

# Remote Alarm Accessory for Radioactive Contamination Screening at Community Reception Centers

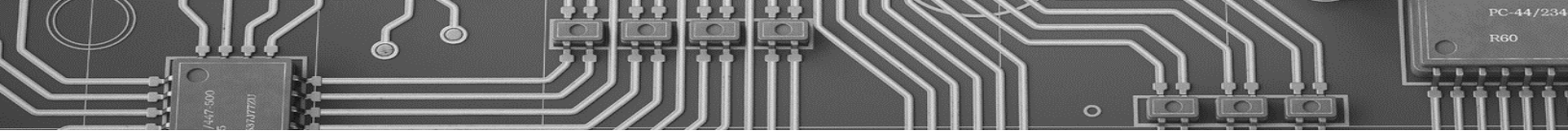
Report

May 2023



Science and  
Technology





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The “Remote Alarm Accessory for Radioactive Contamination Screening at Community Reception Centers” report was prepared by the National Urban Security Technology Laboratory for the Fire Department of the City of New York.

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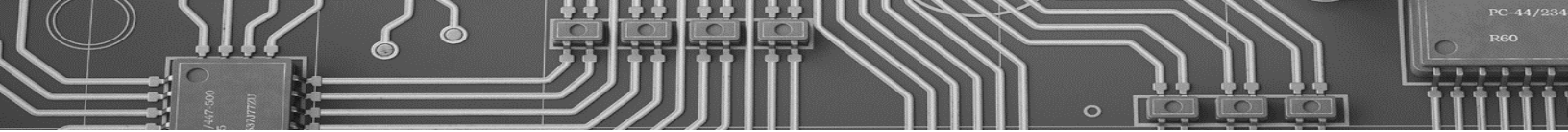
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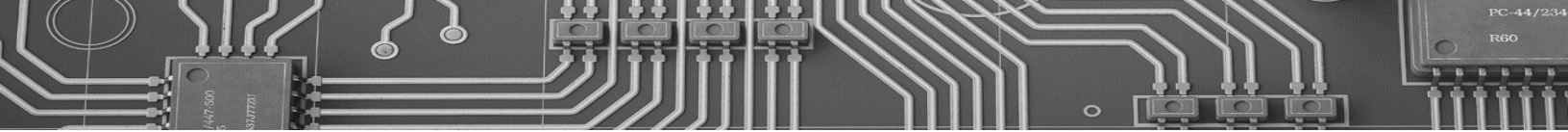
## FOREWORD

The National Urban Security Technology Laboratory (NUSTL) is a federal laboratory organized within the U.S. Department of Homeland Security Science and Technology Directorate. Located in New York City, NUSTL is the only national laboratory focused exclusively on supporting the capabilities of state and local first responders to address the homeland security mission. The laboratory provides first responders with the necessary services, products, and tools to prevent, protect against, mitigate, respond to, and recover from homeland security threats and events.

NUSTL provides independent technology evaluations and assessments for first responders, thereby enabling informed acquisition and deployment decisions, and helping to ensure that responders have the best technology available to use in homeland security missions.

If there is a radiological release, whether from an accident or from a terrorist act, local response agencies can set up community reception centers (CRCs) to screen the public for radioactive contamination. This “Remote Alarm Accessory for Radioactive Contamination Screening at Community Reception Centers” report was prepared to provide the Fire Department of the City of New York and other emergency response organizations with detailed information about an accessory NUSTL invented to aid in screening people’s shoes for possible radioactivity before they enter a CRC.

Visit the NUSTL website at [www.dhs.gov/science-and-technology/national-urban-security-technology-laboratory](http://www.dhs.gov/science-and-technology/national-urban-security-technology-laboratory), or contact [NUSTL@hq.dhs.gov](mailto:NUSTL@hq.dhs.gov) for more information.



