FIRE PROTECTION REPORT
UNLV LIEID LIBRARY
SMOKE MANAGEMENT SYSTEMS REDESIGN

Prepared for:

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# Table of Contents

1. PROJECT DESCRIPTION  
2. BUILDING DESCRIPTION  
3. FIRE-RESISTIVE SEPARATIONS  
4. INTERIOR FINISHES  
5. EGRESS  
6. FIRE PROTECTION SYSTEMS  
7. FIRE ALARM, DETECTION AND EMERGENCY COMMUNICATION SYSTEMS  
8. SMOKE MANAGEMENT SYSTEMS  
9. FIRE COMMAND CENTER  
10. EMERGENCY AND STANDBY POWER  
11. ELEVATORS  
12. PERIODIC OPERATIONS AND MAINTENANCE  
13. FUTURE MODIFICATIONS  
14. CONCLUSION  

Appendix A: Lied Library Site Plan  
Appendix B: Smoke Zone Boundary Layout: Levels 1 through 5  
Appendix C: Fire Alarm and Smoke Control Functional Matrix
1. PROJECT DESCRIPTION

1.1. At the request of University of Nevada Las Vegas (UNLV), JBA Consulting Engineers prepared the following Fire Protection Report (FPR).

1.2. UNLV proposes to redesign the existing smoke management systems serving the Lied Library building to achieve more simple and reliable systems. Existing fire-resistive and smoke barriers and smoke management equipment will be utilized to achieve the revised system requirements. Overall, the existing systems are complicated systems which require activation and arrangement of large numbers of dampers and equipment for proper configuration to achieve code mandated performance criteria. This results in a high level of unreliability, as equipment failures are common. It is intended to review the existing systems and building features to revise system configurations of the smoke management systems. This will result in a simplified and code compliant system that will increase the overall reliability of these systems, substantially increasing the likelihood of proper functionality in a possible fire scenario. This will result in a safer building environment.

1.3. All work will be performed in accordance with the 2012 International Building Code (IBC) and 2012 International Fire Code (IFC) with Nevada State Public Works Division Adopted Standards.

2. BUILDING DESCRIPTION

2.1. Lied Library opened in the year 2000 and was designed and constructed under the provisions of the 1997 Uniform Building Code (UBC) and Clark County Building Code Amendments.

2.2. The Lied Library is centrally located on the UNLV Main Campus, just north of the Classroom Building Complex. The facility is the largest library on the campus. The library is a mixed-use building that has 2,500 study spaces, over 300 computer work stations, electronic instructional rooms, and an automated storage and retrieval system with support areas including offices, electrical and mechanical rooms.

2.3. The facility is an approximately 302,000-square foot, five-story building with an atrium extending the entire height of the facility that is classified as a high-rise building. The building was built of Type I-F.R. construction in accordance with the 1997 Uniform Building Code (UBC), which is consistent with IBC Type IA construction. The facility is provided with standpipe and automatic sprinkler protection throughout supplied by a fire pump and 15,000-gallon secondary water storage, fire alarm detection and emergency voice communication systems, smoke management systems, and an emergency / standby power system. The existing fire command center (FCC) is provided with direct exterior access and is located on the east side of the facility.
2.4. The existing smoke management systems consist of seven active smoke control zones, four pressurized exit stairways and two pressurized elevator machine rooms. Description of zones are noted as follows:

2.4.1. Smoke Control Systems (existing)

2.4.1.1. Smoke Zone 1: Exhaust method; serving the open atrium, which extends from Level 1 through 5.

2.4.1.2. Smoke Zone 2: Pressurization method; Levels 1 through 3.

2.4.1.3. Smoke Zone 3: Pressurization method; Level 1.

2.4.1.4. Smoke Zone 4: Pressurization method; Levels 1 and 2.

2.4.1.5. Smoke Zone 5: Pressurization method; Levels 3 and 4.

2.4.1.6. Smoke Zone 6: Pressurization method; Level 3.

2.4.1.7. Smoke Zone 7: Pressurization method; Level 3.

2.4.2. Pressurized Exit Stairways (existing)

2.4.2.1. Stairwell A (Northwest Stairway).

2.4.2.2. Stairwell B (East Stairway).

2.4.2.3. Stairwell C (Southeast Stairway).

2.4.2.4. Stairwell D (Southwest Stairway).

2.4.3. Pressurized Elevator Machine Rooms (existing).

2.4.3.1. Central Passenger Elevator Machine Room.

2.4.3.2. Freight Elevator Machine Room.

3. FIRE-RESISTIVE SEPARATIONS

3.1. All new construction will be of IBC Type IA construction.

3.2. The facility will remain classified as a high-rise building. Per IBC Section 508.3, the building will be treated as a non-separated mixed use occupancy. Therefore, fire-resistance rated occupancy separations are not required, except as noted below.
3.3. Enclosures of special use/rooms.

