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Vehicle Access and Control Planning Document

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and
Mason & Hanger-Silas Mason Co., Inc.

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ABSTRACT

This document has been prepared as an aid in planning a vehicle access and control system at nuclear fixed site facilities. In this document, various threats have been postulated and countermeasures proposed. Although many of the threats and countermeasures may exceed those presented in Title 10, Code of Federal Regulations, (CFR), Part 73, this was done to present an in-depth study of planning options that might apply to each nuclear fixed site facility. Therefore, the reader should keep in mind the following: (1) options presented need not be considered as requirements which have to be met to comply with Title 10, Code of Federal Regulations (CFR Part 73.2) and (2) overall, the options may appear to vary between inadequate and very excessive. However, when considered as part of a particular facility's physical security system, any one option may prove to be of the most value in helping to reduce the threat to that facility.

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VEHICLE ACCESS AND CONTROL - PLANNING DOCUMENT

PART I

INTRODUCTION

A. GENERAL

The threat potential at NRC fuel cycle facilities and reactor power plants can be likened to that facing Government owned or operated facilities manufacturing, processing or storing high value materials or explosives. This threat potential also exists in commercial enterprises, i.e., banks and airports. While the same type of threat applied in other private enterprises usually involve a limited local crisis, radiological sabotage or the theft of special nuclear material may have broader consequences.

The similarities in each of the above cases are:

A product or target which has a great degree of potential for negotiation in terms of monetary return or political advantage.

A reasonable knowledge of peripheral operations incident to the locale in which a covert attempt by force or stealth is planned.

Intent and dedication of a person or persons to achieve the ultimate advantage.

A medium of advantage, such as weapons, explosives or hostages, sufficient to secure the product or target.

In any situation, it is either impractical or impossible to eliminate the product, the knowledge and the intent factors. Therefore, it becomes essential to address the medium of advantage (the threat potential). One element of threat potential is that associated with the use of vehicles.

The threat potential at NRC sites is similar in many ways to that encountered in other industries and in commerce. The threat analysis described in this document takes cognizance of the experience of Federal, municipal and private agencies in similar situations.

The potential for introducing contraband into nuclear fuel cycle facilities and reactor sites for sabotage purposes and the possibility of unauthorized removal of formula quantities of strategic special nuclear materials by vehicle is perhaps much broader than generally understood. This is not intended to convey the impression that techniques employed in the vehicle access and control process are wholly ineffective. On the contrary, research has confirmed a high degree of interest, initiative and concern on the part of licensees and personnel involved in security management and operations and material control. A great deal of initiative and energy has been expended to meet NRC requirements.

In this planning guide, the vehicle access and control process and the sites referred to include both Nuclear Reactor Sites and Fuel Cycle Sites which have Material Access Areas and/or Vital Areas as defined in Title 10, Code of Federal Regulations, Part 73, Section 73.2.

B. INTENT AND SCOPE

The intent of this material is to describe the type and nature of vehicle-related threats to reactor sites and fuel cycle facilities; to evaluate the various options for reducing or eliminating threats; and to suggest alternative methods to improve vehicle access and control. The integrated elements are indicated in Figure 1.

The guideline parameters for vehicle access and control are outlined in graphic form in Figure 2, indicating controlled access areas and the typical flow of land-type vehicles which could have access to a Licensee's Controlled Area; a Protected Area (PA) on the site; and Material Access Area (MAA) and/or Vital Areas (VA) within the Protected Area. Railroad rolling stock, fire trucks, ambulances, service vehicles, personal automobiles, vendor vehicles and similar transport modes are considered. Neither boats nor aircraft are considered here although they are acknowledged as a vehicle medium which, under an exceptional situation, might be considered as a method for access.

The research and investigative effort disclosed in this document was derived from the following sources:

- literature on activities regarding licensing and operation of Nuclear Regulatory Commission (NRC) regulated sites;
- a review of publications and material on commercial equipment and products actually used or potentially useful for vehicle-related security application;
- personal contact with individuals having knowledge and experience in security-related fields
- the security-related requirements and policies promulgated by the Nuclear Regulatory Commission.

The subject of Vehicle Access and Control required an evaluation of vehicle-related threats at NRC reactor sites and fuel cycle facilities. The evaluation was developed through visits to fuel cycle facilities; through interviews with NRC Inspection and Enforcement personnel, and from their information on the physical characteristics and operating modes of nuclear power plants. In the interest of validating certain data, test models were developed. Inspection mirrors, firearms concealed in vehicles, draft procedures, and other techniques were actually used to check theory, indicate feasibility and verify results.

C. PLANNING CONSIDERATIONS

Data collected during visits to fuel cycle sites and discussions with Inspection and Enforcement personnel of the Nuclear Regulatory Commission revealed three significant factors:

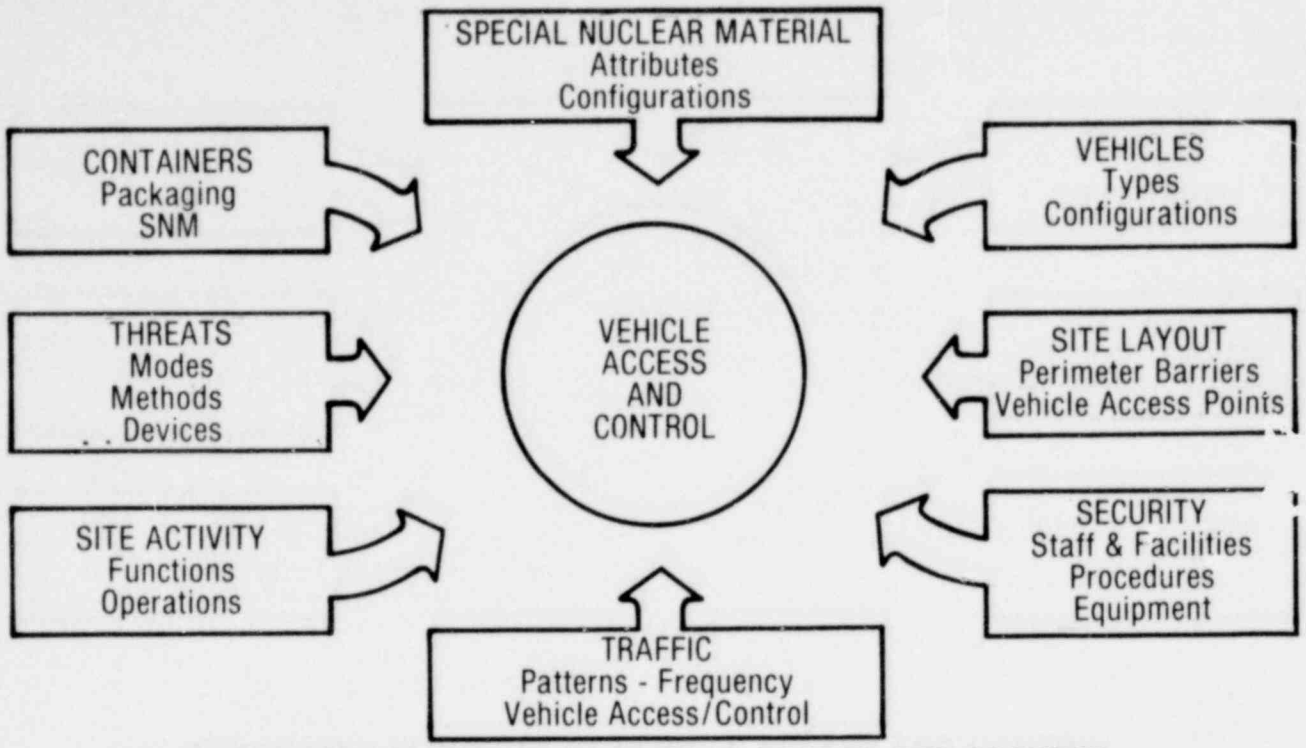
1. The selection of alternatives to meet security needs is dependent in some aspects on the choice of management personnel charged with security.