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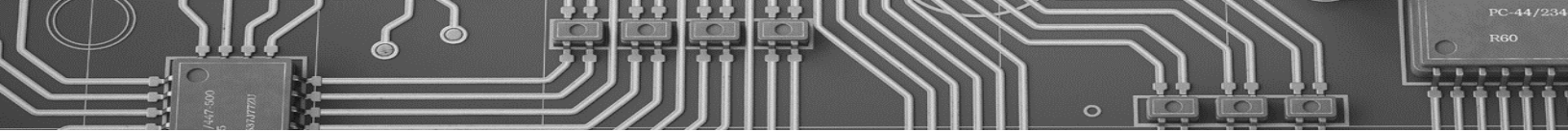
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## 1.0 INTRODUCTION

Following a radiological release, whether from an accident or a terrorist act, local response agencies can set up community reception centers (CRCs) to screen the public for radioactive contamination. To provide the Fire Department of the City of New York (FDNY) and other emergency response organizations with technical guidance for deploying CRC radiation detection equipment to optimize screening efficiency, the Department of Homeland Security (DHS) Science and Technology Directorate's National Urban Security Technology Laboratory (NUSTL) prepared the "Optimizing Radioactive Contamination Screening at Community Reception Centers" report. [1] One of the recommendations in that report is to perform two stages of prescreening with personal radiation detectors (PRDs).

To avoid contaminating the floor of the CRC facility, it is best to screen people's shoes for possible radioactivity before they enter the CRC building. NUSTL developed a way to prescreen shoes during second-stage prescreening, so it takes no additional time. This is done by performing second-stage prescreening while people stand on a small, raised platform with a PRD under it. (Gently sloped ramps lead to and from the platform, as shown in Figure 1). The PRD can detect and alarm on less than 2  $\mu\text{Ci}$  (74 kBq) of Cs-137 or other gamma-emitting radionuclide on the shoes of a person, which is a very small amount of radioactivity. However, because the PRD is hidden beneath the platform, the PRD's alarm light cannot be seen and CRC personnel must rely on the PRD's audible alarm. Unfortunately, the platform muffles the alarm sound, and the use of HazMat personal protective equipment can make it even harder to hear the alarm sound. At the request of FDNY, NUSTL developed a remote audible alarm accessory to amplify the alarm sound from the PRD underneath the ramped platform. The remote alarm accessory box is placed on the ground just outside the ramped platform and connected to the PRD's audio output jack with an audio adapter cable. The remote alarm accessory provides a loud alarm sound that can be easily heard even through the headgear of HazMat personal protective equipment. This report gives a detailed description of the remote audible alarm accessory developed by NUSTL.



**Figure 1 Prescreening a person standing on the ramped platform**

## 2.0 REMOTE ALARM ACCESSORY

The remote alarm accessory is a relatively simple device containing a circuit that feeds the audio output signal from a RadEye PRD-ER to two piezoelectric audio transducers: one that responds to alternating current (AC) signals and one that responds to direct current (DC). The audio output signal of the PRD-ER is a square wave with a frequency that alternates between 1.0 kHz and 2.35 kHz and an amplitude of  $-2.75\text{ V}$  to  $+2.75\text{ V}$ . The signal is connected directly to the AC transducer and connected to the DC transducer through a step-up transformer and a rectifier bridge. With a specific choice of components, this simple circuit allows the transducers to produce a loud alarm signal without the need for powered amplification. No batteries are used; no maintenance is required, and the device is always ready for use even after long periods of storage.

Another important feature for its intended use is that the diecast aluminum box housing the circuit is strong enough to withstand being stepped on or kicked multiple times during use. Figure 2 shows a photograph of the top of a remote alarm box on the left and an opened box on the right. Since the box must have holes in it to allow the sounds from the transducers out, the alarm accessory should be placed inside a plastic bag to protect it from water and the possibility of radioactive contamination when in use at a CRC.

