Guidance Document: Emergency Communication Strategies for Buildings

Final Report

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FOREWORD

The Technical Committees of the National Fire Protection Association responsible for NFPA 72®, *National Fire Alarm and Signaling Code*® have undertaken a major project to incorporate requirements for the planning, design, installation and use of Emergency Communications Systems. One of the goals of the Technical Correlating Committee on Signaling Systems for the Protection of Life and Property (responsible for NFPA 72) is to provide a structured approach for the development and implementation of emergency communication strategies. The work of the NFPA 72 Technical Committees has focused on providing "menus" that permit the development of communications strategies based on differing levels of risk for a variety of different hazards and threats.

The Technical Committee for Emergency Communications Systems has developed significant revisions to NFPA 72 (including a new chapter 24 in the 2010 edition) to address this topic which has resulted in the identification of a series of information and messaging needs. Other work, including a 2009 NIST workshop,[1] also identified a need for further research on messaging and communications strategies. These efforts recognize that in recent years there have been major advancements in technology and systems availability and new demands on systems to meet the needs for emergency events other than fire (e.g. security, natural catastrophe, etc). Also, more recent studies of human behavior in a variety of emergency situations have increased awareness regarding the need for effective communications before and during different stages of an emergency.

The purpose of this report is to provide guidance to system designers, building managers, and/or building emergency personnel responsible for emergency communication on how to create and disseminate messages using basic communication modes (audible and/or visual technology). The guidance provided here is taken directly from a report published by the National Institute of Standards and Technology (NIST), which was based on a review of 162 literature sources from a variety of social science and engineering disciplines[2] and the prioritization of the specific findings extracted from each literature source. This three-year effort was principally funded by the U.S. Department of Homeland Security, Science and Technology Directorate with additional support from industry sponsors.[3]

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[1] Kuligowski, E.D., Peacock, R.D., Averill, J.D., Bukowski, R.W., 2009. Mass Notification Messages: Workshop Proceedings. NIST Special Publication 1093, National Institute of Standards and Technology: Gaithersburg, MD.
[2] Kuligowski, E.D., S.M.V. Gwynne, K.M. Butler, B.L. Hoskins, and C.R. Sandler. (2012) Developing Emergency Communication Strategies for Buildings. Technical Note 1733, National Institute of Standards and Technology: Gaithersburg, MD.
[3] Kuligowski, E.D. and Omori, H., 2014. *General Guidance on Emergency Communication Strategies for Buildings, 2nd Edition*. NIST Technical Note 1827, National Institute of Standards and Technology: Gaithersburg, MD.

The content, opinions and conclusions contained in this report are solely those of the authors.

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The Fire Protection Research Foundation plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.

About the National Fire Protection Association (NFPA)

NFPA is a worldwide leader in fire, electrical, building, and life safety. The mission of the international nonprofit organization founded in 1896 is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education. NFPA develops more than 300 codes and standards to minimize the possibility and effects of fire and other hazards. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/freeaccess.

Keywords: fire alarm, emergency communication, mass notification, emergency messaging, emergency messages

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Guidance Document: Emergency Communication Strategies for Buildings

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The purpose of this report is to provide guidance to system designers, building managers, and/or building emergency personnel responsible for emergency communication on how to create and disseminate messages using basic communication modes (audible and/or visual technology). The guidance provided here is taken directly from a report published by the National Institute of Standards and Technology, which was based on a review of 162 literature sources from a variety of social science and engineering disciplines (Kuligowski et al. 2012) and the prioritization of the specific findings extracted from each literature source. This three-year effort was funded by the U.S. Department of Homeland Security, Science and Technology Directorate and the Fire Protection Research Foundation (Kuligowski and Omori 2014).

This document first presents guidance on how to create and disseminate emergency information in the face of rapid-onset disasters[1] – providing guidance on the dissemination of alert signals, the creation of the warning message, the formatting of messages for both visual and audible means, and the dissemination of the warning message. This document then provides examples of emergency messages (i.e., message templates) for five different types of emergency scenarios. These message templates can be altered to fit the needs of your building occupants, as well as the type of emergency that has occurred and type of technology used to disseminate the alerts/messages.

