ANALYSIS OF PROPOSED AMENDMENT TO THE CITY OF PHILADELPHIA FIRE CODE TO MANDATE THE INSTALLATION OF FIRE SUPPRESSION SYSTEMS IN EXISTING HIGH-RISE RESIDENTIAL BUILDINGS

Prepared on behalf of
Pennsylvania Apartment Association

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EXECUTIVE SUMMARY

The Pennsylvania Apartment Association (PAA) retained Stephen F. Finkelman, P.E. of Thriven Design, Inc. to assess a proposed change to "The Philadelphia Fire Code" requiring the installation of automatic fire sprinkler systems in existing high-rise buildings. This report discusses, among other items the following: The potential cost impacts on apartment building and condominium owners, tenants, and public housing authorities; the ancillary impacts such as relocation/displacement, and potential environmental hazards; empirical fire safety data that would justify or negate the need for imposing this new requirement; and the suggested course of action for the City Council to protect tenants, apartment building and condominium owners, as well as fire fighters while understanding the cost implications of such an action.

The conclusion of this study finds that there is no empirical fire safety data to justify this change in the current fire code. Moreover, strict enforcement of "The Philadelphia Fire Code" requirements would achieve the goal of City Council, to protect and keep Philadelphia residents safe, without needlessly imposing tens of thousands of dollars in retrofit costs on tenants and condominium owners with such an unfunded mandate, as well as potential tax increases that would be needed to pay for publicly funded housing and rental vouchers. Lastly, by not imposing this unfunded sprinkler retrofit mandate, Council would ensure that the city's current affordable housing shortage is not exacerbated as this legislation would not only impact downtown Philadelphia but also would impact a number of BIPOC communities.

Since the 1990's, public officials have discussed whether there is a need for fire sprinkler retrofit requirements in existing high-rise Group R-2 residential buildings (over 75 feet in height), through a change to "The Philadelphia Fire Code." While contemplated numerous times, data shows that high-rise residential buildings are safer than wood frame buildings, and the costs of such a mandate would be astronomical. This is especially true today when we are experiencing record inflation and supply chain constraints. In addition, while not contemplated in this study, it is clear that tenant displacement during such a retrofit would take a significant emotional and psychological toll on families, especially given that we are just coming out of a multi-year global pandemic. Finally, it must be understood that the most vulnerable in our society, those at the very low- and low-income levels would be disproportionately impacted by both cost and displacement resulting from this mandate.

Beyond the aforementioned impacts, this proposed change to the code would negatively affect both public housing authorities and ultimately taxpayers. Given that state and federal tax monies pay for housing authority operations and rental assistance vouchers, any costly mandate would need further appropriations to cover these costs. As such, taxes would need to be raised and vouchers would need to be increased. At the same time, this mandate would not result in a significant increase in fire safety, but would undermine the city's affordable housing stock.

Some specific examples of cost factors and fire safety data generated from this study are as follows:

Displacement and Implementation Cost Impacts.

- The full extent of the displacement costs cannot be defined due to factors such as housing availability or the cost of temporary housing. Specifically, the cost of housing will spike when this proposal is implemented because it will create increased demand on the already limited supply of rental housing. We also cannot ascertain the travel expenses that would be shouldered by displaced residents, depending on location.
- Beyond the costs of displacement, conservative estimates of installing sprinkler systems in existing high-rise apartment and condominium buildings is $35.00 per square foot, including the removal of materials such as lead paint and asbestos.
    - For an average studio apartment in Philadelphia of approximately 500 square feet, the retrofit cost would be approximately $17,500.
    - For an average one-bedroom apartment in Philadelphia of approximately 700 square feet, the retrofit cost would be approximately $24,500.
    - For an average two-bedroom apartment in Philadelphia of approximately 1100 square feet, the retrofit cost would be approximately $38,500.

The costs referenced above would directly impact rental prices. To put this in perspective, if it costs $25,000 to retrofit a single apartment, and the expense is amortized between five and ten years (at zero percent), we can conservatively estimate rent increases of $200 to $400 per month, or $2,400 to $4,800 per year.

Note: When determining cost per unit, these figures do not include the common areas,

which must be factored into the total cost of retrofits which would be borne by tenants and condominium owners. Furthermore, these estimates do not factor the costs related to inflation and supply chain issues, which could increase these costs further. Lastly, the estimates do not include the cost of ongoing maintenance, cleaning up after an accidental discharge, annual testing and certification, or the costs (as stated above) of tenant displacement/relocation during construction.

Empirical Fire Safety Data.

Data available through the National Fire Protection Association (NFPA) and the National Fire Incident Reporting System (NFIRS) indicate the following:

- NFPA research concerning high-rise building fires indicates that fires with flame damage beyond the unit of origin, fire deaths, and average property loss per fire were lower in high-rise apartment buildings than in other multifamily/apartment buildings.
- A three-year NFIRS study indicates that only four deaths out of 145 in residential fires occurred in high-rise apartment buildings. Out of the four deaths, one occurred in high-rise building that was equipped with a fire sprinkler system and none of the deaths or injuries reported occurred to fire fighters when fighting a fire in a high-rise building.

Suggested Course of Action.

It is evidently clear that the impact of this mandate would be dramatic for high-rise apartment and condominium buildings. It would affect families of all income levels, but disproportionately impact very low- and low-income families. Furthermore, the data suggests that high-rise apartment buildings are, in fact, safe, and safer than other types of multifamily buildings. Imposing a fire sprinkler mandate on these properties is not only unwarranted but would have a detrimental impact on the lives of Philadelphians for negligible fire safety benefits.

Considering the astronomical costs and burdensome societal impacts associated with requiring existing high-rise apartment and condominium buildings to install fire suppression systems, and the small risk of fire-related deaths and injuries in such buildings, the present exemption for residential high-rise buildings should **not** be removed from the Philadelphia Fire Code. Instead, strict enforcement of the current Philadelphia Fire Code would achieve the goal of the City Council to protect Philadelphia

residents, without needlessly imposing tens of thousands of dollars in retrofit costs on tenants and condominium owners, displacing families from their homes, potentially increasing taxes to pay for the increased cost of subsidized housing and reducing Philadelphia's already short supply of affordable housing.