3.3.1. Elevator machine rooms: 2-hour.

3.3.2. Emergency electrical equipment rooms: 2-hour.

3.3.3. Fire Command Center (FCC): 2-hour.

3.3.4. Fire pump room: 1-hour.

3.3.5. Boiler Room: 1-hour.

3.3.6. As the original construction of both the boiler room and fire pump room utilizes 1-hour fire resistance rated walls, this rating will be maintained.

3.4. Other separations.

3.4.1. Atrium separations from adjacent spaces: 1-hour.

3.4.1.1. IBC Section 404.6, Exception 3, “A fire barrier is not required between the atrium and the adjoining spaces of any three floors of the atrium provided such spaces are accounted for in the design of the smoke control system.”

3.4.1.2. As allowed per above section, no fire barrier separation will be required from the atrium and Levels 1, 2, and 3.

3.4.1.3. Level 4 will be separated from the atrium by 1-hour fire-resistive fire barrier. Where glass is provided in the wall, IBC Section 404.6 Exception 1.1 will be complied with.

3.4.1.4. Level 5 existing fire-resistance rated separation walls are used to separate various occupancies from the atrium on the west side of the level. Along the west side of the floor, fire-resistance rated walls are provided to separate the atrium from Storage Room 5216, Custodial Room 5213, Mechanical Room 5201, freight elevator lobby, Telephone Room 5196 and Corridor 5192. Restrooms located on the west and south sides of the atrium, Data Room 5117, and Group Study Rooms 5121, 5122, 5123, and 5124 located on the southeast side of Level 5 will not be separated from the atrium by fire-resistance rated walls, as originally constructed. The basic premise of the atrium requirements is that an engineered smoke control system combined with an approved automatic sprinkler system is an adequate alternative to fire-resistance rating of a shaft enclosure. As these spaces are located at the top of the atrium, are only accessed from the atrium, are sprinklered spaces and will not contain quantities of commodities sufficient to support a fire
size that would overpower the engineered smoke control system, these spaces will be considered part of the atrium. Spaces not associated with the atrium, which are adjacent to these rooms, are separated by fire-resistance rated construction and are spaces which are considered typically non-occupied spaces. Sprinkler systems serving this level of the atrium also serve these rooms. During a fire incident within these spaces, the resulting smoke will either be contained within the room, or will spill into the atrium area where it will be exhausted by the smoke control system.

3.4.2. Corridors: non-rated, noncombustible.

3.4.3. Pressurized stairways: 2-hours.

3.4.4. Smoke zone boundaries: 1-hour.

3.4.5. Elevator lobbies.

3.4.5.1. Per IBC Section 713.14.1 Item 5, elevator lobbies are to be constructed as smoke partitions. Duct penetrations are to be protected with smoke dampers.

3.4.5.2. The Central Passenger Elevator opens onto atrium Levels 1 through 5. An elevator lobby is not required, nor provided at these landing as allowed per IBC Section 712.1.6.

3.5. If penetrations of fire-resistance rated construction occurs, penetrations of fire-resistance rated construction will be in accordance with IBC Section 714.

3.6. Duct penetrations and air transfer opening protections will comply with IBC Section 717.

3.6.1. Existing duct and air transfer penetrations will be reviewed for compliance with current building code.

3.6.2. Noncompliant penetrations will be revised to be compliant. Listed through-penetration firestop systems will be provided to the Nevada State Public Works Division (SPWD) inspector for approval before anything is applied to a non-compliant penetration.

3.6.3. Unnecessary opening protections will be rendered non-operational, per approved design documentation.

3.6.4. Proper access and identification will be provided for all fire and smoke dampers maintained as functional, per IBC Section 717.4. Proper access and identification will be provided for all fire/smoke dampers maintained as functional per IBC Section 717.4.
3.6.5. Fire dampers. Fire dampers will comply with the requirements of UL555. Fire dampers will be provided at duct and air transfer openings at the following locations:

3.6.5.1. Fire walls.

3.6.5.2. Fire barriers. Fire dampers are not required at penetrations where any of the following apply:

3.6.5.2.1. Ducts used as part of an approved smoke control system per IBC Section 909, where the use of the device would interfere with the operation of the system.

3.6.5.2.2. HVAC system duct penetrations of 1-hour fire-resistive rated, or less, fire barriers. Such duct will be constructed of sheet steel not less than No. 26 gauge thickness with no flex duct connectors, and will not serve Group H occupancies.

3.6.5.3. Shaft enclosures. Fire dampers are not required at penetrations where:

3.6.5.3.1. Steel exhaust sub-ducts are extended at least 22-inches vertically in exhaust shafts provided with continuous airflow upward to the outside.

3.6.5.3.2. Ducts used as part of an approved smoke control system per IBC Section 909, where the use of the device would interfere with the operation of the system.