Guidance on Emergency Communication Strategies

This section provides guidance for building managers, emergency personnel, alarm system manufacturers, codes/standards committees, or others responsible for emergency communication on the ways in which alerts and warning messages should be created, formatted, and disseminated. The guidance is divided into two main parts: guidance on alerts and guidance on warning messages. Although these two parts often get confused, it is important to distinguish between the purpose of an alert and a warning message. An alert is meant to grab peoples' attention, notifying them that an emergency is taking place and that there is important information, which will be provided to them. The purpose of a warning message is to give that important information to building occupants. Guidance on the construction and dissemination of both alerts and warnings is provided here.

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[1] Rapid-onset emergencies are those emergencies that occur with no or almost no (in the case of minutes) notice, rather than slow-onset events (i.e. emergencies in which the occurrence is known hours or even days in advance). These different emergency types require different sets of emergency messages and dissemination techniques to allow building occupants to receive information in a timely manner, resulting in efficient and safer public response.

Alerts

It is imperative to disseminate an alert to let building occupants know that a warning message will follow. Regardless of whether the warning message is provided audibly, visually, or via tactile means, an alert is necessary to gain people's attention and should be provided separately from the warning message. An effective alert should include the following characteristics:

☐ Alerts should be significantly different from ambient sounds
☐ Buildings should reduce background noise when initiating audible alerts
☐ Flashing, rather than static lights, preferably one standard color for all buildings, can be used to gain attention to visual warning messages
☐ There are additional methods to alert building occupants to an emergency: disruption of routine activities, tactile methods, social networks, and face-to-face
☐ An alert signal should be accompanied by a clear, consistent, concise, and candid warning message
☐ If selected, an alert should be tested for its success in getting occupants' attention in the event of an emergency and used as part of building-wide training

Warnings

Warning messages should provide information to the building occupants on the state of the emergency and what they are supposed to do in response to this emergency. The warning message should come after an alert signal is given, and can be provided via visual or audible means. However, before such guidance on message format for visual and audible messages can be provided, it is vital to provide guidance on the content of the warning message itself.

The Message

Regardless of the method used to disseminate the warning message, there are certain characteristics that are required of an effective warning message. These are included here:

Message content
☐ A warning message should contain five important topics to ensure that building occupants have sufficient information to respond
➢ Who is providing the message? (i.e. the source of the message)
➢ What should people do? (i.e. what actions occupants should take in response to the emergency and, if necessary, how to take these actions)
➢ When do people need to act? (in rapid-onset events, the "when" is likely to be "immediately")
➢ Where is the emergency taking place? (i.e. who needs to act and who does not)
➢ Why do people need to act? (including a description of the hazard and its dangers/consequences)

☐ The source of the message should be someone who is perceived as credible by the building population

☐ Building managers and emergency personnel should understand the building population and, from this understanding, develop a database of possible trusted sources (as well as backup sources)

Message structure

☐ Message order for short messages (e.g., 90-characters) should be the following: (1) source, (2) guidance on what people should do, (3) hazard (why), (4) location (where), and (5) time. Message order for longer messages should be: (1) source, (2) hazard, (3) location, (4) guidance, and (5) time.
☐ Numbered lists can help to chronologically organize multiple steps in a process
☐ For limited message length, message writers could draft the message in a bulleted form; each of the five topics in the warning should be separated as its own bullet point
☐ Distinct audiences should be addressed separately in the message (or multiple messages)

Message language (or wording)

☐ Messages should be written using short, simple words, omitting unnecessary words or phrases
☐ Messages should be written using active voice, present tense; avoiding hidden verbs
☐ Messages should be written using short, simple, and clear sentences – avoiding double negatives and exceptions to exceptions; main ideas should be placed before exceptions and conditions
☐ Emergency messages should be written at a 6th grade reading level or lower. An emergency message can be evaluated for its reading level using computer software and/or a simple calculation (see Kuligowski and Omori [2014] for more details).
☐ Emergency messages should be written without the use of jargon and false cognates