ANALYSIS OF PROPOSED ORDINANCE

Section I: Background of the Ordinance Proposal

On March 31, 2022, Councilmembers mark Squilla and Katherine Gilmore Richardson referred to the Committee on Licenses and Inspections "An Ordinance" to amend Subcode F, "The Philadelphia Fire Code" of Title 4, "The Philadelphia Building Construction and Occupancy Code" Chapter 11 "Construction Requirements for Existing Buildings" Section 1103 "Fire Safety Requirements for Existing Buildings" to require the installation of automatic fire sprinkler systems in additional (existing) high-rise buildings.

> *F-1103.5.6 Highrise buildings. An automatic sprinkler system shall be installed throughout existing high-rise buildings.*
>
> *[Exception: Portions of high-rise buildings occupied by Group R-2 occupancies without a change in occupancy since December 18, 1991.]*
>
> *[F-1103.5.6.1 High-rise Group R-2 occupancies. An automatic sprinkler system shall be installed in the following areas of existing Group R-2 occupancies in the portions of the high-rise building to which the requirements of Section F-1103.5.6 do not apply:*
>
> 1. *Basements in accordance with Section F-1103.5.7.*
> 2. *Rooms used for storage where the floor area exceeds 120 square feet (11 m2).*
> 3. *Trash and incinerator chutes and rooms in accordance with F-1103.4.9.]*
>
> *F-1103.5.8.2 Retrofit schedule. Proof of compliance with the automatic sprinkler system installation requirements of this Section shall be submitted to the Department of Licenses and Inspections in the form of a certification pursuant to Section 901. The required certification shall be submitted prior to January 1, 2022, provided that for portions of high-rise buildings containing Group R-2 occupancies, with respect to which an exception under Section F-1103.5.6 applied on March 1, 2022, but which exception has been rescinded, the installation of automatic sprinkler systems shall be completed by -_____, and the required certification shall be submitted prior to _____.*
>
> *This Ordinance shall be effective immediately.*

Although the amendment specifically maintains an exception for high-rise Group R-2 residential buildings as presently included in the Philadelphia Fire Code, The Pennsylvania Apartment Association understands that this exception may be removed from the final version of the amendment.

In addition, a written rationale, social impact statement, or economic impact statement for the referenced Ordinance has not been provided by the Councilmembers proposing this Ordinance at this time.

It appears there are a number of genuine and valid factors that were not considered prior to

proposing this Ordinance. For instance, there is no indication that an economic analysis was conducted for high-rise residential buildings constructed prior to 1991. Nor is there any indication that all of the possible social impacts or economic impacts resulting from this proposed Ordinance were considered. Finally, it appears that the proposers of this Ordinance did not consider existing safety standards before determining fire suppression systems would be necessary to address the safety risks associated with fires in high-rise residential buildings. The following report considers all of those factors, as well as some additional factors, in order to highlight the actual impact, the proposed Ordinance would have on high-rise apartment and condominium complexes.

Section II: Analysis of the Philadelphia Fire and Building Codes for Existing Buildings

In order to determine whether the installation of fire suppression systems is necessary to address the public safety risk associated with fires in existing high-rise residential buildings, an analysis of existing fire safety codes is required. Indeed, existing structures must be in compliance with the existing Philadelphia Building Codes in affect at this time.

Background: In 1981, the first Ordinance was passed in the City of Philadelphia that directly addressed the fire safety of high-rise buildings. (The Philadelphia Fire Code defines a high-rize building as a building with an occupied floor located more than 75 feet above the lowest level of fire department vehicle access.) This revision to the Fire Code contained the requirement to install automatic sprinklers in new high-rise buildings and in certain spaces in existing high-rise buildings. R-2 residential occupancies were exempted provided that certain provisions of the Code were met. At that time "Code Bulletin F-0102 was issued in 2001 clarifying the spaces incidental to the residential use such as, laundry rooms, sitting rooms, lounges, lobbies, and rental offices when such spaces only served the residential occupancy. In 1991, a new high-rise Ordinance was passed under the City's Fire Code requiring automatic sprinklers throughout all high-rise buildings with the exception of R-2 occupancies. The previous interpretation (noted above) remained in effect to define what should be included in the R-2 exception. The Pennsylvania Uniform Construction Code was amended in 2017 to allow the City of Philadelphia to adapt provisions of the International Construction Codes (ICC). The City adapted the following International Construction Codes and other National Codes effective on February 14, 2022. The following is partial listing of Philadelphia Building Codes:

2018 International Building Code with amendments (Philadelphia Building Code),
2018 International Existing Building Code with amendments (Philadelphia Existing Building Code),
2017 National Electrical Code (Philadelphia Electrical Code),
2018 Philadelphia Fire Code,
Philadelphia Property Maintenance Code.

The Philadelphia Fire Code establishes regulations affecting or related to structures, processes, premises, and safeguards regarding:

1. The hazard of fire and explosion arising from storage, handling or use of structures, materials, or devices.
2. Conditions hazardous to life, property, or public welfare in the occupancy of structures or premises.
3. Fire hazards in a structure or on the premises from occupancy or operations.
4. Matters related to construction, extension, repair, alteration or removal of fire suppression or fire alarm systems.

5. Conditions affecting the safety of fire fighters and emergency responders during emergency operations.

As noted in Section 102 Applicability, this code applies to existing structures, facilities and conditions where required in Chapter 11 and when in the opinion of the fire code official there is a distinct hazard to life or property.

Chapter 11, of the Philadelphia Fire Code, "Construction Requirements for Existing Buildings" is applicable to existing high-rise R-2 (apartment) occupancy buildings. As noted in paragraph 1101 Scope: *"Provisions of this chapter apply to existing buildings constructed prior to the adaption of this code".*

As noted in paragraph 1101.1 Intent: *"The intent of this chapter is to provide a minimum degree of fire and life safety to persons occupying existing buildings by providing minimum construction requirements where such existing buildings do not comply with the minimum requirements of the International Building Code."* Thus, the following Code Sections are intended to address the public safety risks associated with fires in existing high-rise R-2 building occupancies.

- Fire Sprinkler Requirements: Section F-1103.5.6 High-Rise Buildings. An automatic sprinkler system shall be installed throughout existing high-rise buildings with the exception of portions of high-rise buildings occupied by Group R-2 occupancies without a change in occupancy since December 18, 1991.