3.6.5.4. Fire partitions. Fire dampers are not required at penetrations where:

3.6.5.4.1. Corridor walls where the duct penetration is protected as a through penetration in accordance with IBC Section 714.

3.6.5.4.2. HVAC system duct penetrations of 1-hour fire-resistive rated, or less, fire barriers. Such duct will be constructed of sheet steel not less than No. 26 gauge thickness with no flex duct connectors.

3.6.6. Smoke dampers. Leakage ratings shall not be less than Class II and elevated temperature ratings shall not be less than 250°F (121°C). Smoke dampers will be provided at duct and air transfer openings at the following locations:

3.6.6.1. Shaft enclosures. Smoke dampers are not required at penetrations where:
3.6.6.1. Ducts used as part of an approved smoke control system per IBC Section 909, where the use of the device would interfere with the operation of the system.

3.6.6.2. Smoke barriers. Smoke dampers are not required at penetrations where:

3.6.6.2.1. Openings in ducts are limited to a single a single smoke compartment and the ducts are constructed of steel.

3.6.6.3. Smoke partitions. Smoke dampers are not required at penetrations where:

3.6.6.3.1. Ducts used as part of an approved smoke control system per IBC Section 909, where the use of the device would interfere with the operation of the system.

4. INTERIOR FINISHES

4.1. It is expected that existing interior wall, ceiling and floor finishes will not be affected or revised as part of the scope of this project. If modified, the following will be adhered too:

4.1.1. Wall and ceiling finishes will comply with IBC Section 803.

4.1.2. Interior floor finishes will comply with IBC Section 804.

5. EGRESS

5.1. It is expected that existing exiting systems will not be affected or revised as part of the scope of this project. If revised or modified, IBC Chapter 10 will be adhered to.

6. FIRE PROTECTION SYSTEMS

6.1. Modifications to automatic sprinkler system configurations is not expected as part of the scope of this project. If modifications or revisions occur, IBC Section 903 and NFPA 13 for automatic sprinklers systems and IBC Section 905 and NFPA 14 for standpipe systems will be adhered to.

6.2. Sprinkler systems are zoned to correspond with existing smoke control zones. Existing sprinkler systems will be reprogrammed to correspond with the revised smoke management systems configuration as necessary.
7. FIRE ALARM, DETECTION AND EMERGENCY COMMUNICATION SYSTEMS

7.1. Modifications to device placement for initiating devices and notification appliance are not expected as part of the scope of this project, except as noted below. All modifications and/or revisions will be performed in compliance with IBC Section 907 and NFPA 72.

7.2. The system will be maintained as fully addressable.

7.3. Annunciation of fire alarm initiating devices will be provided at the FCC and remote fire alarm annunciator located at the Level 1 Circulation Reserve Counter.

7.4. Upon receiving an alarm signal, audio, visual and evacuation message will be activated throughout the building.

7.5. The fire alarm system will receive an alarm signal from the following initiation devices:

7.5.1. Automatic sprinkler workflow switches.

7.5.2. Area smoke and heat detectors.

7.5.3. Heat detectors.

7.5.4. Projected beam type smoke detectors.

7.5.5. Manual fire alarm stations.

7.6. The fire alarm system will receive supervisory signals from the following devices:

7.6.1. Duct mounted smoke detectors.

7.6.2. Automatic sprinkler, standpipe, and fire pump control valves.

7.6.3. High and low air pressure supervisory switches for dry pipe systems.

7.6.4. Fire pump low fuel status.

7.6.5. Water storage tank high and low level status.

7.6.6. Fire pump running status.

7.7. System smoke detection is provided, and will be maintained in the following locations:

7.7.1. Within pressurized stairways at landings and in entrance vestibules.

7.7.1.1. Activation of detector within pressurized stairways will de-energize the associated pressurization fan.
7.7.2. Corridors.
7.7.3. Mechanical, electrical, transformer rooms and telephone equipment rooms.
7.7.4. Elevator lobbies and machine rooms.

7.7.4.1. Per Section 3.5.4.2 of this report, the Central Passenger Elevator is not provided with elevator lobbies.

7.7.5. Level 1 areas open to atrium.
7.7.6. Restrooms.
7.7.7. Automated Storage and Retrieval System room.
7.7.8. Storage rooms.
7.7.9. Heat detectors are provided where area detection is require but not suitable for smoke detection.

7.7.10. Additional area smoke detection will be provided in the following locations, if not already provided:

7.7.10.1. Fire alarm control units, notification appliance circuit power extender, and supervising station transmitting equipment, per IBC Section 907.4.1.
7.7.10.2. At each entrance to a pressurized exit stairway, per IBC Section 909.20.6. The detector will be located within 5-feet of the vestibule opening.

7.8. Duct type smoke detection is provided at the following locations:

7.8.1. Air-handling unit supply and return air duct serving any system delivering more than 2,000-cfm.
7.8.2. Smoke management supply fans and pressurized exit stairway fans.
7.8.3. Where necessary to close fire/smoke dampers and smoke dampers.