2. Security measures at individual sites are tailored to meet a variety of, but not all, threat possibilities.

3. In terms of vehicle access and control, there will continue to be a distinct possibility of introducing sabotage devices into a site as well as the possibility for theft of nuclear material. The strengthening of the overall security posture may measurably reduce the threat.

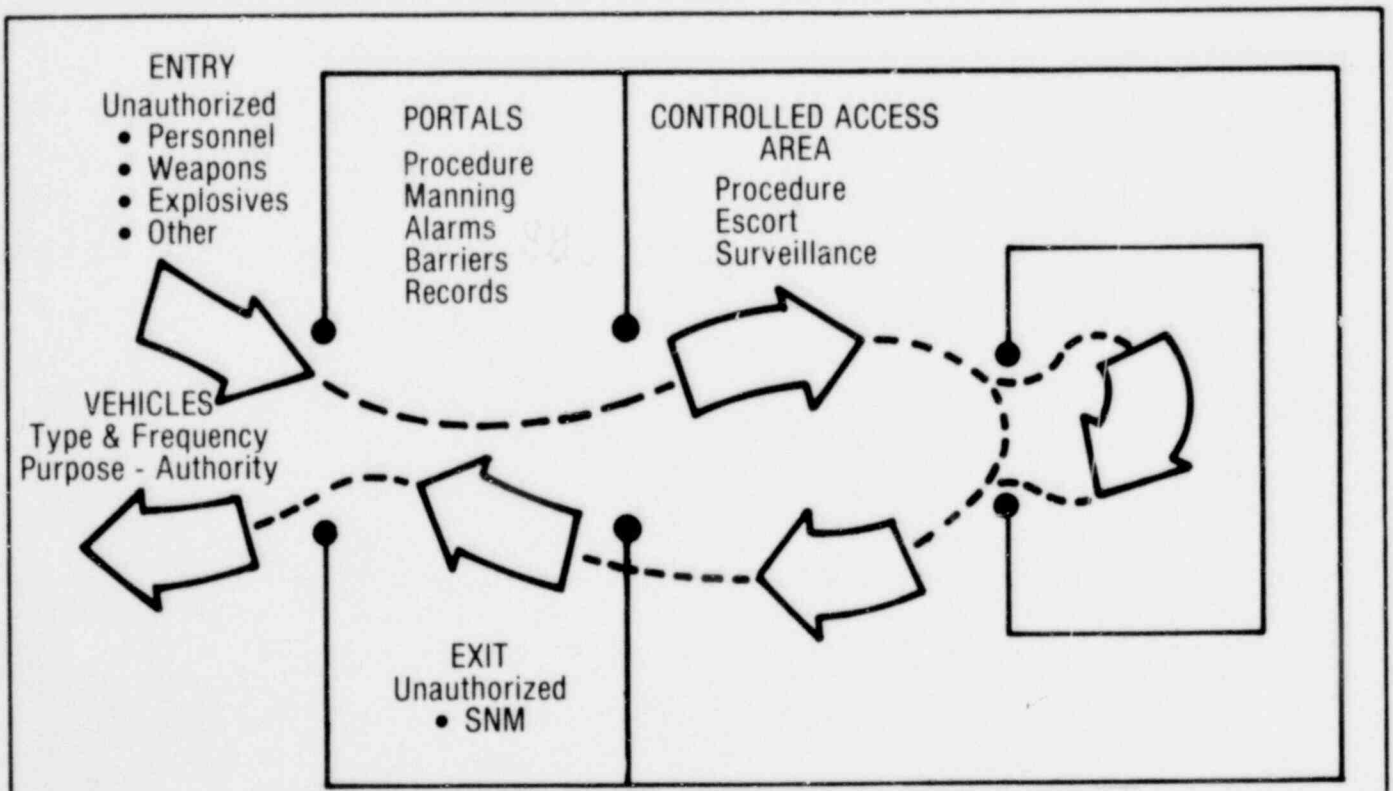
These facts should be reviewed in the process of planning new and revised procedures for vehicle access to NRC-Licensed sites.

In planning for vehicle access and control, some difficulty will be encountered where the subject naturally relates to other elements, such as the manning and capability of security personnel, the clearance and credentials of personnel, the physical configuration and design of plant facilities, and others. These related elements are neither developed nor addressed in detail since the intent here is confined to the access and control of vehicles.



INTEGRATED ELEMENTS OF VEHICLE ACCESS AND CONTROL

Figure 1



PERIMETER - PROCEDURE, BARRIERS, ALARMS, PATROLS
VEHICLE ACCESS and CONTROL PARAMETERS

Figure 2

PART II

SITE CONFIGURATIONS & CHARACTERISTICS

A. GENERAL

Vehicle access and control measures applied at fuel cycle sites and reactor sites may be a combination of plans dependent upon several factors:

1. Site location, topography and area, and configuration of buildings and type of construction

2. Mission and operations involved, and number and skills of employees

3. Volume and configuration of "products" used or processed and traffic volume through the complex

4. Management Direction and Organizational structure and labor-management contracts

5. Interpretation of requirements and results of inspections and evaluations by NRC Inspection and Enforcement personnel

As these situations may differ from site to site, similarly there can be differences in procedures and equipment applied to the vehicle access and search process due to the nature of perimeter barriers, methods applied to control personnel access, security personnel operations, shipping/receiving activities and the search techniques applied to vehicles.

B. NUCLEAR FUEL CYCLE FACILITIES

Some NRC fuel cycle facility licensee sites have formula quantities of strategic Special Nuclear Material (SNM).

Fuel cycle facilities are generally located in rural or semi-rural areas or close to an industrial park. Typically 12 to 15 miles from major metropolitan areas and several miles from small communities, sites are usually sufficient in area so as to provide several hundred yards distance between Protected Areas and public roads.

Protected Area barriers with associated access points may consist of chain link fencing with three-strand barbed wire; a masonry building wall, with or without steel roll-up or swinging doors, dual fence, manual or automatic gates; and illuminated and alarmed barriers and gate houses. Vehicle access to Protected Areas is controlled or observed by various means — by security personnel at the perimeter of the owner-controlled property line based on bumper sticker identification and visitor regulation; by visual observation of access routes from security posts; by closed-circuit television (CCTV) or by other separate methods for control such as card key at one point and guard or CCTV at a second point; and, in some cases, by fences on the perimeter of the owner-controlled area.

Illegal access to site perimeters may be gained by "off-road" approaches, cross-country access and by direct approach via public road. Accessibility may be impeded in some cases by natural barriers, adjacent buildings, and perimeter control procedures.

Employee and visitor parking may be located outside of the Protected Area. Some Protected Areas have warehousing/shipping/receiving facilities outside of the Protected Area, while in other cases these functions are located at the Protected Area perimeter. Nevertheless, some vehicle deliveries by non-employees and non-site vehicles are still required within Protected Areas.