  Section F-1103.5.6.1 High-Rise Group R-2 Occupancies requires automatic sprinkler installed in the following areas of existing high-rise Group R-2 occupancies within portions of the building to which the requirements of Section F-1103.5.6 do not apply.

  1. Basements in accordance with Section F-1103.5.7.
     (Section F-1103.5.7 refers to basements without openings as follows: basements in excess of 2500 square feet without openings shall be equipped with an automatic sprinkler system with the following exceptions; a) basements containing no occupancy or storage, excluding permanently installed building service equipment, but not excluding oil cooled electrical equipment, b) basements with doorway openings below grade that lead directly to ground level by an exterior stairway or outside ramp and such openings shall be distributed such that the linear distance between adjacent openings does not exceed 50 feet or fraction thereof on at least one wall and all portions of the basement are located within 75 feet of the door opening and c) basements with openings entirely above the adjoining ground level totaling at least 20 square feet in each 50 linear feet or fraction thereof, of the exterior wall in the story on at least one side. The required openings shall be distributed such that the distance between adjacent openings does not exceed 50 feet and all portions of the basement are located within 75 feet of an opening. The openings shall have a minimum dimension of not less than 30 inches.)

  2. Rooms used for storage where the floor area exceeds 120 square feet.

  3. Trash and incinerator chutes and rooms in accordance with F-1103.4.9.

(Section F-1103.4.9 refers to waste and linen chutes noting that all waste and linen chutes shall comply with Sections F-1103.4.9.1 through F-1103.4.9.5 in the following occupancies: 1) Group I-2 occupancy and 2) High-rise buildings of Group R-2 occupancy.

Section 1103.4.9.1 requires chutes to be enclosed with 1-hour fire-resistance-rated construction and opening protectives in accordance with Section 716 of the International Building Code and have a fire protection rating of not less than 1-hour. Section 716 of the IBC refers to "Opening Protectives" with the following specific requirements for waste and linen chutes. Section 716.2.6.1 for door closing noting; fire doors shall be latching and self- or automatic-closing in accordance with this section which includes two exceptions neither exception pertaining to R-2 occupancies. Section 716.2.6.3 for chute intake door latching noting; chute intake doors shall be positive latching, remaining latched and closed in the event of latch spring failure during a fire emergency. Section 716.2.6.6 for smoke-activated doors noting that automatic-closing doors installed in the follow locations shall be permitted to have hold-open devices where the doors shall be automatically close by the activation of smoke detectors installed in accordance with Section 907.3 or by loss of power to the smoke detector or hold-open device and notes; in waste and linen chutes, discharge openings and access and discharge rooms shall comply with Section 713.13 and loading doors installed in waste and linen chutes shall meet the requirements of Sections 716.2.6.1 and 716.2.6.3 [both noted above].

Section 907.3 requires automatic fire detectors utilized for the purpose of performing fire safety functions to be connected to the building's fire alarm control unit where a fire alarm system is required by Section 907.2. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or activate a visible and audible supervisory signal at a constantly attended location. In buildings not equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon activation, perform the intended function. The detectors shall be located in accordance with NFPA 72. [Section 907.2 describes where an approved fire alarm system is to be installed in new buildings and structures and therefor does not apply in this instance.]

Section 713.13 describes the requirements of waste and linen chutes and incinerator rooms noting compliance with NFPA 82, Chapter 6 and shall meet the requirements of sections 712 and 713.13.1 through 713.13.6. Incinerator rooms shall meet the provisions of 713.13.4 through 713.13.5

Section 1103.4.9.2 requires chute intakes to comply with Section F-1103.4.9.2.1 or F-1103.4.9.2.2. Section 1103.4.9.2.1 requires chute intakes that are direct from a corridor to have the intake opening equipped with a chute-intake door in accordance with Section 716 of the International Building Coode and have a fire protection rating of not less than 1hour. [The requirements of Section 716 are noted above].
Section F-1103.4.9.2 notes that when the chute intake is accessed through a chute-intake room, the room shall be enclosed with 1-hour fire-resistance-rated construction. Opening protectives for the intake room shall be in accordance with Section 716 of the International Building Code and have a fire protection rating of not less than ¾ hour. Opening protectives for the chute enclosure shall be in accordance with Section F-1103.4.9.1 [noted above]. In buildings where an automatic fire extinguishing system is not required throughout the building and where the chute-intake room is not used for the temporary or permanent storage of combustible materials, the automatic fire extinguishing system is not required in the chute-intake room.

Section F-1103.4.9.3 requires chutes to be equipped with an approved automatic sprinkler system in accordance with Section 903.2.11.2. Section 903.2.11.2 "Rubbish and Linen Chutes" notes that an automatic sprinkler system shall be installed at the top of the rubbish and linen chutes and in their terminal rooms. Chutes shall have additional sprinkler heads installed at alternate floors and at the lowest intake. Where a rubbish

chute extends through a building more than one floor below the lowest intake, the extension shall have sprinklers installed that are recessed from the drop area of the chute and protected from freezing in accordance with Section 903.3.1.1. Such sprinklers shall be installed at alternate floors, beginning with the second level below the last intake and ending with the floor above the discharge. Access in the chutes shall be provided for servicing. Section 903.3.1.1 requires the sprinkler system installed in accordance with NFPA 13.

Section F-1103.4.9.4 requires chutes to terminate in a dedicated chute discharge room separated from the remainder of the building by not less than 1-hour fire-resistance-rated construction. Opening protectives shall be in accordance with Section 716 of the International Building Code [noted above] and have a fire protection rating of not less than 1 hour.

Section F-1103.4.9.5 requires chute discharges to be equipped with self-closing or automatic-closing opening protective in accordance with Section716 of the International Building Code [noted above] and have a fire protection rating of not less than 1 hour.)

- Standpipe System Requirements: Section F-1103.6.1 Class 1 Standpipes. Class 1 standpipes shall be installed in existing buildings with occupied floors located more than 50 feet above or below the lowest level of fire department vehicle access. The standpipes shall have hose connections in each required exit stairway (stair tower, or vestibule where egress width requirements are not violated). Fire department connections shall be in accordance with Section 912. These requirements shall also apply to buildings that were granted variances prior to January 1, 2004, to omit standpipes from the required exit stairways or to have manual dry standpipes.