7.8.3.1. Duct mounted smoke detectors serving fire/smoke and smoke dampers that are disabled will be physically removed and deleted from programming.

7.9. Existing initiation devices will be reprogrammed to correspond with the required functionality for the revised smoke management systems and fire alarm functional matrix.

7.10. Existing control and monitoring program points, and associated hardware will be deleted from programming and physically removed, for dampers that are disabled/deleted as part of revisions to the smoke management systems.
8. SMOKE MANAGEMENT SYSTEMS

8.1. The smoke management systems will be updated to be in compliance with the 2012 IBC. As an atrium extends from Level 1 through Level 5, per IBC Section 404.5 a smoke control system is required and will be maintained (Smoke Zone 1).

8.2. Existing pressurized exit stairways are to be modified as follows.

8.2.1. Existing exit Stairwell A, B, C and D were originally constructed to include non-rated separations creating a partitioned entry way. Original construction of the wall and door separating the entry way from the stairs is of non-rated construction. The nonrated doors will be removed, to maintain an open pathway directly to the stairs within each stairway. The stairwell enclosure will be maintained as 2-hour fire barrier construction, in compliance with IBC Section 909.20.2. With this revision, the associated pressurized stairways will be required to be in compliance with IBC Section 909.20.5. This requires Stairwell A, B, C, and D to be pressurized to a minimum of 0.10-inches water column and a maximum of 0.35-inches water column in the shaft relative to the building, measured with all stairway doors closed under maximum anticipated conditions of stack effect and wind effect. Door opening forces will be maintained at 30-pounds or less. This will include confirming proper pressurization of each stairway with Smoke Zone 1 active and not active.

8.2.1.1. Original pressurized stairway construction included a barometric relief vent open to atmosphere, which was incorporated into original performance criteria. The existing barometric relief damper will be maintained, and utilized as needed for purposes of achieving the required performance criteria for Stairwell A, B, C and D, listed above. A specific volumetric discharge value will not be necessary as part of providing the above listed pressure differential requirements.

8.2.2. Activation of all pressurized exit stairway systems to occur following activation of any waterflow switch, area smoke detector located at the entrance to a stairway or located in a stairway vestibule.

8.2.3. Stairwell A: Located on the northwest corner of the building, this pressurized exit stairway accesses Levels 1 through 5, and provides access to the upper level roof.

8.2.4. Stairwell B: Located on the eastside of the building, this pressurized exit stairway accesses Levels 1 through 5.

8.2.5. Stairwell C: Located on the southeast side of the building, this pressurized exit stairway accesses Levels 1 through 3.

8.2.6. Stairwell D: Located on the southwest side of the building, this pressurized exit stairway accesses Levels 1 through 3.
8.3. Existing pressurized elevator machine rooms are to be maintained, per original design.

8.3.1. Elevator machine room is designed to be pressurized to a minimum 0.05-inch water column, positive, relative to the associated hoistway(s). The hoistway is provided with a fixed-opening vent to the exterior.

8.3.2. Activation of elevator machine room pressurization system to occur following initiation of associated elevator lobby area smoke detector.

8.3.3. Central Passenger Elevator Machine Room: Located centrally within the building, this elevator system consists of two elevator cars within a single hoistway that provides access to Levels 1 through 5 within the atrium. The hoistway is provided with a fixed-opening vent to the exterior.

8.3.4. Freight Elevator Machine Room: Located on the west side of the building, this elevator system consists of a single elevator car and hoistway that provided access to Levels 1 through 5. The hoistway is provided with a fixed-opening vent to the exterior.

8.4. Existing Smoke Zone 2 through Smoke Zone 7 will be decommissioned and removed from the fire alarm program. These areas now will be considered sub-passive areas to the active smoke management system.

8.4.1. Fire alarm system output for previously zoned initiating devices will be reprogrammed to new required systems outputs, per approved design documentation.

8.4.2. Above listed smoke management systems utilized non-dedicated fans for the exhausting of smoke. Associated fans will continue to be utilized for normal air-handling systems functions, as required.

8.4.3. Fans to be removed from programming for smoke management systems are as follows:

8.4.3.1. EF-5 (Smoke Zone 2).
8.4.3.2. RTF-10 (Smoke Zone 3).
8.4.3.3. RTF-9 (Smoke Zone 4).
8.4.3.4. RF-1 and RTF-11 (Smoke Zone 5).
8.4.3.5. RTF-8 (Smoke Zone 6).
8.4.3.6. RTF-7 (Smoke Zone 7).

8.5. Smoke Zone 1, the atrium smoke management system will be maintained, with the overall sequence of operation to be revised to address removed motorized dampers.
8.5.1. The atrium smoke zone is designed to utilize the exhaust method, per IBC Section 909.8. The required existing minimum exhaust rate of 320,000-cfm will be maintained.