Physical relationships between the Protected Area, Material Access Areas and Vital Areas differ among sites. Various combinations include:

1. Vital Areas within Protected Areas
2. Material Access Areas within Protected Areas
3. Vital Areas within Material Access Areas or
4. Material Access Areas within Material Access Areas.

Protected Areas may include one or more vehicle entry gates and possibly a railroad spur.

Vital Areas and Material Access Areas are accessible by over-the-road type vehicles and material handling equipment. Switch engines and accompanying rail cars have access to some Material Access Areas.

C. REACTOR SITES

NRC licensed commercial nuclear reactor sites employ boiling water reactors (BWR), or pressurized water reactors (PWR), using a U-235 fuel of low enrichment. One exception to this involves a high temperature gas cooled reactor which uses fuel derived from highly enriched uranium (HEU).

Fuel elements which are sensitive to sabotage are confined within reactor Vital Areas during normal operations but are subject to outside transport and handling at infrequent times.

Licensee owned reactor sites may vary from 100 to more than 10,000 acres although the Protected Areas are considerably smaller. Nuclear power plants are typically situated adjacent to a body of water. This situation, coupled with other topographical features of nuclear power plants (surrounding hills or forested areas) make many sites somewhat inaccessible except via established public or site access roads.

Public Access varies from winding routes, requiring slow speeds to negotiate, to straight-in, direct line of sight routes to Protected Areas.

Some reactor sites control access to the owner's property outside the Protected Area with security personnel at points of public access to the reservation. Some Protected Areas are defined by a combination of building walls and chain link fence and others by eight-foot chain link fence alone. Vehicle gates are manually or power operated, of hinged or sliding type and manned under differing conditions (manual control at the gate or remote control from a 24-hour guard post within an operations building). Some sites previously have relied on security personnel alone, however enhanced control of the Protected Areas with perimeter intrusion alarm systems of one type or another (some employ two types) is in place at other sites as required by Title 10 CFR Part 73.55.

Normal vehicle access to Protected Areas of plant sites is most typically confined to one gate. Other secured gates may, however, exist which are opened under exceptional conditions such as periodic access by railroad rolling stock over a spur track into the site. Additional control may be exercised by monitoring entrances at the boundary of the licensee's property.

Depending on the number of reactors involved and the particular configuration of the associated structures, the number of Vital Areas varies from site to site. The same variable applies to spent fuel storage which may share a Vital Area with the reactor containment areas.

Vehicle access to the Vital Areas of most reactor facilities is afforded at loading docks or platforms; drive-in loading areas or railroad spurs.

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PART III

VEHICLE RELATED THREATS

A. GENERAL

Vehicle access and control concerns both private and commercial vehicles having periodic access to sites; site-owned vehicles with frequent access; and those which typically remain within the site.

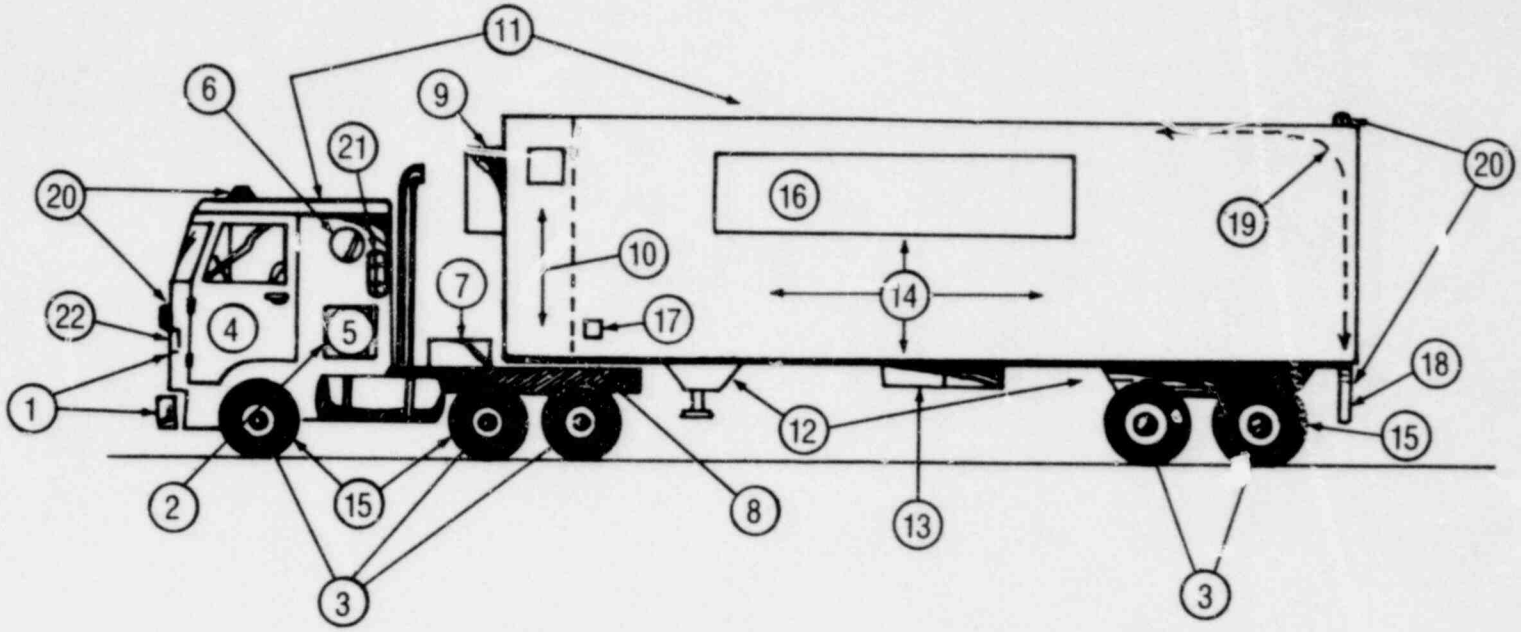
Vehicles have a history of use for concealing contraband and are capable of concealing and transporting explosives or incendiary material. Vehicles have mass, kenetic energy potential and power; have spaces to hide or disguise firearms and unauthorized personnel; and have locations which could be shielded to prevent detection of special nuclear material.

Figure 3 is an example of typical vehicle concealment areas on a tractor-trailer unit. The U.S. Customs Service lists over fifty areas of concealment potential applicable to weapons, explosives and/or special nuclear material. The quality of explosives which could be hidden varies and depends on the specific characteristics of both the vehicle and explosive. Since explosives are commonly in the form of sticks, putty, pellets (prills), liquid, powder, and other solid configurations, it is possible to conceal several hundred pounds of explosives which would not be detected by a superficial search. Explosives could be so concealed that they might not be found even with an explosives detector. Also, it is possible that explosives could be "planted" in a vehicle and remotely detonated. If not normally detectable by instrumentation, some explosives and incendiary materials can be adequately contained to defy detection or may be considered "innocent materials".

Firearms can be so hidden in or on vehicles to prevent detection by visual search or other means without destruction or disassembly of the vehicle or its components. Due to the metal content of the vehicle itself, metal detectors are of little value in certain areas of concealment.