- Fire Alarm Systems: Section F-1103.7 Fire Alarm Systems in Existing Buildings. Fire alarm systems shall be installed in existing buildings and structures in accordance with Sections 1103.7.1 through 1103.7.6 and Sections F-1103.7.7 through F-1103.7.11. Where an existing building or structure does not have the fire alarm system required by this section, a fire alarm system shall be installed in accordance with the appropriate subsection of Section 907. Section 1103.7.6 Group R-2. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in existing Group R-2 occupancies more than three stories in height or with more than 16 dwelling or sleeping units.

  Section F-1103.7.9 Group R-1, R-2, and R-3 Congregate Living Facilities. This Section requires existing Group R-1 and R-2 congregate living facilities to have hard-wired, interconnected smoke alarms installed in accordance with Section F-1103.8 (Group R-2 Congregate living is defined as more that 16 residents.) Section 1103.8 Single-and Multiple-Station Smoke Alarms. This Section requires single- and multiple-station (single station wired together to enable all to sound an alarm when one activates) smoke alarms shall be installed in existing Group R occupancies in accordance with Sections F-1103.8.1 through F-1103.8.3.

  (Section F-1103.8.1 notes the location of smoke alarms. Existing Group R occupancies and dwellings shall be provided with single-station smoke alarms. Where installation is required to meet the requirements of this Section the smoke alarms shall be installed in accordance with Section 907.2.10 except as permitted in this Section.

  Exceptions:
  1. Smoke alarms are not required in sleeping rooms in existing Group R-2 occupancies in high-rise buildings equipped throughout with an automatic fire extinguishing system.
  2. Smoke alarms are not required in sleeping rooms in Group R-2 or R-3 occupancies in buildings built prior to January 1, 1988, and not classified as high-rise.
  3. Where a smoke alarm installed in the immediate vicinity of bedrooms would result in its installation within 3 feet of a door to a bathroom or kitchen, installation beyond the immediate vicinity is permitted, provided that it does not exceed 15 feet from all

bedroom doors.

Section 907.2.10 notes the requirements for smoke alarm installations. Section 907.2.10.2 for Groups R-2, R-3, R-4, and I-1 requires Sigle or multiple-station smoke alarms to be installed and maintained in Group R-2 (among other Groups) regardless of occupant load at all the following locations.: 1) On the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms, 2.) In each room used for sleeping purposes. [Refer to above exceptions.], 3) In each story within a dwelling unit. [Does not apply to R-2 occupancies.])

Section 907.2.12 High-Rise Buildings. This Section requires high-rise buildings to be provided with an automatic smoke detection system in accordance with Section 907.2.12.1, a fire department communication system in accordance with Section 907.2.12.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.

Exceptions: None of the exceptions refer to R-2 occupancies.

Section 907.2.12.1 Automatic Smoke Detection requires automatic smoke detection in high-rise buildings in accordance with Sections 907.2.12.1.1 and 907.2.12.1.2.
Section 907.2.12.1.1 Area Smoke Detection requires area smoke detectors connected to an automatic fire alarm system where the activation of any detector required by this Section shall activate the emergency voice/alarm communication system in accordance with Section 907.5.2.2. In addition to smoke detectors required by Sections 907.2.1 through 907.2.9. smoke detectors shall be located as follows:

1. In each mechanical equipment, electrical, transformer, telephone equipment or similar room that is not provided with sprinkler protection.
2. In each elevator machine room, machinery space, control room and control space and in elevator lobbies.

Section 907.2.12.1.2 Duct Smoke Detection requires duct smoke detectors complying with Section 907.3.1 to be located as follows:

1. In the main return air and exhaust air plenum of each air-conditioning system having a capacity greater than 2,000 cubic feet per minute. Such detectors shall be located in a serviceable area downstream of the last duct inlet.
2. At each connection to a vertical duct or riser serving two or more stories from a return air duct or plenum of an air-conditioning system. In Group R-1 and R-2 occupancies, a smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cubic feet per minute and serving not more that 10 air-inlet openings.

Section 907.2.12.2 Fire Department Communication System. Where a wired communication system is approved in lieu of an emergency responder radio coverage system in accordance with Section 510, the wired fire department communication system shall be designed and installed in accordance with NFPA 72 and shall operate between a fire command center complying with Section 508, elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside interior exit stairway. The fire department communication device shall be provided at each floor level within the interior exit stairway. However, Section F-1103.2 Emergency Responder Radio Coverage in Existing Buildings excepts buildings constructed under the Building Code in effect prior to January 1, 2010.

Section 907.2.12.3 Multiple-Channel Voice Evacuation requires buildings with an occupied floor more than 120 feet above the lowest level of fire department vehicle access, voice evacuation systems for high-rise building shall be multiple-channel systems.

Section 907.5 Occupant Notification Systems requires fire alarm systems to annunciate at the fire alarm control unit and shall initiate occupant notification upon activation, in accordance with Sections 907.5.1 through 907.5.2.3.3. Where a fire alarm system is required by another section of this code, it shall be activated by:

1. Automatic fire detectors.
2. Automatic sprinkler system waterflow devices.
3. Manual fire alarm boxes.
4. Automatic fire-extinguishing systems.

Section 5.2.3.3 Group R-2. In Group R-2 occupancies required by Section 907 to have a fire alarm system, each story that contains dwelling units and sleeping units shall be provided with the future capability to support visual alarm notification appliances in accordance with Chapter 10 of ICC A117.1. Such capability shall accommodate wired or wireless equipment. The future capability shall include one of the following:

1. The interconnection of the building fire alarm system with the unit smoke alarms.
2. The replacement of audible appliance with combination audible/visual appliances.
3. The future extension of the existing wiring from the unit smoke alarm location to required locations for visible appliances.

Section 907.6 Installation and Monitoring requires the fire alarm system to be installed and monitored in accordance with Sections 907.6.1 through 907.6.6.2 and NFPA 72.
(Section 907.6.4 Zones. Each floor shall be zoned separately, and a zone shall not exceed 22,500 square feet. The length of any zone shall not exceed 300 feet in any direction.

