.50**
275	Garcia Residence Hall	$8,000.00	$51,020.00	$23,375.00	**$82,395.00**
414- 500	Greek Complex 500	$0.00	$42,136.50	$42,000.00	**$84,136.50**
414-600	Greek Complex 600	$0.00	$42,136.50	$42,000.00	**$84,136.50**
414-700	Greek Complex 700	$0.00	$42,136.50	$42,000.00	**$84,136.50**
414-800	Greek Complex 800	$0.00	$42,136.50	$42,000.00	**$84,136.50**
60 & 60A	Dan W. Williams Hall	$0.00	$33,435.00	$14,550.00	**$47,985.00**
83	Milton Hall	$0.00	$60,478.50	$5,150.00	**$65,628.50**
278	Branson Library	$0.00	$228,865.00	$250.00	**$229,115.00**
172	Hadley Hall	$0.00	$65,550.00	$0.00	**$65,550.00**
187	Chemistry Buildings (1955,1965,1995)	$0.00	$103,230.00	$14,700.00	**$117,930.00**
248	Regents Row	$0.00	$57,510.00	$0.00	**$57,510.00**
248A	Roberts Hall	$0.00	$4,680.00	$0.00	**$4,680.00**
244	Gerald Thomas Hall	$0.00	$61,054.50	$250.00	**$61,304.50**
284	Pan American Center	$30,500.00	$36,353.00	$23,400.00	**$90,253.00**
288	Guthrie Hall	$0.00	$39,753.00	$250.00	**$40,003.00**
301	Thomas & Brown Hall	$0.00	$61,807.50	$1,075.00	**$62,882.50**
321	James B. Delamater Activity Center	$0.00	$115,777.50	$250.00	**$116,027.50**

Cost Opinion Summary

Bldg#	Building Name	Other Work	Fire Alarm	Sprinkler	Total
338	Educational Services Center	$0.00	$61,807.50	$2,350.00	**$64,157.50**
363	Engineering Complex I	$0.00	$108,795.00	$30,900.00	**$139,695.00**
368	Knox Hall	$0.00	$100,986.00	$8,100.00	**$109,086.00**
386	Business Complex Building	$0.00	$131,025.00	$250.00	**$131,275.00**
389	Music Building	$0.00	$123,285.00	$150.00	**$123,435.00**
391	Science Hall	$0.00	$199,485.00	$2,175.00	**$201,660.00**
461	Zuhl Library	$0.00	$158,197.50	$3,550.00	**$161,747.50**
467	Housing & Bookstore Warehouse	$0.00	$33,067.50	$0.00	**$33,067.50**
276	Walden Hall	$0.00	$38,106.00	$250.00	**$38,356.00**
551	Skeen Hall	$12,500.00	$60,987.50	$1,950.00	**$75,437.50**
	Totals	**$51,000.00**	**$2,295,740.50**	**$502,325.00**	**$2,849,065.50**

The implementation of a corrective action plan to address the deficiencies found on the Las Cruces campus will require a planned approach. Based on the information complied as part of the Risk Assessment Study, the residential dormitories were determined to have the highest priority and would require approximately $850,000.00 to correct the fire alarm and sprinkler deficiencies observed. The remaining buildings surveyed would require approximately $1,900,000.00.

Options to consider include setting up a program that utilizes a pre-determined amount each year to address all deficiencies within a fixed period. Budgeting $500,000.00 a year for 7-10 years would provide required funding to correct the most serious deficiencies with the first 3-5 years. Coordination with the NMSU Master Plan and any other planned building or infrastructure improvements would be necessary to determine the best use of funding.

Other available options to consider would include utilizing a phased replacement approach for fire alarm system replacements in the larger buildings. With prior AHJ approval, upgrades or repairs would be done over an agreed upon period to minimize disruptions to the buildings occupants and allow available funding to be used for correcting more buildings per year.

12. Conclusion

Aon FPE evaluated the fire suppression and fire alarm systems of 40 selected buildings on the NMSU Las Cruces campus in accordance with codes adopted by the SFMO for existing facilities and the ADA. This report provides a summary of the existing fire suppression and fire alarm systems surveyed and provides recommendations to bring the systems into code compliance.

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Appendix A – Building Information Sheets and Field Survey Notes (By Building)

Appendix B – Fire Alarm/Product Information Data Sheets

Appendix C – Fire Alarm and Sprinkler System Deficiency List

Appendix D – Cost Opinions (By Building)

Appendix E – Field Survey Photographs

Appendix F – Sprinkler System Flow and Pressure Evaluations