B. DISTRIBUTION OF VEHICLE THREATS

A vehicle threat may involve a single action or a combination of several actions. For example, 2.2 lbs (1 kg) of plutonium might be stolen at one time or two 1.1 lbs (.5 kg) thefts or ten 1/4 lbs (.1 kg) thefts might occur over a period of time. Weapons or explosives might be entered in stages (several items or varying quantities). In the use of a vehicle, there is less risk to the adversary if the contraband package is small since it is less likely to be detected (either visually or with equipment). (Reference #8)



1. Bumper & Grill Area
2. Engine Area
3. Tire & Wheel Assemblies
4. Cab Area
5. Baggage Compartment
6. Cab Sleeping Area
7. Battery Boxes
8. Fifth Wheel Area
9. Trailer Refrigeration Unit
10. Ice Bunker Compartment
11. Roof-Both Tractor & Trailer
12. Under Entire Tractor-Trailer
13. Spare Part & Chain Compartments
14. Interior of Trailer
15. Wheel Axles
16. Company Sign Panels
17. Document Pouches
18. Bumper on Rear of Trailer
19. Trailer-Upward Sliding Door
20. Light Lenses & Reflectors
21. Externally Mounted Air Filter
22. External Tractor Air inlets

POTENTIAL FOR CONCEALMENT OF ARTICLES IN VEHICLES

Figure 3

C. POTENTIAL ADVERSARIES

1. Perceived Risk

Title 10, CFR Part 73.20 considers types and numbers of adversaries. This is relevant to vehicle access and control methods because insiders and/or outsiders maybe involved in a vehicle-related attempt to steal special nuclear material or cause a radiological sabotage incident.

The dedication of adversaries involves a balance of their motivation and the difficulty of the task. A relatively simple task, attaching a bomb to a vehicle off-site and remotely detonating it on-site, would not require the high level of dedication needed for a forceful entry or covert theft of special nuclear material.

2. Using a vehicle, an adversary can crash a gate and, in a short time, be in direct proximity of his target. Therefore, the time and exposure required by the adversary affects rationale for related vehicle control countermeasures (delaying devices, remote alarms, interrogation, lights).

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PART IV

EXPLOSIVES & INCENDIARIES

The explosives and incendiary devices which may be employed in a vehicle-related threat may include "innocent" material such as fuels and gases normally used at a facility, "non detector-sensitive" materials, and detector-sensitive material.

Typical facilities which can be breached by explosives for access or sabotage include fences, gates, doors, walls, pipes, containment mechanisms, pumps/related equipment and controls.

Since a vehicle can contain large quantitites of explosives or incendiaries, the proximity of vehicles to sensitive areas is critical. Explosive "quantity-distance" tables are available to indicate the relationship of explosive quantities to distance with resultant damage. Figure 4 is a quantity distance table for "Class 9" explosives. This includes most of those of concern such as bulk primer explosives, black powder, and dynamite. (Reference #15) In this table may be found the minimum distance between an inhabited building and a given quantity of explosives wherein only minimal damage would occur in the event of explosion.

Quantity, pounds		Distance in feet
Over	Not over	Inhabited Building
	10	145
10	25	145
25	50	145
50	100	210
100	200	380
200	300	320
300	400	510
400	500	720
500	600	800
600	700	880
700	800	920
800	900	980
900	1,000	1,020
1,000	1,500	1,060
1,500	2,000	1,200
2,000	3,000	1,300
3,000	4,000	1,420
4,000	5,000	1,500
5,000	6,000	1,550
6,000	7,000	1,610
7,000	8,000	1,680
8,000	9,000	1,700
9,000	10,000	1,740
10,000	15,000	1,780
15,000	20,000	1,950
20,000	25,000	2,110
25,000	30,000	2,280
30,000	35,000	2,410
35,000	40,000	2,550
40,000	45,000	2,680
45,000	50,000	2,800
50,000	55,000	2,920
55,000	60,000	3,030
60,000	65,000	3,130
65,000	70,000	3,220
70,000	75,000	3,310
76,000	80,000	3,350
80,000	85,000	3,450
85,000	90,000	3,520
90,000	95,000	3,550
95,000	100,000	3,630
100,000	125,000	3,670
125,000	130,000	3,800
150,000	175,000	3,830
175,000	200,000	4,000
200,000	225,000	4,190
225,000	250,000	4,310

QUANTITY OF CLASS 9 EXPLOSIVE AS RELATED TO DISTANCE FROM BUILDING TO RESULT IN MINOR DAMAGE ONLY

Figure 4

Pertinent extracts from researched and reference material reveal statistics and data concerning the employment of explosive and incendiary materials. (References #4, 8, 9, 10 and 12)

The information described in the referenced documents indicates the potential hazards of explosives and incendiaries and their use for bombings and sabotage. Figure 5 provides a breakdown of bombing and incendiary actions against various targets indicating vehicular incidents and public utilities ranking third and sixth respectively. (Reference #6)

A. COMMERCIAL EXPLOSIVES

Types, sources and configurations of explosives and incendiaries are almost infinite. The configurations of explosives and incendiaries range from solids, powders, plastics, pellets to liquids which permits them to be disguised, packaged and hidden in many different ways. Many of these commercial explosives are accessible to the public.

Commercial explosives may be detected by visual/physical inspection, by metal detectors (if in a metal container or if materials contain sufficient metal), by radiographic inspection, by trained animals, and by electronic high explosives detectors. Each of these methods, however, has its limitations.

B. IMPROVISED EXPLOSIVES/INCENDIARIES

Material for improvised explosives and incendiaries is available in many forms. Most improvised explosive materials would be in a powdered configuration and therefore could be concealed in containers such as thermos bottles, spare tires, oxygen bottles, soft drink bottles, lunch boxes, or disguised as detergents, cleaning powders, garden supplies, or food stuffs.

Improvised explosives may be detected by visual or physical inspection, metal detector (if in a metal container), electronic explosive detector, radiographic scan, or with a trained animal. Although each of these methods of detection has some advantage, each also has its limitations especially when dealing with improvisation and vehicles.

C. MILITARY EXPLOSIVES AND MUNITIONS

Military explosives include blasting and demolition charges, grenades, bombs, artillery projectiles and mines. The configuration of some explosives may be modified for concealment or disguise (particularly the plastic explosives). Detection methods employed may include visual/physical, radiographic, trained animal, electronic high explosive detectors and metal detectors (if in a metal container).

RESIDENCES	560
COMMERCIAL	458
VEHICLES	257
SCHOOLS	187
PUBLIC SAFETY	72
PUBLIC UTILITIES	63
PERSONS	44
RECREATION FACILITIES	38
GOVERNMENT PROPERTY	36
CONSTRUCTION	30
COMMUNICATIONS	23
MILITARY FACILITIES	19
CHURCHES	15
POST OFFICE & COURT HOUSE	22
INTERNATIONAL ESTABLISHMENTS	10
OTHER	173
TOTAL:	2,007

U.S. BOMBING INCIDENTS KNOWN TO THE POLICE DURING ONE YEAR
(Derived From: Sourcebook of Criminal Justice Statistics - 1976)

Figure 5

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PART V

WEAPONS AND WEAPON POTENTIAL DEVICES

A. FIREARMS

The vehicle access and control process may reveal pistols, revolvers, rifles, carbines, shotguns, semi-auto and automatic firearms associated with a vehicle-related threat, as well as firearm "oddities" in the configuration of canes, umbrellas, pens, etc. Metal detectors cannot be relied on to discover such items in a vehicle environment and, therefore, should only be used in conjunction with visual and hand search, X-ray and other search techniques.

B. MISCELLANEOUS WEAPON DEVICES, TOOLS AND EQUIPMENT

Many lethal and non-lethal items are "weapons of opportunity". These may include a piece of pipe, board, wrench, chemicals, short sticks or other common and apparantly "innocent" items. Devices in this category include clubs, knives, electric cattle prods, brass knuckles and aerosol or cartridge "tear gas" devices.