Multiple messages

☐ Building managers and emergency personnel should anticipate the need to write more than one emergency message throughout a building disaster, including feedback messages or updates
☐ In update messages, building occupants should be told *why* the information has changed, to ensure that the new message is viewed as credible
☐ Provide feedback messages after a "non-event" to inform building occupants that the alert signal and warning system operated and worked as planned and the reasons why the event did not occur
☐ Building managers and emergency personnel should test emergency messages with the building population

Visual Warnings

Messages that are displayed visually will have different capabilities and limitations than those disseminated audibly. Message creators should consider different factors and make different

types of decisions based upon the dissemination method. The first consideration is the type of visual technology that will be used to disseminate the messages, which can include textual visual displays, SMS text messages, computer pop-ups, email, Internet websites, news (TV broadcast), or streaming broadcast over the web. Depending upon the technology chosen to display visual warning messages, guidance is provided here on message displays to enable occupants to see or notice the displayed warning, understand the warning, perceive warning credibility and risk, and respond appropriately.

Noticing and reading the warning

☐ Place the emergency sign in a location where people will notice it and be able to read it from their original (pre-emergency) location
☐ Signs will be reliably conspicuous within 15 degrees of the direct line of sight
☐ Text is easier to read when written with a mixture of upper and lower case letters rather than the use of all capitals
☐ The recommended relationship for older adults with lower visual acuity is $D = 100 * h$, providing a more conservative result, and ensuring that a larger population will be able to read the emergency message
☐ A stroke-to-width ratio of the letters is suggested as 1:5 (generally), with a ratio of 1:7 suggested for lighter letters on a darker background
☐ Building managers or emergency personnel should consult the ADA Standards for Accessible Design (U.S. Department of Justice 2010) for additional requirements on signage
☐ Contrast between the text and the background should be at least 30 %, although recommended values could be as high as 60 %
☐ The use of pictorials (in lieu of or in addition to text) can also bring attention to the sign
☐ Message providers should ensure that emergency information is not blocked by other signs or information

Comprehending, believing and personalizing the warning

☐ Printed text should accompany symbols or pictorials used in visual warnings; a minimum number of words should be used to accompany graphics
☐ Diagrams that display a series of sequential steps are more successful for comprehension of a process than one single graphic
☐ Use a color-contrasted word or statement for text that should be read first and/or be perceived as more urgent than the rest, unless color is used for other reasons (e.g. bilingual text)
☐ A warning message can increase in perceived credibility and risk if occupants are shown that others are also responding
☐ Simultaneously displayed text (discrete messages) should be used, rather than a sequentially displayed message
☐ Simultaneously displayed text can also be used for bilingual messages, especially if care is taken to differentiate the text of one language from the text of the other language

☐ Limit the use of flashing words on visual message displays

Audible Warnings

There are specific warning technologies that only (or primarily) affect the aural sense; including public address systems (voice notification systems), automated voice dialing, satellite/AM/FM radio broadcasts, satellite/off-air television broadcasts, and tone alert radios. Whereas visual technologies can limit message length, audible warnings are often limited only by the attention capabilities of the audience. In other words, an audible message can play for long periods of time with these technology types, and the message creator and source must be careful to provide all important information in an appropriate length of time.

In this section, guidance will be given for methods to increase the likelihood that an individual will perceive, or hear the message. Following this, guidance will be provided that can increase comprehension of the message for audible messages, as well as the ways in which to increase credibility and risk assessment of the event when the warning is presented audibly.

Perception

☐ Other, non-alert/warning voices in the background should be reduced or eliminated
☐ Any voice announcements should also be accompanied by simultaneous visual text

Comprehending, believing and personalizing the warning

☐ Letters are more difficult to identify in speech than numbers, which are more difficult than colors
☐ Message speakers (or sources) should not be heavily accented and should speak with a rate of approximately 175 words per minute
☐ Audible warnings should be delivered using a live voice
☐ The live voice method provides the benefit of messages that can be updated with new information while also conveying an appropriate level of urgency, if necessary
☐ Urgency measures should be used selectively to emphasize the more dangerous, immediate, life-threatening situations (since overuse may lead to non-response in future disasters)

