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AN ACTIVATED BARRIER FOR PROTECTION OF SPECIAL NUCLEAR MATERIALS IN VITAL AREAS

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ABSTRACT

The Argonne National Laboratory and Sandia National Laboratory have recently installed an activated barrier, the Access Denial System (ADS) for the upgrade of safeguards of special nuclear materials. The technology of this system was developed in the late 70's by Sandia National Laboratory-Albuquerque. The installation was the first for the Department of Energy. Subsequently, two additional installations have been completed. The Access Denial System, combined with physical restraints, provide the system delay. The principal advantages of the activated barrier are: (1) it provides an order of magnitude improvement in delay over that of a fixed barrier, (2) it can be added to existing vital areas with a minimum of renovations, (3) existing operations are minimally impacted, and (4) health and safety risks are virtually nonexistent. Hardening of the vital areas using the ADS was accomplished in a cost-effective manner.

INTRODUCTION

The physical protection of special nuclear materials (SNM) consists of: (1) detection, (2) delay, and (3) response. Advancements in detection technology in the areas of alarm sensors, alarm processing, and closed-circuit television have provided the security force with positive capabilities in determining the presence of an adversary. Tactics have been refined so that containment response is available in 5 to 10 minutes after assessment. Delay is the function that ties together detection and response to defeat the adversary.

In the past, delay was provided by fixed barriers, such as doors, walls and fences; improvements consisted of bigger, thicker and more. These solutions applied to existing facilities, if not impossible, are very difficult. Walls, doors, floors, ceilings and utility posts must all be hardened uniformly.

Since the mid 70s, research has been under way to provide a new type of barrier - an active barrier. An active barrier is a component that is installed in a passive mode and is activated by a

security inspector after the positive assessment of an adversary. When the activated barrier is deployed, a delay of up to 30 minutes is provided.

BARRIER TECHNOLOGY

Barrier technology is divided into two classes - fixed or activated. The fixed barriers were discussed above. The active barriers fall into four generic classes; aqueous foam, cold smoke, rigid foam and sticky foam. Table 1 shows a matrix of their relative characteristics. One of the most interesting aspects of the activated barrier is its effect on personnel, materials, and equipment in the vital area if the barrier is deployed. Two of the activated barriers, rigid and sticky foam, are considered unacceptable for their effects on personnel, materials or equipment. The remaining two, aqueous foam and chemical smoke are benign; in fact, neither are harmful to personnel, even if they are exposed throughout the persistency of deployment.

BARRIER SELECTION

Recently, a number of existing SNM storage and/or working facilities have been analyzed to improve the delay time for timely response. In the majority of cases, cold smoke activated barriers were selected. This technology was selected because of the:

- o Minimal impact on operations
- o Minimal modifications to the existing plant
- o Safety consideration, and
- o Economy

Activated barriers are typically used with physical restraints. The activated barrier, together with the physical restraints, comprise an Access Denial System. The physical restraints are placed over and around sensitive items in the vital area. Their purpose is to stop an adversary from grabbing and snatching a sensitive item even though an active barrier is, or has been deployed. The synergistic effects on adversary movement in an active barrier environment (smoke), plus adversary action with a fixed restraint, means that a delay of 30 minutes can be achieved for an Access Denial System.

ACTIVE BARRIER SELECTION MATRIX

	COLD SMOKE	AQUEOUS FOAM	RIGID FOAM	STICKY FOAM
PERSISTENCY	GOOD	MARGINAL	GOOD	GOOD
PREMATURE CONSEQUENCES	GOOD	GOOD	BAD	BAD
SAFETY	GOOD	GOOD	MARGINAL	BAD
VOLUME	LARGE	LARGE	SMALL	SMALL
COST	GOOD	GOOD	MARGINAL	MARGINAL
AVAILABILITY	COMMERCIAL	COMMERCIAL ~~R&D~~	R&D	R&D

Table 1

INSTALLATION ENGINEERING

Typically, after a survey of a facility has been conducted, the engineering and installation of an ADS take 7 months. The physical protection system must be upgraded to include at least 2 firing positions for barrier deployment. When the firing positions have been selected, the cable runs must be designed to connect the firing positions to the vital area using diverse and redundant paths.

The smoke particulates are sub-micron to 10 microns in size; to maintain their persistency they must remain suspended in air, thus heating, ventilating and air conditioning (HVAC) must be deactivated. Deactivation of the HVAC is automatically accomplished when the ADS is fired. Additionally, personnel in the areas are warned to vacate the area by the use of sonalert high intensity sound, also automatically activated on arming before actual firing. Figure 1 shows a block diagram of a typical Access Denial System Installation.

Operation personnel are consulted as to any restriction on location of the smoke generator. The entire engineering design is then presented to personnel responsible for:

- o Facility operations
- o Security
- o Safety
- o Plant engineering
- o Materials accountability
- o Fire/emergency

After this review, the fabrication and installation can proceed. After installation, the training of security inspectors, and operational and maintenance personnel is necessary so that all those involved in activities in the vital area are aware of changes that could effect their normal and emergency duties.