8.5.1.1. Originally the system was designed for compliance with UBC Section 905.5.2.1, which requires the lowest horizontal smoke layer height be maintained at least 10-feet above the highest walking surface within the zone. IBC Section 909.8.1, requires the horizontal smoke layer height be maintained at least 6-feet above the highest walking surface within the zone. Therefore the original design exhaust capacity is safely assumed to be conservative and sufficient to provide the necessary exhaust to achieve the revised horizontal smoke layer height of 6-feet above highest walking surface.

8.5.1.2. A total of eight (8) smoke exhaust fans are provided, each of which has a design exhaust rate of 40,000-cfm (SE-1 through SE-8).

8.5.2. Makeup air is provide through a combination of natural ventilation and mechanical supply.

8.5.2.1. Makeup air velocities are to be maintained below 200-feet per minute.

8.5.2.2. Mechanical makeup air will be provided by existing fans utilized in the original design of the system.

8.5.2.3. Natural makeup air is provided through eleven (11) motorized dampers, which open upon activation of the smoke management system. The dampers are located on the east wall above the east main entrance and provide an estimated total of 225.8-square feet of free area.

8.5.2.3.1. Makeup air velocities at the dampers to be confirmed at approximately 10-feet from the openings.

8.5.3. Door opening forces at points of egress from the active smoke management system will be 30-pounds or less.

8.5.4. Activation of Smoke Zone 1 is to occur following initiation of any airflow within the building and upon initiation of beam detector(s) located at the top of the atrium.

8.5.5. Adjacent areas to Smoke Zone 1 will be treated as sub-passive areas to the active smoke zone.

8.5.5.1. For sub-passive areas, full height partitions will be provided and maintained at these boundaries. In a fire event within sub-passive areas, it is expected these barriers will sufficiently confine smoke to these areas. If smoke does migrate to the atrium, the smoke will be exhausted by the
active system. For a fire event within Smoke Zone 1, it is expected these barriers in conjunction with active smoke management will sufficiently confine smoke to the active zone.

8.5.5.2. These areas are provided with sprinkler protection, separate from Smoke Zone 1. Initiation of these sprinkler systems will activate Smoke Zone 1.

8.5.5.3. In the event of a fire incident in sub-passive areas, if desired post salvage mop-up for the affected area(s) can be accomplished through the activation of Smoke Zone 1, or through the opening of existing operable doors to exterior.

8.5.5.3.1. Exhaust will be achieved through providing atmospheric communication between the area of incident and the active zone by the opening of existing operable door(s).

8.5.5.3.2. Supply air can be provided/supplemented through the opening of pressurized stairways and/or openings to the exterior. Accessing pressurized exit stairways is acceptable for this purpose as post salvage mop-up operations will only occur following arrival of the fire department, and only when all occupants have evacuated and the fire incident has been fully extinguished.

8.5.5.3.3. Although true smoke removal system(s) are not being provided for sub-passive areas, sufficient exhaust capacity is provided by Smoke Zone 1 to achieve air-change rates, well above rates required by IBC Section 403.4.7 Item 2, for the entire sub-passive areas located on each level for mop-up operations.

<table>
<thead>
<tr>
<th>Sub-passive Areas Calculated Exhaust Rate to achieve one air change every 15-minutes: Levels 1 through 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREA (ft²)</td>
</tr>
<tr>
<td>LEVEL 1 SUB-PASSIVE AREA:</td>
</tr>
<tr>
<td>LEVEL 2 SUB-PASSIVE AREA:</td>
</tr>
<tr>
<td>LEVEL 3 SUB-PASSIVE AREA:</td>
</tr>
<tr>
<td>LEVEL 4 SUB-PASSIVE AREA:</td>
</tr>
<tr>
<td>LEVEL 5 SUB-PASSIVE AREA:</td>
</tr>
</tbody>
</table>

8.6. Existing ductwork will be utilized for supply and exhaust.

8.7. Fans.

8.7.1. Existing fans will be utilized for all active smoke management systems.
8.7.2. Smoke management fan motors will have a minimum service factor of 1.15 per IBC Section 909.10.5.

8.7.3. For belt driven fans, the number of belts provided will be 1.5-times the required standard number with a minimum of two (2) provided, per IBC Section 909.10.5.

8.8. Monitoring of smoke management system equipment.

8.8.1. Fans utilized by the smoke management systems will be monitored for proper operation by the existing fire detection system.

8.8.2. Combination fire/smoke dampers, smoke dampers and automated dampers utilized by the smoke management system will be monitored for proper verification of actuation (open / closed) by the existing fire detection system.

8.9. Pre-programmed weekly test sequences for verification of smoke control system component verification will be performed per IBC Section 909.12.

8.10. Smoke management system equipment will be connected to the standby power supply. Where volatile memories are utilized, a UPS system (battery power) will be implemented.

