Memorandum

To: Mary Ellen Carroll, Executive Director of San Francisco Department of Emergency Management
From: DEM/DT RFI Review Team
Re: Outdoor Public Warning System RFI Findings and Next Steps
Date: Dec 6, 2024

Executive Summary:

The Department of Emergency Management (DEM), in partnership with Department of Technology (DT), conducted a Request for Information (RFI) to explore options for replacing the city's outdoor public warning system (OPWS). The RFI Review Team found that the vendors who responded to the RFI offered largely similar systems in terms of features, capabilities, costs, and recommended siren placement strategies. Proposed technologies generally align with standard practices for outdoor warning systems, and there were no groundbreaking innovations that would significantly enhance performance or reduce costs.

DT estimates costs for replacing the system to be approximately $8.5 million for 35 sites and $20 million for 112 sites. Estimated annual costs are projected to add long-term financial commitments of $950,000 annually for 35 sites and $3 million annually for 112 sites (see Attachment 1 for detailed cost estimates).

Upon approved budget allocation, bringing the system back online would take an estimated 3 years to 6 years to complete, issue a request for proposals (RFP), contract initiation, hardware installation, systems integration, training, and testing (see Attachment 2 for Timeline).

Alert and warning technology has advanced significantly since the Cold War, with cell phones now serving as "mini-sirens" for targeted and immediate notifications through platforms like AlertSF and Wireless Emergency Alerts (WEA). Modern alternatives, such as drones with speakers, public-address systems, and public safety vehicles with hi-lo sirens and Code 3 lights, offer flexible, efficient, and cost-effective ways to alert outdoor populations during emergencies, as demonstrated during tsunami events in 2022 and 2024.

Whether to fund a partial or complete restoration of the OPWS system is a policy question. If the City chooses to fund the system, a phased implementation focused on tsunami inundation zones along the coastline would provide coverage where the system's utility is highest and allow scalability for future expansion as funding becomes available. **An approved budget allocation and formal Request for Proposals (RFP) process resulting in a ten-year contract, would be required to move forward.**

Background:

OPWS in San Francisco

An outdoor public warning system has been a part of the San Francisco's emergency alert infrastructure, since 1946, when sirens were installed in major cities to warn of possible air raids. In 2005, the city used a $2.1 million federal grant to initiate a replacement of the WWII-vintage system with an expanded network of 112 emergency sirens. Overall costs for the project exceeded the initial grant amount.

In December 2019, following concerns that the system had security flaws that left it vulnerable to hacking, the full system was taken offline to upgrade the sirens with a renewed operating system, stronger encryption, and more reliable and secure hardware. Originally, the upgrade project was anticipated to take between 18-24 months and cost approximately $2.5M. However, many factors, including the response to COVID-19 and budgetary limitations since then, have impeded this project from being implemented.

In the summer of 2023, this project was presented at a San Francisco Disaster Council meeting, where Mayor Breed provided direction to the Departments of Technology (DT) and Emergency Management (DEM) to pursue a pathway forward for restoring the siren system. After that meeting, a citywide inspection was performed that demonstrated a 55-70% equipment failure across the system.

In order to expedite the siren restoration process, existing City vendors were interviewed and directed to compile a multi-phase plan and corresponding cost proposals. Proposals from existing city vendors resulted in high costs that have posed challenges to project implementation.

In May 2024, DEM and DT worked together to develop an RFI to explore current and alternative outdoor warning technologies and cost proposals, culminating in October 2024 with vendor interviews. The RFI review team requested pricing for an initial set of 35 siren sites as well as pricing for 112 sites.

Best Practices: Outdoor Warning Systems in High-Risk Regions

Outdoor warning systems became popular in the United States during World War II and the Cold War era, when they were deployed as part of civil defense initiatives to warn of potential air raids or nuclear attacks. Their use expanded in the 1950s and 1960s to include natural disaster alerts, particularly in tornado-prone regions, where the systems provided a means of rapidly notifying people outdoors of imminent severe weather threats in the absence of cell phones.