Tools may be required for maintenance or operating functions or deliberately acquired for adversary purposes. Some require transport by vehicle because of their size, weight, and power requirements. Power tools for forced entry can receive their power source from the gasoline powered vehicle engines or converters (12v DC to 120v AC) attached to vehicle batteries and alternators.

Weapon potential devices should be subject to specific authorization when they are to be transported on-site or carried in a vehicle. Many of these devices and their effectiveness relative to barrier penetrations are described in References 12, 16 and 17.

C. THEFT OF SPECIAL NUCLEAR MATERIALS

The purity or usefulness of special nuclear material determines the theft priority of that material. For sabotage, the desirability would be related to the extent of damage and hazard expected to be achieved. As a political advantage, the desire may be only to create a minor disorder or threat to public health and safety rather than causing a catastrophe.

1. Configuration of Nuclear Material

   For the purpose of vehicle access and control problems, the specific nature of nuclear materials at fuel cycle sites and reactor plants in relationship to their transport modes should be considered. Nuclear materials may be found in any of the following forms:

Particles (micron size)	Alloyed components
Powder	Fuel "rods"
Metal disks or "buttons"	Fuel "assemblies"
Cylindrical "pellets"	Scrap and waste

The Licensee must consider the configuration of on-site nuclear materials in formulating plans for the access and control of vehicles.

2. Containers for Special Nuclear Material

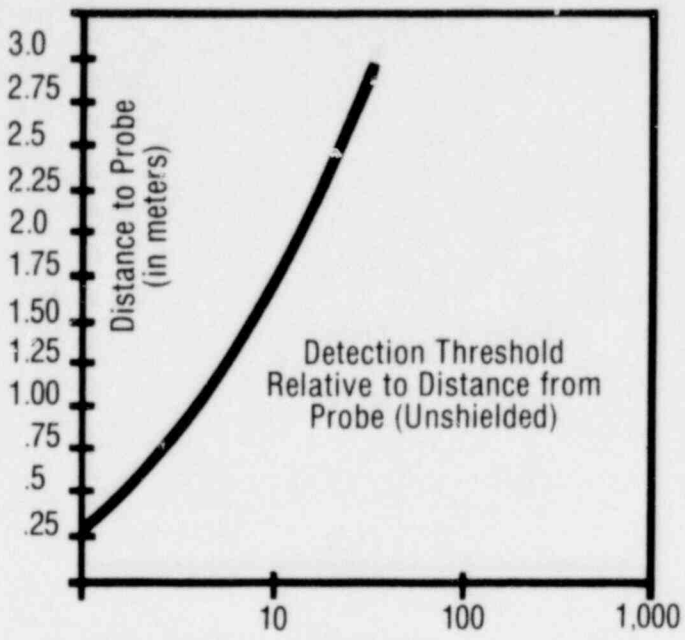
When considering vehicle access and control procedures, the nature of special nuclear material containers has a distinct bearing on the methods selected. Some special nuclear material containers are hand portable. Others are designed specifically for handling irradiated fuels, to seal and secure unirradiated materials for in-house storage, processing or for shipping and require cranes, hoists and similar equipment due to the size of the containers.

3. Special Nuclear Material Shielding

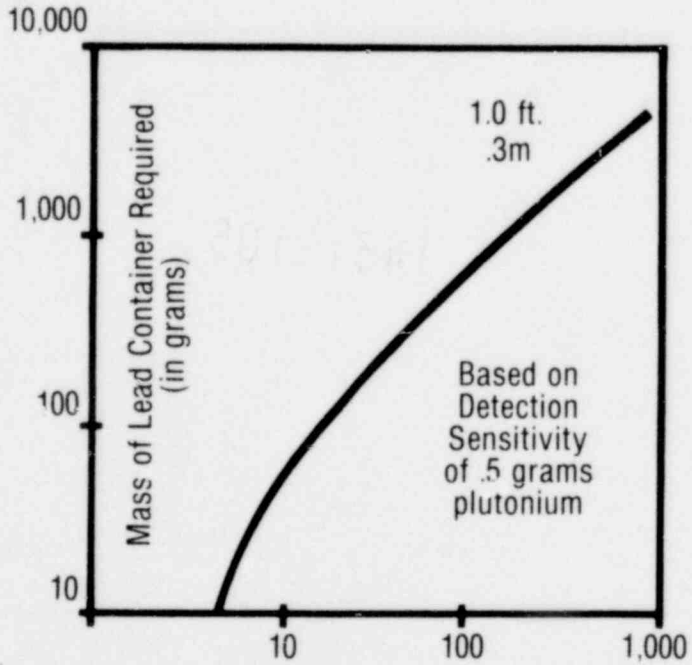
The "rated" sensitivity of special nuclear material detectors occurs when the detector is within approximately 8 inches (.2 meters) of the source. If a hand-held detector is moved too rapidly, or held at a distance in excess of .2 meters, the sensivitity is degraded (Reference #18). These factors are critical to the effectiveness of special nuclear material searches with hand-held detectors. (Figure 6) As a result of shielding special nuclear material, the effect on detection is also illustrated.

If the special nuclear material and shielding is in a non-metallic environment, such as on a person, the metal could be detected by a metal detector or by X-ray. However, a knowledgeable person inside the security confines of an installation, dedicated to diverting nuclear material, could package special nuclear material such that it would not be discovered by electronic detection devices.

In a covert mode, it is assumed that theft of special nuclear material is most likely to be accomplished by knowledgeable persons, therefore shielding of the material is a likely possibility. If a vehicle compartment was secretly modified to provide a shielding medium, there is little likelihood that concealed special nuclear material would be discovered without disassembly of vehicle components.



Mass of Plutonium Removed (in grams)
Special nuclear material detection sensitivity to distance from probe



Mass of Plutonium Removed (in grams)
Shielding required to preclude special nuclear material detection with a typical hand-held passive gamma monitor

SPECIAL NUCLEAR MATERIAL
DETECTION DISTANCE COMBINED WITH SHIELDING EFFECT
Figure 6

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PART VI

VEHICLES AS THREAT POTENTIALS

A. VEHICLE ACTIVITY

1. Concealment Potential

Private and commercial vehicles which have periodic access to sites; those which are site-owned with frequent access; and those which remain "captive" within the site except for periodic maintenance outside the facility, are capable of concealed transport of explosives or incendiary material, have places to hide or disguise firearms, hide unauthorized personnel and shield or conceal special nuclear material. Figure 7 indicates the potential for concealment in a tractor-trailer unit, as an example.