8.11. Smoke management system activation will be initiated immediately after receipt of appropriate automatic or manual activation command. System sequence will activate necessary equipment as necessary to prevent damage to fans, damper and other equipment.

8.12. Upon receipt of an appropriate automatic or manual activation command, proper status of all necessary system equipment will provide proper configuration at the fire-fighter's smoke control panel (FSCP) within 90-seconds.

8.13. Per IBC Section 909.15, smoke control diagrams will be prepared to properly reflect the functionality of all smoke management systems. The control diagrams will show all devices in the system, identify their location and functionality.

8.14. A new FSCP will be provided, replacing the existing to indicate and provide necessary functionality for the revised smoke management systems. The new FSCP will comply with the requirements of IBC Section 909.16.

8.14.1. The panel will be designed to graphically depict the arrangement of smoke management systems within the building. The FSCP will include status indicators and manual controls for all smoke management systems. Smoke management system fans will be shown on the FSCP with a clear indication of airflow provided.

8.14.2. On/off/auto control switches will be provided that provide manual and override control for each system. For each smoke management system, the manual switch will replicate the entire smoke control sequence for the associated system.
8.14.3. Green lights (LED) will indicate smoke management system equipment are configured for normal status.

8.14.4. Red lights (LED) will indicate an alarm condition and positively identify when fans are properly operating and that system dampers are properly positioned.

8.14.5. Yellow lights (LED) will indicate a fault condition when the system is activated and is not operating properly (i.e., fans are not moving air, dampers are not properly position, etc.).

8.14.6. Green and yellow lights will illuminate when a smoke management system is not active and the associated equipment do not report normal operating status.

8.14.7. Upon activation and during configuration of a smoke management system, the green light will extinguish and both the red and yellow lights will illuminate. Once confirmation that all associated equipment is properly configured, the red light will remain illuminated and the yellow light will extinguish. If proper configuration is not reported, the red and yellow lights will remain illuminated.

8.14.8. Detailed documentation, including full scale drawings and outline of functionality of the FSCP will be submitted to the Nevada State Fire Marshal (NSFM) for review and acceptance prior to fabrication and installation.

8.14.8.1. Documentation to be submitted as a deferred submittal will be listed on the cover page of the associated discipline plans, in accordance with IBC Section 107.3.4.1.


8.15.1. Acceptance testing means and methods will comply with NSFM requirements.

8.15.2. Following completion of construction and pre-testing of associated systems by the responsible contractor, acceptance testing by an approved Special Inspection Agency will be performed, as required by IBC Sections 909.18.8 and 1705.17.

8.15.3. All inspection and testing activities will be performed in compliance with applicable approved design, construction and as-built documentation.

8.15.4. Inspections and testing of smoke management systems will consist of the following:

8.15.4.1. Documentation of each device will include type, manufacturer, model, listing number, classification, and temperature rating as applicable.
8.15.4.2. Confirmation of proper functionality and monitoring by the fire alarm system will be confirmed for all necessary smoke management system equipment.

8.15.4.3. Verify sequence of operation as indicated in approved design documentation. The proper sequence of operation for fans and dampers, as well as closing of elevator lobby and smoke zone boundary doors as appropriate.

8.15.4.4. Automatic and manual control of all necessary systems will be confirmed.

8.15.4.5. Appropriate smoke management system response times will be verified.

8.15.4.6. Proper system performance will be confirmed for each system as follows:

8.15.4.6.1. Pressurized exit stairways:

8.15.4.6.1.1. Stairway pressurization fans will be activated and all door openings confirmed closed.

8.15.4.6.1.2. Pressure differentials will be measured between the stairways to adjacent floors. Pressure differentials will be a minimum of 0.10-inches water column and a maximum of 0.35-inches water column, in the shaft relative to the building measured with all stairway doors closed under maximum anticipated conditions of stack effect and wind effect. Pressure differential readings will be confirmed with Smoke Zone 1 active, and not active.

8.15.4.6.1.3. Door opening forces at or below 30-pounds will be verified at all doors from the stairway.

8.15.4.6.1.3.1. Proper closure and latching of all doors will be confirmed from a full open position.

8.15.4.6.1.4. The above procedures will be performed with Smoke Zone 1 properly configured and operational and again with Smoke Zone 1 not operational.

8.15.4.6.2. Smoke Zone 1:
8.15.4.6.2.1. All smoke management system fans will be activated and all smoke zone boundary openings protective will be confirmed to be in the appropriate position.

8.15.4.6.2.2. Proper exhaust capacity will be confirmed.

8.15.4.6.2.3. Proper makeup air capacities and makeup air velocities will be confirmed.

8.15.4.6.2.4. Door opening forces at or below 30-pounds will be verified at all doors from the active smoke management system.

8.15.4.6.2.4.1. Proper closure and latching of all doors will be confirmed from a full open position.

8.15.4.6.3. Pressurized Elevator Machine Rooms:

8.15.4.6.3.1. All smoke management system fans will be activated and all boundary opening protective will be confirmed to be in the appropriate position.