Today, outdoor warning systems are most popular in regions where fast-developing, large-scale natural hazards frequently occur, especially those that threaten people in outdoor environments with limited access to digital alerts. Common examples include:

- Tornado-prone areas (Midwest and South US)
- Tsunami risk zones (coastal areas like Hawaii, Oregon, and Washington)

- High fire hazard severity zones (increasing popularity in areas with fast-moving wildfires in California, Colorado etc)
- Industrial hazard areas (chemical plants, nuclear facilities, refineries etc are often required by regulatory agencies to have outdoor warning systems to alert people in the surrounding areas of potential emergencies)

Key considerations for implementing an outdoor public warning system[1]	
Strengths	**Limitations**
• Delivers widespread notification to people outdoors for fast-onset hazards with limited warning time, like tsunamis • Adds a layer of coverage if digital alerting systems fail • Does not rely on personal devices or availability of cell coverage • Grabs attention and prompts people to seek more information • Becomes part of the soundscape and public safety culture of a community	• Limited effectiveness reaching people indoors or in cars • In an urban environment (such as in downtown San Francisco), noise pollution and dead zones near hills and buildings limit reach • Equity consideration: does not reach people who are hard-of-hearing or deaf • For this tool to be effective, agencies must implement robust public education but frequent testing can also lead to de-sensitization • Not good for complex messages or calls to action (short, simple, repetitive messages only) • Not good for "shelter in place" as the sound draws people out of their homes to tune in • Does not currently integrate with earthquake early warning system • In areas with strong cell coverage and smartphone penetration, digital approaches like AlertSF offer more effective alerting solutions • Another redundant tool with limited additional reach adds complexity and operational burden to the City's alerting program

Alert and warning technology has evolved significantly since the Cold War, when fixed sirens were the primary means of notifying the public about emergencies. Today, with the widespread use of cell phones, individuals effectively carry "mini-sirens" in their pockets, allowing for more targeted and immediate notifications through platforms like Alert SF and Wireless Emergency Alerts (WEA).

[1] FEMA's Outdoor Warning Systems Guide (CPG 1-17); National Weather Service's Tsunami Preparedness Information; NOAA's Detection, Warning, and Forecasting Systems; NIST's Outdoor Siren Systems: A review of technology, usage, and public response during emergencies; DHS's Outdoor Warning Sirens Market Survey Report

Additionally, less costly and more versatile alternatives to fixed sirens are now available, such as drones equipped with speakers, public-address systems and hi-lo sirens mounted on public safety vehicles, and the use of Code 3 lights and sirens by public safety agencies. In certain situations, including during a tsunami advisory in 2022 and tsunami warning in 2024, public safety vehicles served as mobile alerting platforms to reach outdoor populations. These modern alternatives provide greater flexibility, efficiency, and cost-effectiveness in San Francisco's alert and warning program.

RFI Findings:

- **Vendor Comparisons**
  - The Review Team evaluated responses from 4 vendors and previous information from Motorola and found limited differentiation in the products and capabilities offered. Key commonalities include:
    - Estimated costs: Vendors offered minimal variation in estimated costs for system installation and maintenance
    - Communication/power systems: Vendors offered similar siren technologies and redundant options for power (primary via grid with back-up via solar or battery) and connectivity (primary via IP, with back-up via satellite)
    - Voice/tone flexibility**:** All vendors support both pre-recorded and live messaging, with options for tone-only, voice-only, or a combination. Voice is not recommended for Motorola infrastructure.
    - Coverage: Each vendor recommended conducting an acoustic study to optimize siren placements for coverage. Based on discussion with references and review of RFI responses, the RFI Review team believes methodologies for establishing siren locations are similar across vendors and would not result in significant changes to existing siren locations[2].
    - Vendors such as HQE offer a higher siren wattage capacity (5,400W), which could enhance coverage areas and sound clarity. ATI and Genasys provide options around 3,200W, aligning with previous system benchmarks.
- **Projected Implementation and Maintenance Costs**
  - *The Department of Technology reviewed cost proposals from four vendors and analyzed City-incurred expenses from comparable projects to develop the following cost estimates (which are summarized in Attachment 1)*
  - One-Time Implementation Costs:

[2] To maximize coverage, sirens should be placed at high-elevation points, in centralized and open areas, and spaced strategically to ensure overlap and minimize sound gaps. They should also be positioned near vulnerable or high-population areas while accounting for environmental factors like background noise, topography, and obstructions from the built environment. Siren placement is further limited by the availability of locations the City owns or can access easily, such as schools.