Section 907.6.4.2 High Rise Buildings requires in high-rise buildings, a separate zone by floor shall be provided for each of the following types of alarm-initiating devices where provided:

1. Smoke detectors.
2. Sprinkler waterflow devices.
3. Manual fire alarm boxes.
4. Other approved types of automatic fire detection-devices of suppression systems.)

- Carbon Monoxide Alarms: Section F-1103.9. Carbon monoxide alarms shall be installed in existing dwelling units or sleeping units in accordance with Sections F-1103.9.1 through F-1103.9.3 where any of the conditions in Section 915.1.2 through 915.1.6 exist.
Exception: Carbon monoxide alarms are not required in dwelling units and sleeping units of I-1, I-2, I-4, R-1 and R-2 occupancies constructed before April 1, 2019.

- Means of Egress Requirements: Section1104 Means of Egress for Existing Buildings. Means of egress in existing buildings shall comply with the minimum egress requirements where specified in Table 1103.1 and further enumerated in Sections 1104.2 through 1104.25, and the building code that applied at the time of construction. Where the provisions of this chapter conflict with the building code that applied at the time of construction, the most restrictive provisions shall apply. Existing buildings that were not required to comply with a building code at the time of construction shall comply with the minimum egress requirements where specified in Table 1103.1 as further enumerated in Sections 1104.2 through 1104.32.

  Section 1104.2 Elevators, Escalators and Moving Walks are not to be used as a required means of egress, except elevators used as an accessible means of egress where allowed by Section 1009.4 or previously approved in existing buildings. However, Section 1103.3.2 Elevator Emergency Operation requires existing elevators with a travel distance of 25 feet or more above or below the main floor or other level of a building and intended to serve the needs of emergency personnel for fire-fighting or rescue purposes shall be provided with emergency operation in accordance with ASME A17.3.

  Section 1104.3 Exit Sign Illumination. Exit signs shall be internally or externally illuminated. The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 foot-candles. Internally illuminated signs shall provide equivalent luminance and be listed fir the purpose. Exception: Approved self-luminous signs that provide evenly illuminated letters shall have a minimum luminance of 0.06 foot-lamberts.

  Section 1104.4 Power Source. Where emergency illumination is required in Section 1104.5, exit signs shall be visible under emergency illumination conditions. Exception.: Approved signs that provide continuous illumination independent of external power sources are not required to be connected to an emergency electrical system.
  Section 1104.5 Illumination Emergency Power. Where means of egress illumination is provided, the power supply for means of egress illumination shall normally be provided by the premises electrical supply. In the event of a power supply failure, illumination shall be automatically provided from an emergency system for the following occupancies where such occupancies require two means of egress. This includes Group R-2 occupancies except where each dwelling

unit or sleeping unit has direct access to the outside of the building at grade.
Section 1104.5.1 Emergency Power Duration and Installation. Emergency power for means of egress illumination shall be provided in accordance with Section 1203. In other than Group I-2, emergency power shall be provided for not less than 60 minutes for systems requiring emergency power.)

- Corridor Construction: Section 1104.17 Corridor Construction requires corridors serving an occupant load greater than 30 and the openings therein shall provide an effective barrier to resist the movement of smoke. Transoms, louvers, doors and other openings shall be kept closed or be self-closing. (None of the exceptions within this Section apply to R-2 occupancies.)

- Standards for Interior Finishes: Section 803 Interior Wall and Ceiling Finish in Existing Buildings. The provisions of this Section shall limit the allowable fire performance and smoke development of interior wall and ceiling finishes in existing buildings based on location and occupancy classification.
(Section 803.3 Interior Finish Requirements Based on Occupancy requires interior wall and ceiling finishes to have a flame spread index no greater than that specified in Table 803.3 for the group and occupancy designated. Table 803.3 requires R-2 occupancies, in non-sprinklered buildings to have the following flame spread index:
    1. Interior exit stairways, exit ramps and exit passageways: Class B Flame Spread 26-75; smoke developed index 0-450.
    2. Corridors and enclosure for exit access stairways and ramps: Class B Flame Spread 26-75; smoke developed index 0-450.
    3. Rooms and enclosed spaces: Class C Flame Spread 76-200; smoke developed index 0-450.

  Section 803.4 Fire-Retardant Coatings allows the flame spread or smoke-developed index of surfaces in existing buildings to be achieved by the application of approved fire-retardant coatings, paints or solutions to the surfaces have a flame spread index exceeding that allowed. Such applications shall comply with NFPA 703, and the required fire-retardant properties shall be maintained or renewed in accordance with the manufacturer's instructions.

- Section 1103.4.8 Occupancies Other Than Group I-2 and I-3 requires floor openings containing exit access stairways or ramps that do not comply with one of the conditions listed in this Section shall be protected by 1-hour fire- resistance-rated construction. The conditions noted in this Section generally do not apply to high-rise R-2 buildings.Stairway Standards: Section 1104.10 Stair Dimensions for Existing Stairways: Existing stairways in buildings shall be permitted to remain if the rise does not exceed 8 ¼" and the run is not more than 9". Existing stairways can be rebuilt. (Section 1104.10.1 Dimensions for Replacement Stairways. The replacement of an existing stairway in a structure shall not be required to comply with the new stairway requirements of Section 1011 where the existing space and construction will not allow a reduction in pitch or slope.)

  Section 1104.24 Stairway Identification Signs. Existing stairways shall be marked in accordance with Section 1023.9 and Section F-1104.24.1. (Section F1104.24.1 notes where access to the roof from the exit enclosure is not direct but is available through a room or corridor accessed from the exit stair enclosure, the stairway identification sign shall include the words "Indirect Roof Access". A properly oriented floor diagram shall be provided at the exit stair landing at the floor level that provides the indirect roof access. The floor diagram shall indicate the route to the door, stair or ladder that leads to the roof and be located at approximately eye level near the stairway identification sign.

  Section 1023.9 Stairway Identification Signs: This Section indicates the requirements for all stairway signs in interior exit stairways in buildings of more than three stories.