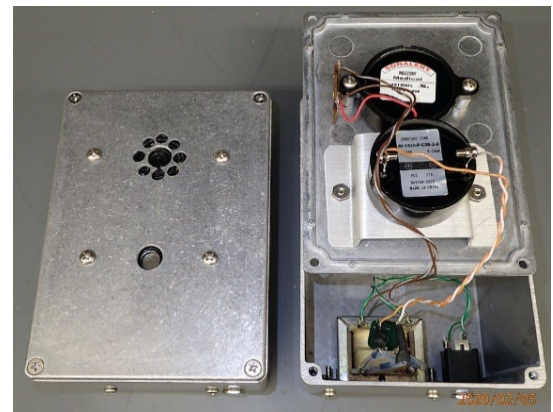
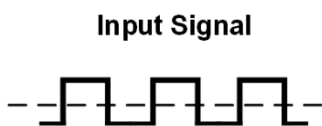
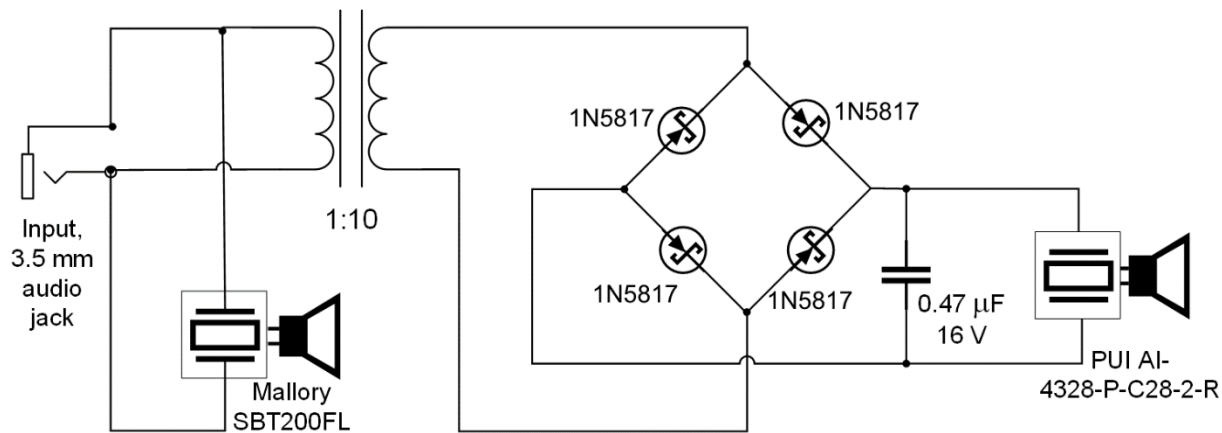


Figure 2 Assembled remote alarm accessory box (left) and an opened box (right)

The circuit diagram and parts list are shown in Figure 3. All the parts are available from major suppliers of electronic components. In small quantities, the total cost of the parts for each remote alarm accessory was approximately \$65 in 2022.

The alarm accessory was designed to work with the Thermo Scientific RadEye PRD-ER. We performed a brief test of the device with the successor model to the PRD-ER, the RadEye PRD-ER4, and the accessory worked equally well.

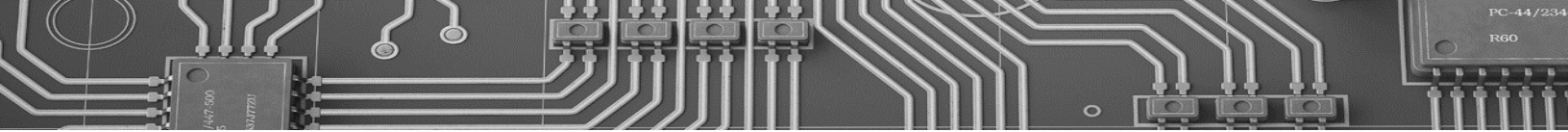
DHS has patented this device: U.S. patent 11,140,476, Remote Audible Alarm Accessory for Detection Instruments with Audio Outputs. State, local, tribal, and territorial emergency response agencies may exercise the patent for noncommercial purposes, including making these accessories for their own use. To apply for a commercial use license, email the DHS Technology Transfer and Commercialization Branch at [T2C@hq.dhs.gov](mailto:T2C@hq.dhs.gov). Please reference DHS-0213 in the subject line. For additional information about how to make the device, email [NUSTL@hq.dhs.gov](mailto:NUSTL@hq.dhs.gov).



PARTS LIST		
Description		QTY
Box, diecast aluminum (Hammond Mfg. 1550W K)		1
Transformer (Signal Transformer 241-4-12)		1
Schottky rectifier diode (1N5817)		4
Capacitor (0.47 µF 16V)		1
Audio jack, 3.5 mm		1
Piezoelectric alarm (PUI Audio Inc. AI- 4328-P-C28-2-R)		1
Piezoelectric alarm (Mallory Sonalert SBT200FL)		1
Audio adapter cable, 2.5 mm male to 3.5 mm male		1

Figure 3 Remote audible alarm accessory circuit diagram and parts list





### 3.0 REFERENCES

- [1] National Urban Security Technology Laboratory, "Optimizing Radioactive Contamination Screening at Community Reception Centers Report," expected 2023.