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A Passive Automated Personnel Accountability System for Reactor Emergency Preparedness

Prepared for the U.S. Department of Energy
Assistant Secretary for Defense Programs

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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A PASSIVE AUTOMATED PERSONNEL ACCOUNTABILITY SYSTEM FOR REACTOR EMERGENCY PREPAREDNESS

INTRODUCTION

In 1985 a project was undertaken at the N Reactor* on the Hanford Site to develop an automated personnel accountability system to ensure accountability of all personnel within 30 minutes of a site evacuation. The decision to develop such a system was made after a full-scale evacuation drill showed that the manual accountability system in use at the time was inadequate to meet the 30-minute requirement. Accountability systems at commercial nuclear power plants were evaluated, but found to be unsuitable because they were not passive, that is they required action on part of the user for the system to work. Approximately 2,500 people could be required to evacuate the 100-N Area. Therefore, a card key system or badge exchange system was judged not to be feasible. A passive accountability system was desired for N Reactor to allow personnel to enter and leave the site in a more timely manner.

To meet the need for an automated accountability system at N Reactor, a special Evacuation Accountability System (EVACS) was designed and developed. The EVACS system has three basic components: the transponder, a credit card-sized device worn with the security badge; portal monitors, which are electronically activated by the transponder; and a computer information system that contains the personnel data base. Each person wearing a transponder is accounted for automatically by walking through a portal.

In this paper, a description of the hardware and software will be presented, together with problems encountered and lessons learned while adapting an existing technology to this particular use. The system is currently installed and requires acceptance testing before becoming operational.

EVACUATION ACCOUNTABILITY SYSTEM DESCRIPTION

The EVACS consists of two types of computer systems working together; the detection system, or Local Processing Unit (LPU), and the host system. The detection system operates at all times. It detects the passing of personnel and determines in which of the three security areas they are located. The host system is an auxiliary computer system that monitors activity and operates only when needed to update personnel information records.

The detection system is made up of the transponder worn by all personnel, portal sensors that detect the transponders, and one or more microcomputers (LPUs).

The portal sensors are located at the entrances and exits of the controlled access area. As a person wearing a transponder walks through a portal, a unique code is transmitted to a nearby LPU. The unique code identifies the person and the LPU updates the person's location record. The LPU receiving the input will send that data to all the other LPUs. Portals will be located at the vehicle gates to allow entrance and exit of individuals in vehicles without their walking through the security gate to be recorded by the system.

The host system is a microcomputer data base system. The host system data base contains all the information necessary to administer the issuance of transponders to personnel. The information stored in the computer data base includes the date; badge number; payroll number; first, last, and middle names; title; work location; company; and organization code. Several peripherals are connected to the host system to allow printing of files, printing labels, and programming and reading transponders. The master data base files reside on the host system.

*N Reactor is owned by the U.S. Department of Energy and operated by Westinghouse Hanford Company.

EVACUATION ACCOUNTABILITY SYSTEM OPERATION

All personnel entering the controlled access area at 100-N Area are provided with transponders that are issued in a plastic holder and are attached in close proximity to the security badge. Transponders can be read through clothing, briefcases, etc., but not through metal containers. The EVACS works passively 24 hours a day and does not require operator attention except for maintenance and modifications.

The EVACS system records personnel wearing transponders as they pass through a set of portal monitors. Each transponder is encoded with a unique code assigned to an individual. When an individual walks through a portal, the portal emits an audible signal ("chirp") to indicate that the transponder was read. The individual then passes through the second portal monitor. The transponder is again read and the portal emits a "chirp." Using two portals in series allows the computer to determine whether the individual is coming into or leaving the controlled area. The microcomputer automatically updates the individual"s location record during passage through the portals.

When the evacuation alarm is sounded, all personnel not assigned emergency responsibilities will evacuate the site. Approximately 20 minutes after evacuation has commenced, the EVACS system will be accessed to provide a list of people still onsite. A list of individuals onsite will be printed and distributed to the managers. Personnel remaining onsite to respond to the emergency will be marked off the list. With 30 minutes of initiation of the evacuation, the names of individuals onsite and not accounted for will be available. Only personnel issued temporary transponders or those issued transponders after the last update of the personnel data base will not be identified by name. However, the system will register that someone wearing that particular transponder is still onsite.

PROBLEMS AND LESSONS LEARNED

A commercial accountability system to meet the specific needs of the 100-N Area was not available so the system hardware was purchased and the software to run EVACS was developed at the Hanford Site.

The most significant problem encountered with the EVACS is the lack of a positive correlation between a transponder signal and a person entering or leaving the site. An individual walking through a portal without a transponder is not recognized or prevented from passing through. Therefore, there is the possibility of individuals entering the controlled area without being recorded in the accountability system. There are several possible solutions to this problem. These solutions involve the use of a device that registers the passage of a person coincident with the readout of the transponder. Occurrence of a signal without the other signal would initiate an alarm and some type of intervention by the guard. Any of several devices could be used to provide the coincidence signal, including a mechanical turnstile, ultrasonic or infrared detectors, or electro-optical instruments. Another solution would be to have a transponder reader at the security guard's station so that the transponder is read as the security badge is being shown to the guard. A visible or audible indication could be provided to indicate that the transponder was read. Signals from the two portals would then be used to determine if the person is entering or exiting.

During initial installation and testing, the portal monitors were found to be adversely affected by weather, especially moisture. The supplier of the hardware provided a new design for the portals, but there is still some concern about the sensitivity of the monitors. Portals will be sent back to the supplier to be analyzed and modified as necessary.