No.	Suspect Area	Portability		Concealment Potential				
	Area or Component	Removable	Fixed	Parcels	Firearms	Personnel	SNM	High Explosives lbs.
1	Air cleaner (false)	x		x			x	30
2	Bumpers		x	x	x		x	20
3	Tractor body panels		x	x	x		x	20
4	Trailer body panels		x	x	x		x	100's
5	Battery	x		x	x		x	50
6	Air tank		x	(explosives)			x	100
7	Fender wells		x	x	x		x	40
8	Engine compartment		x	x	x		x	100
9	Door panels		x	x	x		x	20
10	Glove box		x	x	x		x	20
11	Headliner		x	x	x		x	20
12	Under dash		x	x	x		x	50
13	Fuel tanks		x				x	700
14	Under seats		x	x	x		x	100
15	Seats (upholstery)		x	x	x		x	20
16	Sun Visors	x		x	x		x	6
17	Spare tire	x	(explosives)				x	100+
18	Trailer frame		x	x	x		x	100
19	Tractor frame		x	x	x		x	50
20	Cargo & area	x	x	x	x	x	x	(tons)

POTENTIAL FOR CONTRABAND CONCEALMENT IN VEHICLES
Figure 7

B. VEHICLE USE

Typical vehicle-related activities within Protected, Material Access, and Vital Areas are:

Shipping and receiving - (nuclear material, non-nuclear supplies and equipment)
Construction
Refuse removal and disposal (nuclear/non-nuclear)
Vending and cafeteria supply and service
Bulk deliveries (gas cylinders, etc.)
Security patrols
Personnel conveyance (official business)
Material handling
Emergency response (fire, ambulance, etc.)
Road, yards and grounds maintenance
Communications services (by vendors)
Equipment services

Some of these functions are performed by commercial vendors and suppliers, contractors, and trucking firms in addition to employees of the Licensee.

To accomplish the routine and special functions peculiar to the various sites, a variety of vehicles may have access to the Licensee Controlled Area, Protected Areas, Material Access Areas and Vital Areas. These consist of sedans, station wagons, 4-wheel drive vehicles, many configurations of trucks (from pickups to 18 wheel tractor/trailer units), forklifts, material handling equipment, heavy construction equipment, railroad rolling stock, special purpose vehicles such as fuel cask trailers, SST's (safe-secure trailer), high pressure (liquid) gas trucks, fuel oil tank trucks, refuse trucks, and emergency vehicles.

Vehicles required within Protected Areas, (i.e., forklifts, security vehicles, flatbed trucks, pickups, ambulance, cranes and tractors) for maintenance, warehousing and service functions, ideally should not be parked within the Protected Areas during non-operating hours if such can be avoided.

PART VII

VEHICLE THREAT AREAS

A. GENERAL VEHICLE THREATS

Vehicle threats at fuel cycle facilities and reactor sites may be expected at two primary areas, the Protected Area boundary and inside the site. Vehicle threats may also exist outside the facility but are not addressed in this document.

1. Protected Area Perimeter

   A vehicle may be used as the device to breach the Protected Area by crashing through the fence, transporting a hostage, or by covertly attempting an unauthorized introduction of substitute/fake special nuclear material containers, substitute/fake special nuclear material, explosives, incendiaries, non-authorized persons, conventional and non-conventional weapons (tools) and vehicles.

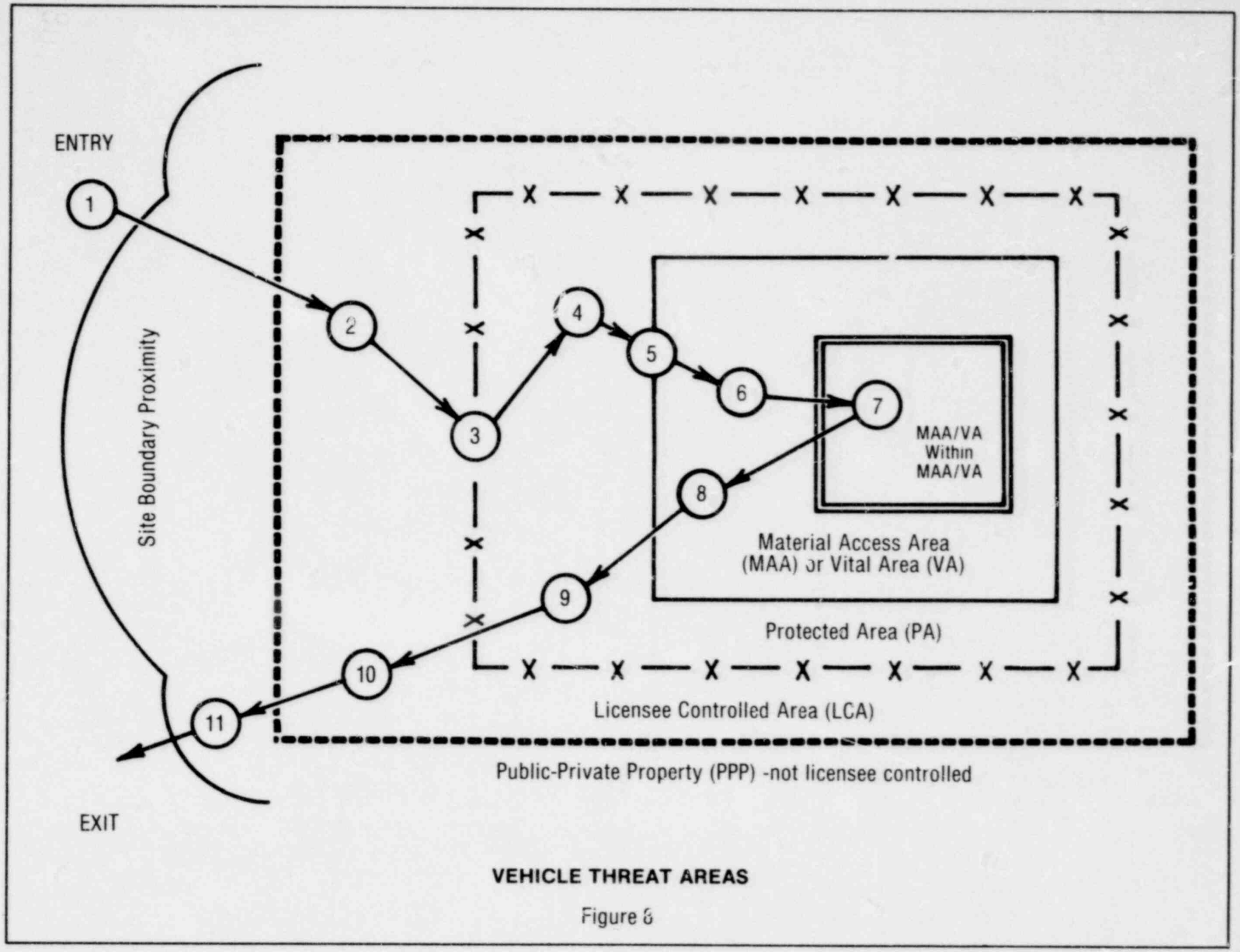
2. Internal

   Within the Protected Area the threat can occur through concealment of unauthorized items, (i.e., special nuclear material, explosives and incendiaries, unauthorized persons, substitute containers, substitute special nuclear material, conventional weapons, or non-conventional weapons, tools, etc.).

B. DESCRIPTION OF VEHICLE THREATS

Specific vehicle-related threats can occur in the areas identified as the Private-Public Property Area, Licensee Controlled Area, Protected Area, Material Access Area, and Vital Area. For planning purposes, vehicle threats which may exist are described here. In Figure 8 each circle and number identifies a typical location of the threat as a vehicle would progress from initial entry to exit from the site. Eleven locations in these areas require attention from the point of vehicle access and control.

Beginning outside the Licensee Controlled Area, eleven general vehicle threats are indicated. Five of these (#3 through #7) relate to entry of vehicles into the Protected Area and five relate to exit of vehicles (removal of material) -- #7 through #11. The specific nature of each vehicle threat and the rationale for considering appropriate measures are described in the following paragraphs



VEHICLE THREAT AREAS

Figure 8

1. Private and Public Property

Vehicle Threat #1

A vehicle threat may occur here because a licensee does not have complete control over vehicles in this area. Such vehicles may have been "rigged"; tampered with; have weapons, explosives, personnel concealed by built-in features or modifications; or off-site preparations may be made for concealment of special nuclear material subsequent to entry to the site.