PERSONNEL SAFETY MATERIALS STUDIES

During the research and development phase of the engineering for the cold smoke barriers, extensive testing was conducted under the direction of Sandia National Laboratory - Albuquerque (SNLA). The personnel safety tests were conducted on laboratory animals, and the tests indicated no harmful effects even after exposure to the cold smoke for the life of its

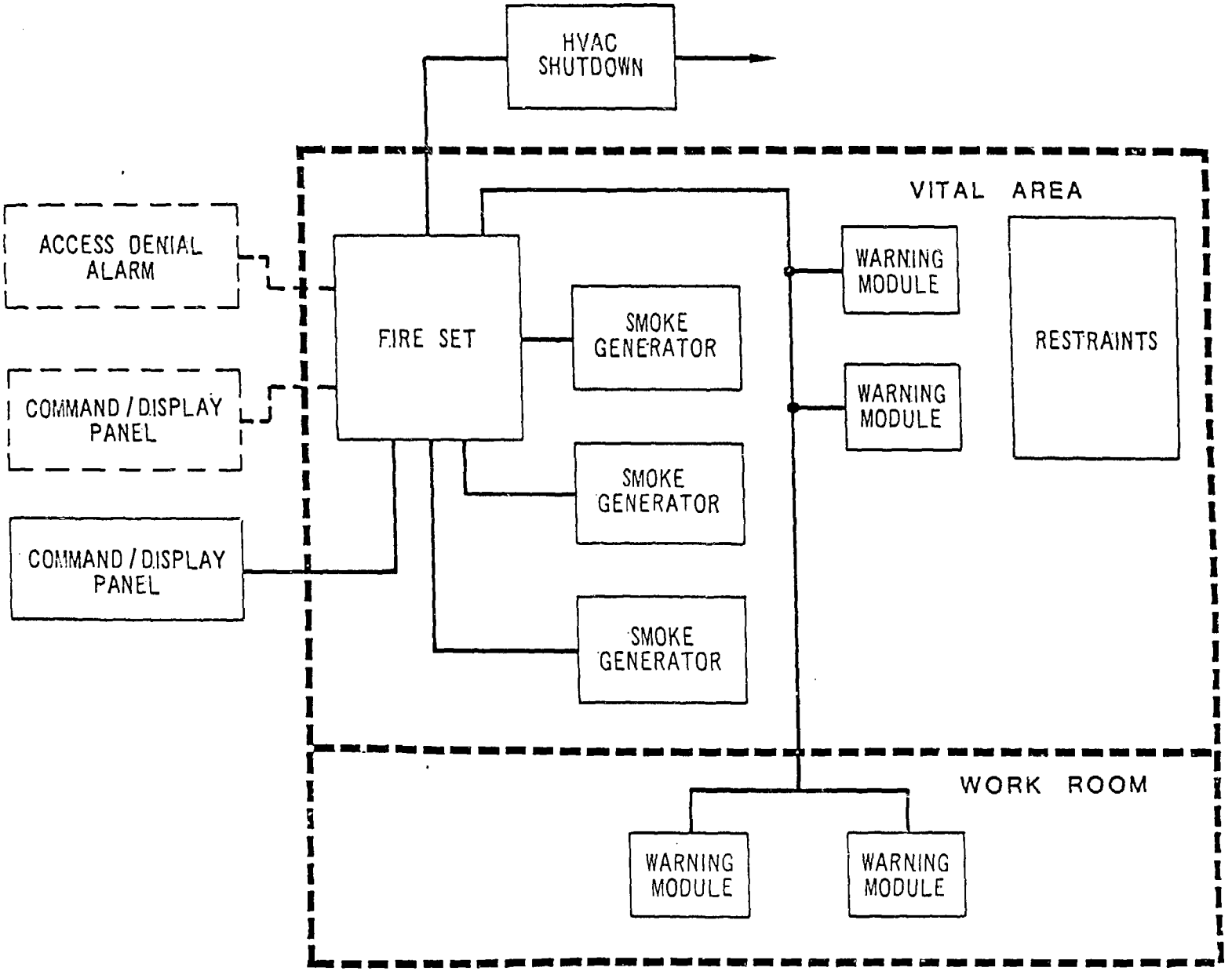

FIGURE 1 ACCESS DENIAL SYSTEM BLOCK DIAGRAM

persistency. Obvious discomfort was experienced due to the particulate matter irritating the eyes, nose, throat and lungs. The materials studies were conducted on polymer seals and aluminum. In all cases, after clean-up, no corrosive or decomposition of materials was found. At the present time, testing of austenitics has been proposed to DOE. Complete copies of all these reports are available from the author.

SUMMARY

The access denial system provides an added dimension to protection of special nuclear materials. The improved delay time provides margins in performance for operational security that previously could only be achieved by large and costly additions to fixed barriers. The installation of the equipment was accomplished in less than a month.

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