- Exit Doors: Section F-1104.28 Exit Doors requires exit doors in existing buildings to be self-closing and latching and in accordance with Sections F-1104.28.1 and F-1104.28.2. (Section F-1104.28.1 Exit Door Rating: Exit doors shall maintain the fire resistance rating required by the building code in effect at the time of construction, but at a minimum shall have a fire resistance rating of one hour. Where a door is replaced in an existing exit enclosure, the replacement door shall be a labeled fire door with a fire resistance rating of at least one hour. Existing door frames shall be maintained in good repair with no gaps between the door and the door frame exceeding

½". Section 1104.28.2 Exit Stairways Doors requires exit stairway doors in existing buildings to be operable from both sides without the use of a key or special knowledge or effort. Exceptions:

1. Stairway discharge doors shall be openable from the egress side and shall only be locked from the opposite side.
2. Exit doors arranged in accordance with the current or past edition of the Philadelphia Building Code.
3. In stairways serving not more than 4 stories doors are permitted to be locked on the opposite egress (stairway side).
4. In stairways serving more than 4 stories the doors are permitted to be locked from the stairway side provided they unlock, but not un-latch, upon the loss of power to the door locks and are in accordance with 4.1 or 4.2.

4.1 Unlock upon the activation of the building fire alarm system.

4.2 Unlock remotely from a constantly attended location, and telephones or two-way communication system connected to the constantly attended location are installed in the stairway at not less than every fifth floor.)

- Section 1103.4 Vertical Openings: Interior vertical openings, including but not limited to stairways, elevators, hoistways, service and utility shafts that connect two or more stories of a building, shall be enclosed or protected as specified in Sections 1103.4.1 through 1103.4.10. (Section 1103.4.3 More Than Five Stories requires such vertical openings to be protected by 1-hour fire-resistance-rated construction.)

- Section F-103.2 Fire Protection Systems indicates where any required fire protection system or part thereof becomes inoperative and affects the fire safety of a structure or the occupants therein, the fire code official shall order the system to be repaired and returned to service and is authorized to order the structure vacated until the inoperative system is repaired and returned to service.

- Section F-105.6.3 High-Rise Building indicates the fire code official shall inspect high-rise buildings for compliance with the Philadelphia Fire Code. (Section 1101.4 Owner Notification indicates when a building is found to be in non-conformance with Chapter 11, the fire code official shall duly notify the owner of the building. Upon receipt of such notice the owner shall be subject to the time limits approved by the fire code official.)

In addition to all of the aforementioned safety code requirements, high-rise residential buildings are constructed in such a way to avoid the spread of fires (constructed mostly of concrete, steel and other masonry material) so to contain fires within the perimeter of the dwelling unit and between floors. Thus, the risk associated with fires in these buildings is more than adequately addressed by existing fire, safety, and related construction code requirements. Generally, fires are contained in their area of origin in high-rise buildings. **Existing Code standards also ensure early warning/detection of fires in high-rise buildings, thereby allowing occupants to evacuate safely during a fire.**

The proposed Code change provides no evidence that the added requirement of a fire suppression system in all existing high-rise residential buildings will enhance existing safety standards in place intended to protect occupants of high-rise apartment complexes during a fire, or even firefighters who are involved in fighting those fires, there is no need from a fire-safety standpoint to adopt the proposed rule and require the installation of fire suppression systems in residential high-rise structures.

Section III: Statistics Regarding Fire-Related Deaths and Injuries

The proposed amendment lacks any analysis of the risk of injury to occupants of high-rise buildings and the firefighters who must fight those fires. A review of available studies of fire incidents reveals that there is no public safety threat that justifies the adoption of the proposed amendment to install fire suppression systems in existing high-rise apartment buildings.

At this time we have not been provided statistics for Philadelphia, we have utilized a National Fire Incident Reporting System ("NFIRS") study that summarized New Jersey's experience with fire between 2004 and 2006. New Jersey's Fire Code is similar to that presently enforced in Philadelphia with respect to existing Group R-2 high-rise apartment buildings and is a good barometer to mimic the results we would also expect in Philadelphia. As a result, it became apparent that during that three-year span, (2004 to 2006):

- Only four people died as a result of a fire in high-rise residential buildings (one of those deaths occurred in a building that contained a fire-sprinkler system); and
- 106 people died from injuries that occurred in single-family homes, accounting for approximately 73% of the total for all deaths occurring in residential dwellings in that State.

The NFIRS statistics make clear that people living in single-family homes are more at risk for death or serious injury resulting from a fire than those living in high-rise residential apartment buildings. In light of these statistics, a more thorough analysis is required.

The NFIRS studies reveal the following regarding fire-related injuries in residential structures in New Jersey in 2004, 2005 and 2006:

Total Serious Injuries (including deaths)
Resulting From New Jersey Residential Fires

	2004	2005	2006
Single-Family	257	301	298
Low-Rise [1-2 stories]	35	27	38
Mid-Rise [3-6 stories]	21	52	44
High-Rise [7+ stories]	***17***	***12***	***12***
Multi-Family [type unreported]	78	82	20
Total [all residential]	**413**	**474**	**412**

Residential Fire Deaths in New Jersey

	2004	2005	2006
Single-Family	32	34	40
Low-Rise [1-2 stories]	3	4	2
Mid-Rise [3-6 stories]	1	4	5
High-Rise [7+ stories]	***1***	***2***	***1***
Multi-Family [type unreported]	10	6	0
Total [all residential]	**47**	**50**	**48**

Source: NFIRS data provided by New Jersey Division of Fire Safety. Data provided 9/27/2007.

Based on the data prepared by NFIRS, the following is undisputed that there were only 41 reported serious injuries that occurred in connection with a fire in a high-rise residential building, four of which resulted in a death. In particular, the following facts are not in dispute:

- **Only 3% of serious injuries that occurred in New Jersey between 2004 and 2005 in a residential setting occurred in connection with a fire in high-rise residential buildings.**
- 12 of the 41 serious injuries occurred in high-rise buildings with fire sprinklers.
- 28 of the 41 injuries occurred in high-rise buildings without fire sprinklers.
- **The four deaths in high-rise residential buildings in New Jersey over a three-year span of time constituted only 2.7% of the total of fire-related deaths in New Jersey – out of those four unfortunate deaths, one of them as a result of a fire in a high-rise building that was equipped with a fire sprinkler system.**
- 106 people in single-family homes died between 2004 and 2006, accounting for 73% of the total deaths caused by fire in New Jersey.

The conclusion from all available data is clear: occupants in single-family homes are at a greater risk of injury than those in high-rise buildings in the case of a fire. The following chart emphasizes the risk of serious injury resulting from a fire is greater in nearly every other residential setting than in a high-rise building.