Dissemination of the Warning Message

☐ Use multiple channels to disseminate the warning message, including visual, audible, and tactile means
☐ A warning message should be repeated at least once, with some research advocating for message repetition of at least two times

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- Messages should be stated in full, and then repeated in full, rather than repeating statements within the same message
- Warning messages should be repeated at intervals, rather than consecutively
- Warning messages should be disseminated as early as possible
- Face-to-face communication should accompany other audible or visual technologies
- Messages should be disseminated using a combination of both push and pull technologies
- Push communication[2] is most important to use for alert signals as well as initial warning messages

Emergency Message Templates

Rapid-onset emergencies often come with little warning and can have a major impact on communities. In order to provide clear, effective instructions for a threatened population, it is important to create message templates ahead of time for a variety of different emergencies.

This section provides examples of message templates for five types of emergency, using various forms of emergency communication technology. All bracketed text can be altered and replaced with text that better suits the needs of the building occupants, emergency scenario, emergency response strategies, and the technology being used. Please see Kuligowski and Omori (2014) for more information on the process associated with the development of these templates. Each template follows the guidance presented in this document.

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[2] Push technologies are those that do not require individuals to take extra effort to receive the alert or warning message (e.g. public address systems or text messages), whereas pull technologies require the individual to seek additional information to acquire the alert/message (e.g. Internet websites).

Scenario 1 – Fire in a building, partial evacuation strategy, building-wide public address announcements:

Scenario 1 is a fire located on the 10th floor of a 20-story building. Individuals are unable to use elevators in this scenario, except for those who are unable to negotiate the stairs, in which case building staff or fire fighters will assist them using the freight elevator(s).

Protective actions: Occupants on floors 9, 10, and 11 are told to evacuate to the 8th floor (2 floors below the fire floor). All other occupants are provided with a message to remain on their floor. Therefore, in this scenario, two different types of messages are required to be provided simultaneously to occupants, depending upon the floor on which they are located: one message will be disseminated to floors 9, 10, and 11, while a different message will be disseminated simultaneously to all other floors.

Technology used to disseminate the message: The building-wide public address system, which is capable of providing different messages to different floors (using a live voice).

Message Templates for Scenario 1:

Message 1a (building-wide announcement to Floors 9, 10, and 11): "Attention [Floors 9, 10, and 11]. This is your [Building Safety Officer, Joe Smith]. A fire has been reported on the [10th floor] of the building. Everyone on the [9th, 10th, and 11th floors] should move to the [8th floor] to be protected from heat and smoke, since heat and smoke can creep into nearby floors during a fire. Use the stairs immediately. Do not use the elevators. Those who need help getting to the 8th floor, please wait inside the stairwell [or go to the freight elevator lobby]."

Message 1b (building-wide announcement to all other floors): "Attention. This is your [Building Safety Officer, Joe Smith]. A fire has been reported on the [10th floor] of the building. Please wait on your floor. At this time, you are safer remaining on your floor than leaving the building, because this building is designed to confine the fire [e.g., locally OR to the 10th floor only]. Do not use the elevators for any reason. We will give you further instructions, if the situation changes."

Scenario 2 – Fire in a building, full evacuation strategy, building-wide public address announcement and cell phone text message:

Scenario 2 is a fire located on the 2nd floor of a 20-story building in which smoke is traveling up the building's air-conditioning/venting system, causing the need for a full-building evacuation. Individuals are unable to use elevators in this scenario, except for those who are unable to negotiate the stairs, in which case building staff or fire fighters will assist them using the freight elevator(s).

Protective actions: Occupants on all floors are requested to evacuate the building, known as a full-building evacuation.

Technologies used to disseminate the message: The building-wide public address system, which is capable of providing different messages to different floors (using a live voice). Also, a 90-character text message alert to cell phone users in the building.

Message Templates for Scenario 2:

Message 2a (building-wide public address system): "Attention. This is [Chief Smith from the Springfield Fire Department]. A fire has been reported on the [second floor] of the building. Everyone must leave the building now to avoid contact with the fire's heat and smoke. Go NOW to your closest stair and leave the building. People who cannot use the stairs should go to the freight elevator lobby for help."