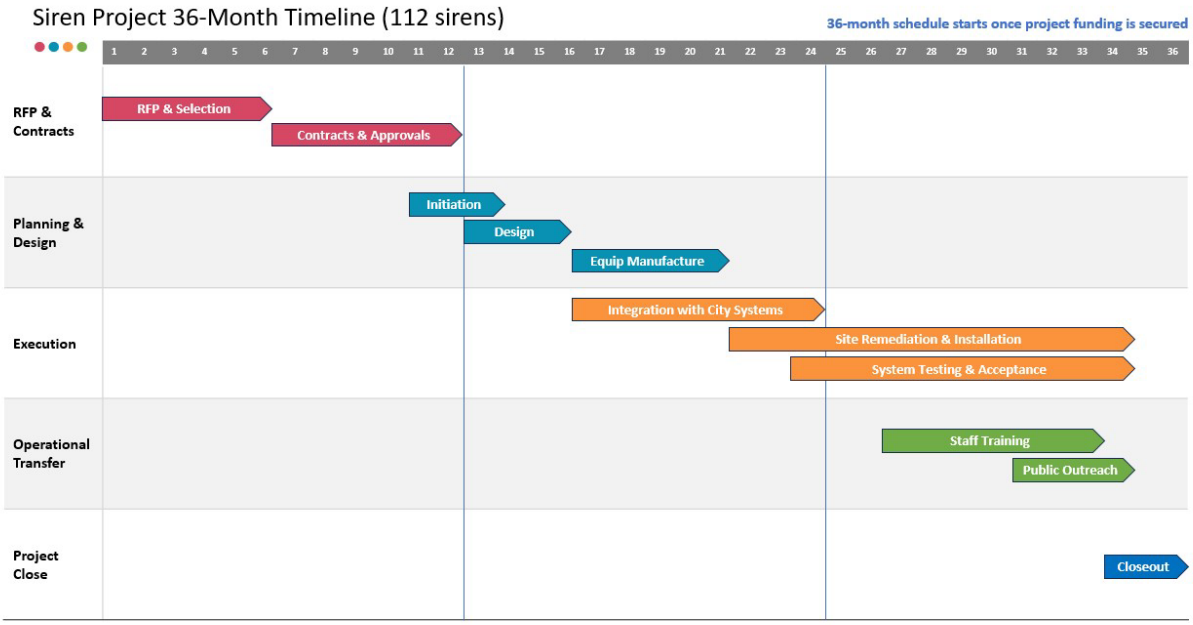
        - *Acoustic Survey*: Costs for engaging a vendor to determine optimal siren placement for compliance and coverage. ($80,000 for 35 sites; $256,000 for 112 sites)
        - *RFP, Selection, & Contracts*: Staff time to develop and manage the request-for-proposal (RFP) process, evaluate responses, negotiate contracts, and obtain necessary approvals. ($360,000 for both configurations)
        - *Site Surveys*: Surveys of existing sites to assess preparation needs for new installations. ($140,000 for 35 sites; $448,000 for 112 sites)
        - *Site Remediation of Previous System*: Removing faulty hardware from previous system and other decommissioning ($280,000 for 35 sites; $900,000 for 112 sites)
        - *Hardware and Installation*: Expenses for siren hardware, mounting hardware, and the labor required for installation.
            - Installation and permitting process adds uncertainty to timeline and cost
            - Installation costs are difficult to predict as they will vary on a site-by-site basis.
            - Some vendors may offer the option to train City staff to perform the installation of their hardware, enabling the City to reduce reliance on vendor labor.
            - Hardware: $3.38M for 35 sites; $10.8M for 112 sites. Installation: $1.8M for 35 sites; $3.1M for 112 sites
        - *Integration, Training, and Public Outreach*: Costs for integrating the new OPWS system with city systems, developing training materials, and conducting staff and public outreach. (Integration: $500,000 for both. Training: $325,000 for both)
        - *Risk Contingency*: A 20% reserve fund to address unexpected project costs. ($1.42M for 35 sites; $3.47M for 112 sites)
        - Total One-Time Costs: $8.52M for 35 sites and $20.85M for 112 sites.
    - <u>Ongoing Annual Support Costs:</u>
        - *Hardware and Software Maintenance:* Annual contracts for the maintenance and support of sirens and software systems. (Hardware: $843,823 for 35 sites; $2.7M for 112 sites. Software: $17,500 for 35 sites; $56,000 for 112 sites)
        - Site Infrastructure and Communications: Costs for staff time to inspect and maintain the sites, as well as third-party communication fees for system operation. (Site Support: $62,500 for 35 sites; $200,000 for 112 sites. Communications Fees: $35,000 for 35 sites; $112,000 for 112 sites)
        - Total Annual Costs: $958,823 for 35 sites and $3.07M for 112 sites.