Casualties	w/ Sprinklers	w/o Sprinklers	Undetermined	Total
Single Family	1	728	127	856
Multi Family Low-Rise	1	98	1	100
Multi Family Mid-Rise	7	103	7	117
Multi Family High-Rise	12	28	1	41
Multi Family Undetermined	13	88	79	79
Total All Residential	34	1045	215	1294

Source: NFIRS data provided by New Jersey Division of Fire Safety. Data provided 9/27/2007.

As to the risk posed to firefighters, the Division of Fire Safety investigated 10 fire incidents that occurred in the State between 2002 and 2007, which resulted in a death or serious injury to a firefighter. The conclusions included report prepared as a result of that investigation note the following:

- Nine of the ten fires reported occurred in single-family home. The other incident occurred in a 3-story apartment structure.
- A total of 20 firefighters were seriously injured, 7 of which died as a result of their injuries.
- **None of those deaths or injuries occurred in connection with fighting a fire in a high-rise apartment building.**

The statistics clearly demonstrate that occupants of single-family homes are more at risk for injury in the case of fire than those in high-rise residential structures. It appears that existing fire code standards, which are more rigid in the case of high-rise structures than all other residential structures, both in New jersey and Philadelphia, addresses the risk associated with fires in high-rise residential structures. Therefore, there does not appear to be any compelling reason to adopt the proposed amendment if it would be applicable to existing high-rise apartment buildings, especially where the statistics prove that the risk of death or serious injury in the case of fire is more serious in the case of single-family residential structures.

Section IV: Implementation Costs

A written rationale on the economic impact of the proposed code amendment has not been provided by the Councilmembers at this time, however it must be noted the cost associated with installing automatic fire suppression systems within existing high-rise apartment buildings will be significant and will have an economic impact on the existing apartment buildings within the City. Thus, there is no indication that a thorough analysis of the costs has been conducted. In the absence of specific information regarding the implementation costs of installing such automatic fire sprinkler systems in existing high-rise apartment buildings, the following is an opinion as to what would be required to implement this proposal.

Retrofitting existing high-rise apartment buildings that do not contain automatic fire suppression systems would be a complex construction project. Walls will need to be demolished and rebuilt; specific equipment and material will need to be purchased; various contractors will need to be retained for each job; replacement and/or upgrades of existing fire safety apparatus will be required, including fire alarm control panels; coordination with the water department is required to ensure proper water supply and installation of necessary fire water pumps. The following are some of the costs that would be included in every single construction job to ensure compliance with the code change proposal:

- General contractor and subcontractor costs.
- Suppression system material and labor costs.
- Permitting and related fees.
- Temporary protection.
- Selective demolition of existing walls and structure.
- Cutting and patching of existing walls and structure.
- Construction and installation of soffits when needed.
- Plaster, drywall, and masonry repair.
- Fire stopping.
- Final cleaning.
- Labor costs.
- Moving or relocation of tenants.
- Miscellaneous painting to damaged walls, floors and ceilings.
- Lead paint and asbestos removal.
- Professional fees.
- Unknown conditions.

When all of these factors are included in a cost estimate analysis, the cost to retrofit in an existing high-rise residential building could easily approach $35.00 per square foot or higher. This would mean a typical 700 square foot, one bedroom apartment would be cost approximately $24,500, a typical 500 square foot, studio apartment would cost approximately $17,500, and a typical 1,100 square foot, two-bedroom apartment would cost approximately $38,500.

It is my conclusion that the cost per unit to install an automatic fire suppression system in high-rise residential buildings constructed prior to 1991, based on unit type, will be approximately $17,500 to $38,500. Note, this cost does not include other ongoing costs such as maintenance, clean-up after an accidental fire sprinkler head discharge, and annual testing and certification costs. If amortized over five years, the result in a rent increase would be between $300 to $600 per month, depending on unit type.

The financial burden on condominium and cooperative association unit owners, and more importantly on low-income tenants will be substantial. The Philadelphia Housing Authority and the Federal Department of Housing and Urban Development should also consider whether subsidization of this retrofit provision is a cost benefit for their tenants. It cannot be avoided that the costs to implement this proposed code change could decrease the number of affordable units available to citizens in the city which is in need of affordable housing.

It is clear that the substantial economic impact associated with implementing this proposal, as well as the related social costs, far outweigh the fire safety risks with residential high-rise buildings.

Section V: Reliability of Automatic Fire Suppression Systems

The National Fire Protection Association (NFPA) and its members have produced various reports analyzing the operational reliability of automatic fire sprinklers over the years. After considering the probability that the system and/or the system's components will operate as intended when needed, NFPA has concluded that automatic fire suppression systems are reliable only 87% to 89% of the time.[2] The reports also note that automatic sprinkler systems are designed to control fires, not necessarily to extinguish fires. Indeed, only 20% of fires in apartment buildings were actually extinguished by an automatic sprinkler system over the years studied in the report. The studies also reveal that automatic sprinkler systems are considered by building insurance underwriters as a means to limit property damage claims rather than address occupant safety.

Additionally, residential settings are not perfectly amenable to sprinklers. The placement of furniture (e.g., coat racks, clothing, curtains) may obstruct the spray of the sprinkler head limiting its effectiveness. **Since the operational reliability of fire sprinkler systems in a residential settling is not absolute and are instead primarily intended to assist in a reduction of property loss caused by a fire in a high-rise apartment building, there is no evidence to suggest that the installation of automatic sprinkler systems in existing high-rise apartment complexes is absolutely necessary to address any compelling risk or threat associated with fires in high-rise residential structures. Other means of protection, such as early warning and compliance with existing safety codes, provide more protection for the occupants of a high-rise apartment complex.**

Section VI: Comparison of Other Governmental Action in this Area

The Cities of New York and Chicago have each decided against mandating the installation of sprinkler systems in existing high-rise apartment complexes located within their jurisdiction. Instead, the governing bodies of Philadelphia, New York and Chicago favor compliance with fire safety code requirements that address the risk associated with fires in high-rises rather than impose substantial economic and social costs on their communities. Each of those cities provide an accurate means of comparison in light of their close proximity to New Jersey (Philadelphia and New York) and because many of the buildings located in those cities are similar to the high-rise apartment complexes located in the cities of New Jersey.