8.15.4.6.3.2. Pressure differentials will be measured between the elevator machine room and associated hoistway(s).

8.15.4.6.3.3. Door opening forces at or below 30-pounds will be verified at all doors from the elevator machine room.

8.15.4.6.3.3.1. Proper closure and latching of all doors will be confirmed from a full open position.

8.15.5. Smoke management system fans:

8.15.5.1. All fans utilized by the smoke management systems will be inspected and tested to confirm safe operation and document:

8.15.5.1.1. Proper rotation.
8.15.5.1.2. Operating voltage.
8.15.5.1.3. Operating amperage.
8.15.5.1.4. Operating revolutions per minute (rpm).
8.15.5.1.5. Proper number of belts, in accordance with Section 8.7.3 of this report.
8.15.5.1.6. Belt tensions, as applicable.
8.15.5.1.7. Volumetric output (cfm).

8.15.6. Confirm standby power is provided and has been maintained to all necessary smoke management system equipment.

8.15.7. Special Inspections Acceptance Testing Documentation and Reporting.

8.15.7.1. All inspection and testing activities and results will be documented and maintained by the special inspection agency, including daily reports, noncompliance reports, test data sheets and test scenarios.

8.15.7.2. Upon conclusion of acceptance testing, a complete report will be prepared by the special inspection agency and submitted to NSFM for review and approval. The report will include all applicable documentation prepared by the special inspection agency.

8.15.7.2.1. A statement of special inspections in compliance with IBC Section 1704.3.1, prepared by the registered design professional in responsible charge, will be provided with final report.

8.15.7.3. Once approved, a copy of this report will be maintained in the FCC.


8.16.1. Acceptance testing means and methods will comply with NSFM requirements.

8.16.2. Recertification to be performed by approved Special Inspection Agency.

8.16.3. All inspection and testing activities will performed in compliance with applicable approved design, construction and as-built documentation.

8.16.4. Immediately after the smoke management systems pass acceptance testing, routine recertification testing efforts will be initiated, per IFC Section 909.20.1. All recertification testing activities will occur on a five-year cycle, as outlined below.

8.16.5. Non-Compliant Issues.

8.16.5.1. All non-compliant issues to applicable documentation will be reported immediately to Ownership to allow for proper resolution. The Special Inspection Agency will provide notification of non-compliance issues to NSFM within 24-hours.
8.16.5.2. The Special Inspection Agency will provide notification to NSFM following correction/resolution of non-compliant issues which represented an immediate hazard to occupants and/or building safety. Notification will be provided within 24-hours following correction/resolution.

8.16.6. Standard Annual Testing Requirements. The following are the testing requirements to be performed yearly except during Quinquennial Testing periods (5-year period), throughout the life of the building.

8.16.6.1. Six-Month Period: Confirm proper activation and configuration of Smoke Zone 1, all pressurized stairways, and pressurized elevator machine rooms via manual activation. Proper configuration of each system will be confirmed at the FSCP.

8.16.6.2. One-Year Period: Confirm proper configuration for Smoke Zone 1, all pressurized stairways, and pressurized elevator machine rooms via automatic and manual activation. Proper configuration of each system will be confirmed at the FSCP. Confirm proper performance of each active smoke management system, as outlined in the Acceptance Testing section.

8.16.6.2.1. Automatic activation: 100% of all water flow sensing devices will be tested each year. For every other initiating device, on each floor 20% of each type of device, which activates smoke management systems, will be tested each year to ensure at the conclusion of the Quinquennial Testing period, 100% of these devices have been tested.

8.16.7. Quinquennial Testing Requirements. The following are the testing requirements to be performed every five-years, in the place of that year’s Annual Testing efforts. For this year’s testing, no six-month period inspections and testing will be required.

8.16.7.1. Confirm proper configuration of Smoke Zone 1, all pressurized stairway, and pressurized elevator machine rooms via automatic and manual activation. Proper configuration of each system will be confirmed at the fire-fighter’s smoke control panel and by field inspections. Inspection and testing efforts will include confirmation of proper functionality and monitoring of all necessary smoke management system equipment. Confirm proper performance of each active smoke management system, as outlined in the Acceptance Testing section.

8.16.7.1.1. Automatic activation. 100% of all water flow sensing devices will be tested each year. For every other initiating
device, on each floor 20% of each type of device, which activates smoke management systems, will be tested each year to ensure at the conclusion of the Quinquennial Testing period, 100% of these devices have been tested.

8.16.7.2. Confirm standby power has been maintained to all necessary smoke management system equipment. This will be accomplished through a shunt of the normal power systems.

8.16.8. Special Inspections Recertification Testing Documentation and Reporting.

8.16.8.1. All inspection and testing activities and results will be documented and maintained by the special inspection agency, including daily reports, noncompliance reports, test data sheets and test scenarios.