Typical vehicles which have access to the sites are licensee-marked vehicles, government vehicles, service and delivery vehicles which might only be identifiable by their markings such as "UPS", "Vending Service", "common carrier", "telephone truck", etc. Some vehicles could even be private automobiles designated for site access.

Any vehicle which appears in this area without positive control is potentially a suspect vehicle. If the distance between the Private/Public Property and the Protected Area is short, vehicles with explosives or incendiaries could do significant damage to structures inside the Protected Area.

2. Licensee Controlled Area

Vehicle Threat #2

The perimeter of the Licensee Controlled Area is the first "line" which is subject to control. If this control consists only of a barbed wire or stick fence, or no fence at all, and if the perimeter is not lighted, alarmed or patrolled, the Licensee Controlled Area is readily accessible to an adversary vehicle. The ease with which the Protected Area perimeter may be approached is increased.

Vehicles in the Licensee Controlled Area which are not under surveillance are subject to being tampered with. Therefore, any such vehicle in this area is potentially a suspect vehicle.

In the Licensee Controlled Area a vehicle has potential access to the Protected Area and access should not be permitted unless the vehicle has official business status (registration, bumper sticker, recognition by security personnel, card key, or other official recognition).

Facilities in the Licensee Controlled Area could conceivably include visitor center, utilities, warehouses or other non-secured facilities which may be subject to sabotage using a vehicle in a diversionary mode.

Parking spaces in the Licensee Controlled Area are frequently designated for a particular employee, a mail vehicle, the site manager, security vehicles, and others. Such designations may identify specific vehicles which have access to the Protected Area or a particular person who could become a candidate for hostage.

Other than signs and topographical barriers, roads may provide the only means by which to control vehicle entry. If roadways are not fenced and do not have roadside barriers, there is no physical deterrent to off-road clandestine activities under the guise of repairs or breakdowns.

The vehicle threat here occurs because the licensee may not, in reality, have control of vehicles in the area thereby increasing the possibility that the vehicle has subsequent access to the Protected Area.

3. Protected Area

Vehicle Threat #3

Vehicles which have access to the Licensee Protected Area pose a threat in that they may be used to force entry through the Protected Area (wall, fence, door or gate). A vehicle in the Protected Area might also be intended for subsequent use in removing contraband or for get-away purposes.

NRC criteria requires that the perimeter of the Protected Area be alarmed against intrusion. Generally, an intrusion detection system capable of detecting personnel would be expected to detect vehicle penetration; however, there are some exceptions. For example, a vehicle (or an attached boom or bucket on a vehicle) can be used as a platform to place a person over the fence. If the fence has a vibration type alarm or a gate with switches/pull aparts, etc., such an intrusion may not be detected. Then, too, a speeding vehicle can penetrate the Protected Area Perimeter and, due to time and distance, may reach Material Access and Vital Areas before Security Personnel can respond to the threat.

Vehicle access and control shall be established at the entrance to the Protected Area. A search for explosives, incendiaries, unauthorized personnel and weapons is required. However, due to the nature of these items, it is impossible to assure a statistically high confidence factor for discovery of all of these. Any vehicle which has been outside of the Protected Area without positive surveillance and control should be completely suspect prior to entering the Protected Area and still potentially suspect after searching and access to the Protected Area is authorized. By legal determination, search is authorized and required; however, interpretation of what constitutes a suitable search and the techniques of search vary. Delivery vehicles which have permissible access but contain cargo or parcels not belonging to the licensee also constitute a security threat which is independent of the knowledge of the driver or passengers.

Proper access authorization for the vehicle is imperative at this point. However, authorization for the vehicle to enter the Protected Area is not wholly sufficient in terms of a guarantee against sabotage or removal of special nuclear material. Even though access is limited to designated vehicles or permitted in individual situations based on policy dictates, collusion remains as a prime concern since an employee or an employee with an outsider can control illegal deliveries into the Protected Area.

Vehicles entering the Protected Area ideally should be escorted. Even though the escort is armed and directed to ride, follow, or lead the authorized vehicle, a single escort without other controls is still less than desirable. Potential adversaries could be the non-employee driver of the vehicle and the employee escort.

Security personnel who conduct a search at the entrance to the Protected Area, without the support of a backup observing from a secured position, are subject to being overpowered by vehicle occupants. During periodic gate openings there would be particular vulnerability at locations where gates are not manned full time and the gate is opened by one member of the security force.

Vehicle Threat #4

According to NRC criteria, an employee escort and non-employee driver constitute an adversary threat combination. If vehicles in the Protected Area are not kept locked and secured, it is possible to remove items which may have been undetected by search; "rig" the vehicle for future material removal; utilize the fuel as an incendiary; or use the vehicle to crash the perimeter of Material Access Areas or Vital Areas. Even though vehicles in the Protected Areas are escorted, if the escort is not equipped with duress and/or communications equipment, he/she is subject to being overpowered and prevented from immediately reporting the situation.

Where roads within the Protected Area are not controlled by surveillance, by escort, or fenced or lined with barriers to prevent off-road activities, weapons or explosives which may have been placed in or on the vehicle outside the Protected Area would pose a potential threat due to the proximity of Material Access and Vital Areas.

Vehicle proximity to the perimeter of Material Access Areas involves potential direct access to the doors, gates, fences or walls of Material Access Area/Vital Areas. At this point, explosives, tools, or penetration by moving vehicles can readily and quickly provide access with a sabotage or theft possibility.

A "stand-off" barrier at a demarkation point some distance from the Material Access Area would minimize the access or penetration possibility, particularly where the distance inside the Protected Area into Material Access and Vital Areas may be very short.

4. Material Access Area/Vital Areas

Vehicle Threat #5

Entry into Material Access & Vital Areas poses the same threat as encountered at the Protected Area except that some access control and processing may have previously been accomplished.

Fewer vehicles have access to Material Access & Vital Areas than have access to the Protected Area. However, with the possible exception of vaults and some Vital Areas, the doors, gates, fences and walls to Material Access Areas & Vital Areas are not always vehicle-resistant. Vehicles remain a threat if they are allowed close to a loading/unloading door even though not permitted to go through the doorway. If the door or gate is open, no other physical barrier may exist to prohibit vehicle access. Exceptions would include loading docks or doors too small for vehicles.

Vehicle Threat #6

Vehicles which have access to Material Access Areas and Vital Areas are potentially capable of harboring weapons or explosives which may not have been previously detected. Vehicles inside the Material Access Area may be in immediate proximity to Vital Areas.

Vehicle Threat #7

In Material Access and Vital Areas, most of the concentrated form of vault-type materials is hand-portable although major assemblies of fuel would require material handling equipment. The threat potential in these areas is primarily related to actions of an employee, who may or may not be successful in a theft effort dependent upon the success of security measures previously applied.

5. Exit From Controlled Access Areas

Vehicle Threat # 8

The chance of a vehicle leaving the Material Access Area without surveillance should be limited. Upon leaving the area, these vehicles should be searched with special nuclear material detectors for either security or health physics purposes. The check may also disclose that vehicles or trailers temporarily admitted to the area have been modified with shielding and concealment features devised for removing special nuclear material.