A. New York City

New York City has decided against requiring high-rise residential buildings to be retrofitted with automatic sprinkler systems. Instead, New York's Building Code (Title 27 of the Administrative Code of New York City, updated through October 2007) indicates that all high-rise office buildings are to install fire sprinkler systems by 2019, but existing residential high-rise buildings are exempt from this requirement with the exception of basements, cellars and other locations below grade. It is not until an owner of an existing high-rise residential building decides to conduct a major construction project that installation of a fire sprinkler system may be required. For instance, if four or more dwelling units of an existing residential building are altered, and the alterations take place on an entire floor, or the value of the alterations within any twelve-month period exceed fifty percent of the building value, New York City's Building Code requires the installation of automatic fire sprinkler systems. Cf. N.J.A.C. 5:23-6.1. This rule requirement makes a lot of sense because it is at this time – when an existing high-rise building is undergoing construction – that the costs associated with retrofitting the building is more cost efficient. And, the City of New York has required additional safety upgrades in high-rise residential buildings, such as standpipes and fire alarm systems. The City of New York also imposes strict means of egress requirements, which are similar to those of Philadelphia at this time.

B. City of Chicago

The City of Chicago took an alternate approach to provide a reasonable balance between safety and the economic and social costs of mandating the installation of automatic fire suppression systems in

existing non-sprinklered high-rise non-transient, residential buildings built prior to 1975 and over 80 feet in height. Due to concerns over costs, it was decided that existing high-rise residential building would undertake a Life Safety Evaluation (LSE) instead of being required to install automatic fire sprinkler systems. The City of Chicago instituted an ordinance pursuant to Section 13:196-205 of the City's Building Code, to demonstrate that a specific high-rise building can provide a reasonable level of safety from fire for the occupants by evaluating three areas of building safety, i.e., fire safety, means of egress and general building safety. The ordinance requires that the approved life safety compliance plan address any deficiencies found as a result of the LSE inspection, and evaluation.

The safety codes emphasize the importance of containment, early warning and safe evacuation. The LSE is to be prepared by a licensed professional, to identify whether any remedial action is required to bring the building into conformance with City's fire safety codes and regulations. If the building cannot be brought into compliance through alterations, then an automatic fire suppression system must be added. Chicago also provides tax incentives to encourage the implementation of additional fire safety precautions that are taken in existing high rise apartment buildings. The City of Chicago model therefore provides an alternative means of compliance to encourage improvements in existing residential high-rise building occupants without mandating the installation of costly automatic fire suppression systems.

Section VII: Conclusion

After a review of the proposed Code amendment and available data regarding fire suppression systems, it is not in the public interest from a fire safety standpoint to adopt the proposed amendment if the exemption for existing apartment buildings without fire sprinkler systems to be eliminated.

Economic Impact: The proposal did not assess the economic costs associated with implementing this Code amendment. However, it is uncontested that the construction costs associated with implementing this regulation are staggering. This is a cost that cannot be borne by renters in this City without imposing significant hardship to them and is of such significance that it cannot be absorbed by housing providers along. Thus, tenant rents are likely to increase between $200 to $400 per month. According to Pew Research, Philadelphia household annual incomes range between $30,000 and $52,000, an increase of up to $4800 per year in renters' budgets would be unduly burdensome. It is also clear that municipalities will be affected by this regulation, especially if their public utility infrastructure is unable to deal with this burden associated with implementing this proposal. And, the proposal fails to take into account the impact this will have on affordable housing apartment complexes.

Social Impact: The social impact associated with implementing this regulation had not been proposed. For instance, the costs associated with relocating residents during the construction phase of this project, or the demographics of those likely to be impacted during the implementation phase. Most renters in Philadelphia already dedicate approximately 40% of their income toward rent; upon the adoption and implementation of this proposal, they would then be required to dedicate up to half of their income toward their rental payments.

Safety Risks in High-Rise Apartment Buildings: Existing safety Codes and regulations that are in place to address the risk associated with fires in high-rise apartment buildings. In addition, studies that show deaths and injuries are more likely to occur in single-family homes (67%) rather than high-rise apartment buildings (3%). It appears, therefore, that existing fire safety Code requirements address the risk associated with high- rise residential buildings. There is no evidence to suggest that fire suppression systems would result in a decrease in fire-related deaths and injuries in high-rise residential buildings. Instead, available data suggests that existing fire safety Codes provide equivalent degree of protection to occupants of high-rise residential buildings.

Summary: **Considering the astronomical economic and burdensome social costs associated with requiring existing Group R-2 high-rise apartment and condominium buildings to install fire**

suppression systems, and the small risk of fire-related deaths and injuries in such buildings, if City Council should decide to adopt this Code change, City Council should continue the exception specifically for Group R-2 existing high-rise apartment and condominium complexes.

End of Report

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- Philadelphia Passive House Community, Board Member
- Green Building United, Board Member
- American Arbitration Association, Construction Industry Arbitration Panel
- Association of Energy Engineers
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Steve has over 50 years of experience in the engineering and construction field as a consultant, forensic engineer, manager of a fortune 100 corporation's corporate design and engineering department for worldwide National Aeronautics and Space Administration projects, financial manager and executive administration officer of a consulting engineering and construction firm, vice president of a consulting mechanical and electrical engineering firm, and principal and director of engineering for an architectural, engineering, planning and interior design firm. Steve has administered, designed, and engineered projects in the commercial, health care, public, industrial, educational, hotel, casino, residential, energy, environmental, and pharmaceutical fields. He is instrumental in the design, engineering, and testing of alternate energy conservation systems for demonstration and practical applications, such as ground source geothermal systems, thermal ice storage systems, solar domestic hot water systems, solar photovoltaic systems, and energy recovery systems. Steve remains active in research and education related to sustainable design, commissioning, and energy conservation and has taught sustainable engineering design at Jefferson University.

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Forensic Project Experience: Steve serves as a Construction Industry Arbitration Panel member for the American Arbitration Association, helping to adjudicate construction project claims, and as an expert on construction claims within his disciplines of expertise. He has testified in arbitration hearings and court both in PA and NJ, before the Judge Advocate General in VA, and in the U.S. Court of Federal Claims.

Expert Testimony & Expert Reports Available Upon Request

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