Message 2b (cell phone text message (90 characters*)): "Evacuate building now. It is on fire. Go to freight elevator if you need help."

*Note: A description of the hazard (a more detailed "why" statement) is not included in this message due to character limits. Also, the source is not listed. It is possible that the source will already be identified in the "From" or "FRM" line of the text message. If message contents are limited, there is always the option to send a follow-up text message that provides more information or that continues the previous message. Also remember that some phones (i.e. non-smart phones) may display longer text messages in reverse chronological order.

Scenario 3 – Tornado imminent on a college campus, campus-wide audible messaging system and Twitter message:

Scenario 3 is a tornado imminent on a college campus.

Protective actions: The individuals on the college campus are instructed to "shelter in place". Additionally, the National Weather Service provides examples of protective actions (included below):

Example 1: "TAKE COVER NOW. FOR YOUR PROTECTION MOVE TO AN INTERIOR ROOM ON THE LOWEST FLOOR OF A STURDY BUILDING."

Example 2: "TAKE COVER NOW. MOVE TO AN INTERIOR ROOM ON THE LOWEST FLOOR OF A STURDY BUILDING. AVOID WINDOWS. IF IN A MOBILE HOME...A VEHICLE OR OUTDOORS...MOVE TO THE CLOSEST SUBSTANTIAL SHELTER AND PROTECT YOURSELF FROM FLYING DEBRIS."

Example 3: "THE SAFEST PLACE TO BE DURING A TORNADO IS IN A BASEMENT. GET UNDER A WORKBENCH OR OTHER PIECE OF STURDY FURNITURE. IF NO BASEMENT IS AVAILABLE...SEEK SHELTER ON THE LOWEST FLOOR OF THE BUILDING IN AN INTERIOR HALLWAY OR ROOM SUCH AS A CLOSET. USE BLANKETS OR PILLOWS TO COVER YOUR BODY AND ALWAYS STAY AWAY FROM WINDOWS.

IF IN MOBILE HOMES OR VEHICLES...EVACUATE THEM AND GET INSIDE A SUBSTANTIAL SHELTER. IF NO SHELTER IS AVAILABLE...LIE FLAT IN THE NEAREST DITCH OR OTHER LOW SPOT AND COVER YOUR HEAD WITH YOUR HANDS."

(Examples found here: http://www.nws.noaa.gov/view/validProds.php?prod=TOR)

Technologies used to disseminate the message: A campus-wide siren system with audible messaging capabilities. Also, a 140-character Twitter[3] message should be disseminated as well for this emergency.

Message Templates for Scenario 3:

Message 3a (campus-wide audible messaging system): *Alert tone precedes message* [siren]. "This is [Joan Smith, Chief of Campus Police]. A tornado has been sighted on the ground at [20th Street and Mockingbird Lane]. The tornado is strong and is moving toward the college campus at high speeds (with winds over 160 mph). High winds and large, flying debris can flatten a

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[3] Certain commercial entities, equipment, or materials are identified in this document in order to describe an experimental procedure or concept adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the entities, materials, or equipment identified are necessarily the best available for the purpose.

building in a storm of this magnitude. Take shelter now. Get inside now, go to the lowest level, and get away from windows. Stay there until further instructions."

Message 3b (Twitter message (140 characters**)): "Take shelter inside a building NOW. Go to the lowest level, get away from windows. Strong tornado near campus." [Include hashtag in 140 characters]

**Note: The source of the message is not included in this Twitter message since the source will be evident from the Twitter message layout.

Scenario 4 – Chemical spill in a building, building-wide public address announcements and building-wide email messages:

Scenario 4 is a chemical spill in a 40-story office building. The event was an accident and occurred on the 1st floor of the building. There is the possibility of the chemical negatively affecting individuals on the lower floors of the building. Individuals are unable to use elevators in this scenario. For those who are unable to negotiate the stairs, only one freight elevator will be used with fire fighter assistance.