8.16.8.2. Upon conclusion of acceptance testing, a complete report will be prepared by the special inspection agency and submitted to NSFM for review and approval. The report will include all applicable documentation prepared by the special inspection agency.

8.16.8.2.1. A final report will be completed and submitted at the conclusion of each Standard Annual Testing period and again at the conclusion of the Quinquennial period testing. A total of five reports will be submitted for each five year testing cycle.

8.16.8.3. Once approved, a copy of each report will be maintained in the Fire Command Center.

8.16.8.3.1. Documentation of one full testing Recertification Testing Cycle will be maintained in the FCC at a minimum.

9. **FIRE COMMAND CENTER**

9.1. The existing Fire Command Center will be maintained.

9.2. A new FSCP will be installed.

9.3. The following equipment will be maintained:

9.3.1. Emergency voice/alarm communication system control unit.

9.3.2. Fire detection and alarm system annunciator panel.

9.3.3. Elevator status panel.
9.3.4. Elevator fire recall switch.

9.3.5. Emergency and standby power status indicators.

9.3.6. Generator supervision devices, manual start and transfer features.

9.3.7. Fire department communication system.

9.3.8. Fire pump status indicators.

9.3.9. Telephone for fire department use with controlled access to the public telephone system.

9.3.10. Work table.

10. EMERGENCY AND STANDBY POWER

10.1. Existing emergency and standby power system will be maintained.

11. ELEVATORS

11.1. Existing elevator systems will be maintained.

12. PERIODIC OPERATIONS AND MAINTENANCE

12.1. All active fire protection systems and devices will be regularly tested in accordance with the applicable codes and standards by qualified individuals acceptable to NSFM.

12.2. Records of maintenance and testing will be retained on-site and presented to NSFM representatives upon request.

13. FUTURE MODIFICATIONS

13.1. All future modifications and expansions will be documented in amendments/addenda to this FPR. The document will be prepared by a design professional licensed in the State of Nevada working within the area of their expertise. As appropriate, licensed design professionals will be included in the design of all renovations/expansions.

14. CONCLUSION

14.1. The devices, systems and approaches outlined in this report are intended to provide a level of life safety and property protection which are compliant with the applicable codes. This level of protection is based on interaction of both active and passive fire protection
features. Active systems include fire suppression and detection systems, as well as emergency and standby power, communications and mechanical smoke control. Passive features include compartmentation with fire-resistive separations, Type IA construction, means of egress systems, and flame spread limitations. Nothing in this document is intended to imply non-code compliance.

14.2. This report provides general fire protection guidelines developed for the University of Nevada Las Vegas Lied Library Smoke Management System Redesign project. Working drawings and specifications will be coordinated to comply with the fire protection features outlined in this document.

jba consulting engineers

Prepared by:

Mark E Mecham, PE
Senior Engineer

Owner's Representative:

University of Nevada Las Vegas

Nevada State Public Works Division

Nevada State Fire Marshal Division
APPENDIX A

Lied Library Site Plan
APPENDIX B

Smoke Zone Boundary Layout: Levels 1 through 5 and Roof
APPENDIX C

Fire Alarm and Smoke Control Functional Matrix
### UNLV Lied Library Smoke Management Redesign

**Fire Alarm/Smoke Control Matrix**

**General Notes:**
2. De-energize associated stair pressurization fan, if operational following automatic activation.
3. De-activate elevator machine room pressurization system, if operational following automatic activation.

<table>
<thead>
<tr>
<th>Initiating Devices</th>
<th>Smoke Detectors</th>
<th>Heat Detectors</th>
<th>Waterflow Switches</th>
<th>Manual Pull Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisory/Trouble</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual Override Controls (I)</td>
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<tr>
<td>Primary Power Failure</td>
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<tr>
<td>Monitor Smoke Management System Equipment</td>
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<tr>
<td>At Entrance to Pressurized Stairway</td>
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<td>In Pressurized Stairway (II)</td>
<td>x x x x x</td>
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<td></td>
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<tr>
<td>Elevator Lobbies</td>
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<tr>
<td>Elevator Machine Room (III)</td>
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<td></td>
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<tr>
<td>Doors on Hold-Open Devices</td>
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<td></td>
</tr>
<tr>
<td>All Others</td>
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<td></td>
</tr>
<tr>
<td>Beam Detectors</td>
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<tr>
<td>Duct Mounted: Fire Smoke and Smoke Dampers</td>
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<td></td>
</tr>
<tr>
<td>Duct Mounted: Supply/Return Fan</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Heat Detectors</td>
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<td></td>
</tr>
<tr>
<td>Waterflow Switches</td>
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</tr>
<tr>
<td>Level 1 Through 5</td>
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</tr>
<tr>
<td>Manual Pull Station</td>
<td>x x x x</td>
<td></td>
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</tbody>
</table>