Name: _____ Unit VIII
Mr. Willis Electromagnetic Spectrum & Light
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VIII

Cosmic rays to fight terror

Directions: *Read the following news article and answer the questions below.*

1. What device is described in this article? _____

2. What is the purpose of this device? _____

3. Where is this device being developed? _____

4. Why would such a device be better for its stated purpose than other devices such as x-ray machines? _____

5. Define “dirty bomb.” _____

6. Currently, the device has a margin of error of _____ .

7. What is a muon? _____

8. What improvements are being made to the device to make it feasible to use in large volumes of traffic? _____

9. Describe the way the device can detect radioactive material. _____
_____

10. Where do the muons come from that are used by the machine? _____
_____

Cosmic rays to fight terror

Los Alamos lab touts nuclear arms detector

By Michael Kilian
Washington Bureau
Published February 23, 2005
WASHINGTON -- Scientists at Los Alamos National Laboratory have developed a muon cosmic ray screening device that can accurately detect smuggled nuclear weapons and materials in any vehicle or container, the nuclear lab reported Tuesday.

The device would provide, according to Los Alamos officials, an enormous advantage over X-ray scanning equipment, which can generate dangerous amounts of radiation and cannot penetrate lead containers and other shielding.

Several test models of the scanner have been built and successfully operated, and work on a full-sized prototype has begun, the laboratory said.

Summer completion expected

"We expect it will be completed this summer," said Rick Chartrand, a member of the Los Alamos project team in New Mexico.

Large enough to scan a 50-foot trailer truck or a 20-foot-long ship container, the new device would cost about $1 million each and could be used for screening vehicles at border crossings or ship cargo at major ports.

Its essential parts are two sets of parallel tubular sensors constructed so that large trucks and other vehicles could drive through or the sensors would fit over ship containers.

In its threat analysis for the year just ended, the CIA said, "The threat of terrorists using chemical, biological, radiological and nuclear materials remained high."

In their campaign debates last fall, both President Bush and Sen. John Kerry declared nuclear terrorism the greatest threat facing the United States.

Though few believe terrorist groups yet possess the sophisticated knowledge and means to construct a nuclear weapon, that possibility exists--as does the more likely prospect of terrorists deploying a "dirty bomb" that would scatter radioactivity over a large area with a conventional explosion.

Despite the worry over these threats, less than 5 percent of the cargo entering the U.S. is examined, largely because the government lacks an efficient and reliable means of doing so.

The Department of Homeland Security has been approached about the muon cosmic ray device but has made no decision on its deployment.

"We believe we've worked through all of the major obstacles to building a prototype system for a range of security scenarios," said Chris Morris, another Los Alamos scientist.

Chartrand said the new system has proven to be accurate within a 3 percent margin for error, and "we think we can continue to improve that."

At present, it takes 60 seconds for the muon system to complete its examination of a vehicle or object. The scientists expect to reduce that time to 20 seconds, Chartrand said, making it feasible for use with a large volume of motor traffic or cargo.

The muon device was developed and funded by the Los Alamos nuclear lab, which is part of the Department of Energy and one of three such facilities in the U.S. The labs invent and develop new technology and products but don't manufacture them.

Scientists had been studying the possibility of using muon cosmic rays for screening purposes but the project didn't get its full impetus until the Sept. 11 terrorist attacks. It received its principal funding in October 2003, two years after the attacks.

X-ray devices such as those used at airports require the generation and focusing of radiation beams that can penetrate luggage or metal packaging material but not highly dense lead and similar shielding.

Also, they produce only images, which must still be interpreted by an operator.

X-ray devices pose hazards

Any X-ray systems large and powerful enough for motor vehicles and ships' containers not only would have a poor success rate but would pose a significant health hazard, according to the team's report.

"If you had illegal migrants inside a container you would kill them [with X-rays]," Chartrand said.

The new Los Alamos technology uses cosmic rays called muons that already are bombarding Earth and require no generation. Consisting of charged particles, they are able to penetrate virtually all substances but are deflected to varying degrees by denser materials such as lead and uranium.

According to Chartrand, the device is essentially a data analysis system that measures exactly the amount of deflection caused by the rays bouncing off different materials and identifies them according to the degree of deflection.

Instead of interpreting images on a screen, operators need to consult only the readings.

"It can decide directly whether a bomb, nuclear materials or shielding are present," a laboratory spokesman said.

Particles in the air could help find nuclear weapons

Scientists at Los Alamos National Laboratory are testing technology that uses muons--tiny charged particles in the atmosphere--to detect potential nuclear materials in vehicles or ship containers.

MUON FORMATION

Cosmic rays heading toward Earth interact with atmospheric gases and produce electrically charged subatomic particles called muons.

Muons, which have a mass 207 times that of an electron, fall to earth, moving through most materials, but scattering when they come into contact with high-density materials.

DETECTING NUCLEAR MATERIAL

1. By placing detectors above and below a vehicle, scientists can monitor muon interaction with different materials in the vehicle's cargo.

2. The higher density a material is, the more muons will scatter when they make contact.

3. A computer uses the scatter data to create an image of the different materials in the vehicle. High-density materials, such as plutonium or uranium, are flagged.

MUON SCATTERING IMAGE EXAMPLE

These images are of a car that has undergone muon radiography. The lowest level of muon scattering appears on the car's metal parts (green), while the highest level of scattering (red) appears on two uranium samples that were placed in the car. Sources: Los Alamos National Laboratory, Stanford University