Protective actions: Occupants are advised to perform different actions based upon the floor on which they are located. First, occupants on the first floor are advised to evacuate the building. At the same time, occupants on floors 2-10 are advised to travel to locations higher in the building – preferably to floors 20-30. Concurrently, occupants on floors 11 and above are advised to remain in place. Therefore, in this scenario, three different types of messages are required to be provided simultaneously to occupants, depending upon the floor on which they are located: one message will be disseminated to the first floor, one message will be disseminated to floors 2 through 10, and a third message will be disseminated to all other floors.

Technologies used to disseminate the message: The building public address system, which is capable of providing different message to different floors (using a live voice). Additionally, an email message (through the company's email system) should be disseminated to employees on floors 2-10 to relocate to a higher floor. [*Note: Do not worry about an email to other employees, although in an actual emergency, that would be necessary.*]

Message Templates for Scenario 4:

Message 4a (Building-wide public address system): [First floor occupants] "This is your [Building Manager, Joe Smith]. A dangerous chemical has spilled on the first floor. The chemical makes it difficult to see and can cause trouble breathing. Evacuate immediately."

Message 4b (Building-wide public address system): [Floors 2 through 10] "This is your [Building Manager, Joe Smith]. A dangerous chemical has spilled on the first floor. The chemical makes it difficult to see and can cause trouble breathing. Immediately use the stairs to relocate to the [20th through 30th floors] and then wait for further instructions. If you can't use the stairs on your own, go to the freight elevator and wait for help. Relocate now."

Message 4c (Building-wide public address system): [Floors 11 and above] "This is your [Building Manager, Joe Smith]. A dangerous chemical has spilled on the first floor. The chemical makes it difficult to see and can cause trouble breathing. People on [floors 1-10] are being evacuated. Please stay on your floor. You are safer remaining where you are than if you try to leave the building. The chemical will not reach people on floors 11 and above. You would possibly be exposed to the chemical if you tried to leave the building. Do not use the elevators for any reason. We will give you further instructions if the situation changes."

Note: Provide emails with the same messages as listed above

Scenario 5 – Violent event in an airport, airport-wide visual messaging screens and cell phone text message:

The fifth scenario is a violent event. Specially, the emergency involves an active shooter that has been identified in a major U.S. airport.

Example protective action: Occupants should evacuate the airport through all accessible doors, including doors from the gate waiting areas onto the tarmac area.

Technologies used to disseminate the message (along with example character limits that can be typical for these types of technologies): A 90-character text message alert to individuals' phones within the airport. Also, airport-wide visual messaging screens (limit message to 60 words or less) can be used to alert individuals in terminals where the shooter is NOT located.

Message Templates for Scenario 5:

Message 5a (airport-wide visual messaging screens): "This is Los Angeles Police. Evacuate the terminal NOW. Follow directions from airport security. Shots have been fired near 'Gate 22'."

Message 5b (cell phone text message (90 characters***)): "Leave NOW. Follow airport security. **Shots fired!** Police report: Shooter in Terminal A."

***Note: A description of the hazard (a more detailed "why" statement) is not included in this message due to character limits. If message contents are limited, there is always the option to send a follow-up text message that provides more information or that continues the previous message. Also remember that some phones (i.e. non-smart phones) may display longer text messages in reverse chronological order.

Future Direction

The purpose of this report is to provide guidance to system designers, building managers, and building emergency personnel responsible for emergency communication on how to create and disseminate effective messages using basic communication modes (audible vs. visual technology), as well as examples of emergency messages (message templates) for five different types of emergency scenarios. START (2013) contains additional message templates for similar types of rapid-onset events for both limited- and unlimited-character length dissemination technologies. Additionally, Kuligowski and Omori (2014) provide guidance on how to test the effectiveness of these messages.

As with any document, there are gaps in the research that hinder the ability to provide guidance on certain topics, including message length and repetition. This guidance document focuses specifically on textual message creation, creating room for additional guidance on the development and testing of visual symbols that could be used instead of, or in addition to, textual emergency messages. In the future, as research gaps are addressed, additional editions of this document would be useful to enhance the findings and guidance provided here.

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