These figures underscore the significant upfront and recurring investments required to support the system, both in terms of financial resources and operational efforts.

Potential next steps

An approved budget allocation is required to move forward with this project. Funding is a policy question that would be determined by the Mayor, Board, Committe on Information Technology, Capital Planning Committee, and other stakeholders.

Upon funding approval, DT and DEM have outlined the following next steps:



- *Move to RFP Process:* If the City opts to proceed with replacing OPWS by allocating funding to the project, the next step would be to initiate a formal RFP process. Given the scope of work, DT/DEM recommends an RFP that would result in a 10-year contract. This would require Board and Ethics approval and detailed scoping of system specifications and costs. Proceeding with an RFP before funding has been approved is not recommended, as price proposals can expire if there is a delay in securing the budget appropriation needed to support the project.

Programmatic Options:

- **Phased implementation focused on tsunami inundation zones**: If the Board/Mayor's Office chooses to allocate funding to this project, the RFI Review Team recommends an initial contract and build-out focused on tsunami inundation zones along the coastline and Bay. This limited deployment would:
    - Provide coverage where the system's proposed utility is highest

- Allow the city to evaluate real-world costs and benefits (including installation costs, permitting challenges, sound coverage, and use cases) before potentially scaling to a citywide system, as funding allows.

- **Trailer-mounted sirens as a potential alternative to a fixed system**: ATI and Genasys also produce portable units, that can be mounted onto trailers and deployed to locations as needed. Trailer-mounted speakers provide flexibility to cover specific events or emergencies without the need for permanent installation. One RFI respondent Genasys has provided trailer-mounted sirens in Mill Valley, San Jose, and several other communities to supplement fixed siren systems.
  - Cost considerations: Genasys quoted $315,000 as the cost per trailer-mounted siren. This option may require purchase of additional vehicles. DT encouraged adding a risk contingency of 20% to the estimated costs, which brings the estimated cost to $378,000 per unit.
  - Advantages:
    - Cost-Effective: Lower upfront costs as they avoid permanent infrastructure requirements.
    - Adaptability: Can be staged at critical facilities and repositioned based on real-time needs
  - Challenges:
    - Coverage limitations: May not provide full coverage of an area unless multiple units are deployed.
    - Deployment: Unlike sirens that are permanently mounted to fixed sites, trailer-mounted sirens require set-up and staging in areas where they are needed. This is not always feasible in a short notice event.
    - Maintenance: Mobile units stored at city facilities, would need to be maintained by a responsible party. City staff would also need ongoing training on the deployment of these systems.
    - Existing technologies, like siren and speaker systems mounted to public safety vehicles, offer similar capabilities without the same set-up constraints.

Attachment 1: Budget Estimate

Pricing Components

One-time implementation costs

35 Sites		112 Sites	
▪ Acoustical Survey	80,000	▪ Acoustical Survey	256,000
▪ RFP, Selection, & Contracts	360,000	▪ RFP, Selection, & Contracts	360,000
▪ Site Surveys	140,000	▪ Site Surveys	448,000
▪ Hardware	3,375,291	▪ Hardware	10,800,931
▪ Commissioning	87,500	▪ Commissioning	280,000
▪ Software	70,000	▪ Software	224,000
▪ Platforms and servers	80,000	▪ Platforms and servers	180,000
▪ Integration with City Systems	500,000	▪ Integration with City Systems	500,000
▪ Site Remediation	281,250	▪ Site Remediation	900,000
▪ Training	325,000	▪ Training	325,000
▪ Installation	1,800,000	▪ Installation	3,100,000
Sub Total	**7,099,041**	**Sub Total**	**17,373,931**
▪ Risk Contingency (20%)	1,419,808	▪ Risk Contingency (20%)	3,474,786
Total	**8,518,849**	**Total**	**20,848,717**

On-going annual support

▪ Hardware	843,823	▪ Hardware	2,700,233
▪ Software	17,500	▪ Software	56,000
▪ Site Infrastructure support	62,500	▪ Site Infrastructure support	200,000
▪ Communications Fees	35,000	▪ Communications Fees	112,000
Total	**958,823**	**Total**	**3,068,233**

Attachment 2: Project Timeline, Upon Funding Approval