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Vehicle Threat #9

Vehicles in the Protected Area may be used to conceal stolen special nuclear material or the material may already have been concealed on vehicles in expectation of moving it from the Material Access Area or Vital Area into the Protected Area. Again, vehicles in the Protected Area can be used to crash out of the Protected Area or for a platform for going over the perimeter barrier.

If given access to the Protected Area perimeter, an attempt may be made to leave the Protected Area. Past this point, there is little likelihood that special nuclear material could be recovered.

Vehicle Threat #10

Vehicles with concealed special nuclear material which reach the Licensee Controlled Area from the Protected Area will not likely be detected. Vehicles in this area could make pick ups of special nuclear material thrown over the Protected Area barriers.

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PART VIII

ASSESSMENT OF VEHICLE THREATS

A. EVAULATIONS & CONCLUSIONS

Conclusions which may be drawn from analyzing the potential vehicle-related threats are:

1. Special nuclear material threats

   a. A covert special nuclear material theft could involve a multitude of mixed factors and the probability and location of an attempt cannot precisely be predicted. Periodic inventory of special nuclear material would perhaps detect a loss after multiple or successive thefts, but a knowledgeable and dedicated individual employee could systematically defeat the system.

   b. Vehicle access and search procedures should be designed to detect the smallest quantity of contraband feasible although security, operational, & equipment limitations may inhibit or restrict this.

   c. Detection of the presence of contraband solely at vehicle entry points is unreliable since there are limits to detection sensitivity.

2. Sabotage Threats

   a. Approximately 90 percent of criminal incidents may include less than four people and about 40 percent of criminal incidents include two people. Some 80 percent of criminal cases related to shipping and vehicles involve employees (Reference #5). For these reasons, it can be concluded that a viable threat exists when one employee (including an escort) is singularly responsible for any vehicle activity. The effectiveness of a single escort (with the possibility of the insider-outsider combination) is less desirable than a "buddy" or "double insider" coverage. Two escorts are better than one.

3. Adversary Attempts

   a. Adversaries attempting a forced entry on a nuclear facility will certainly be aware of the potential risks. It is desirable to have a substantial vehicle security "appearance".

   b. It is desirable to design vehicle access and control systems to minimize the potential of remotely-activated sabotage events

   c. Vehicle security measures should not be scheduled. An element of randomness which cannot be predicted should be required in the security program.

d. Search procedures for weapons should emphasize firearms located in places readily accessible to vehicle occupants (under seat, behind visor, under dash, wheel wells, etc.).

e. Special attention should be given to those personnel who have access to, or responsibility for, vehicles including:

Vehicle operators
Material custodians
Security personnel
Escorts
Repair personnel (vehicle, security equipment)
Delivery persons and stock pickers, packers
Outside vendors and services
Other insiders (overt action)
Other outsiders (overt action)
Outsiders (covert action)

4. Explosives/Incendiaries

a. To gain access to special nuclear material or cause a radiological sabotage incident, quantities of explosives can be concealed in a vehicle or parcel in such a way that the explosive is not visually discernible.

b. Certain explosives (but not all) can be detected using electronic detectors, trained animals or other means.

c. Because of the possibility of remotely detonating explosives, the proximity of vehicles to Material Access Areas and Vital Areas requires specific attention and control.

d. On-site incendiary materials, including vehicle fuel, require management control and cognizance.

5. Firearms/Miscellaneous Weapon Devices

a. Firearms hidden in or on vehicles might not, with assurance, be detected by visual search or other means short of disassembly of the vehicle or its components. Due to the metal content of the vehicle itself, metal detectors are not effective. Disassembly or modification of firearms with dedicated introduction piece by piece (barrels, receivers, ammunition, etc. for subsequent re-assembly and use) increases the difficulty of detection.

b. Adversaries can make good use of vehicle-transported tools for forceful entry. Such tools require security control because they are effective for circumventing common security devices such as locks, chains, wire fences, and window bars.

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c. Vehicle searches preferentially should include a back-up security person posted in a secure position to overcome a duress action by vehicle occupants using concealed weapons.

6. Nuclear Materials

   a. Nuclear material in the quantities available at nuclear fuel cycle facilities can readily be concealed in an infinite variety of containers or other devices.

   b. Knowledgeable employees can conceal "losses" of material for some period by substituting containers, falsifying documents, and interrupting or manipulating computer systems. This possibility depends upon the degree of sophistication employed by management for nuclear material control.

   c. In many cases typical special nuclear material containers are small enough to conceal several kilograms of material in or on vehicles without transfer from the original containers.

   d. From the point of high visibility, many containers for special nuclear material are not distinctive in design or readily recognizable.

   e. Substitute containers can be produced from readily available material since almost all of the existing containers are fabricated from off-the-shelf hardware, materials or receptacles.

7. Special Nuclear Material Shielding

   a. Available material such as lead sheeting can provide adequate shielding to deny detection of special nuclear material. Unclassified information on shielding methods and their effectiveness is readily available to the general public.

   b. There is no feasible way to electronically detect shielding of concealed special nuclear material in a vehicle.

8. Vehicle Activity

   a. Currently, there exists sufficient vehicle traffic in and out of [illegible] to facilitate covert adversary actions. Many vehicles have access into sites on a regular or scheduled basis.

   b. On-site authorized and captive vehicles and other vehicles used for operational support purposes are often not under positive control.

   c. By common practice and necessity, vehicles at NRC Licensee Sites are permitted in close proximity to Material Access/Vital Areas.

   d. Vehicles can readily penetrate existing fences and gates and certain doors and walls.

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e. Due to the speed and mass of vehicles, they can penetrate and gain access to Material Access Areas or Vital Areas in a very short time.

f. The practice of distinctly identifying vehicles having access to Protected Areas or marking parking places which identifies an employee with a specific vehicle should be avoided to preclude vehicle access in a hostage situation or the use of such knowledge for coercion and unauthorized entry.

PART IX

THREAT COUNTERMEASURES AND OPTIONS

A. PLANNING VEHICLE ACCESS AND CONTROL SYSTEMS

In planning vehicle access and control systems, various categories and options are available. These range from the simple and obvious to those which are more costly and represent a very conservative approach. A number of these are presented here to help planners consider particular options or to identify concepts which may be adapted.

The actions which may be undertaken are generally categorized in terms of "Deterrence", "Search", "Surveillance" and "Control". Various options within each category are identified by an option number and described under the heading of "Countermeasure Options".

Vehicle threat countermeasures, with their definition and category identifiers are:

Category	Action	Intended Result
A	Deterrence	Applications of physical barriers and other impediments designed to initially discourage stop, interrupt, or prevent a safeguard incident to prevent or degrade ultimate success.
B	Search	Subjecting vehicles, persons or items to a "hands on" inspection and visual examination.
C	Surveillance	Watching, escorting, and observing.
D	Control	The supervision and managment necessary to monitor and control an activity by authoritative action; including the limiting of vehicle use by mechanical or other means in order to deny unauthorized or uncontrolled activity; applying positive means to locate, confine or monitor vehicle movement including the use of documentation to authorize and record movement of vehicles; and applying specific measures to locate, confine or monitor vehicle occupants.

It should be noted that there is no intent to perform a detailed analysis regarding ultimate vulnerability of specific options.

B. DETERRENCE (CATEGORY "A" COUNTERMEASURE OPTIONS)

1. Perimeter Barriers

Roadway impediments to unrestricted movement of vehicles to prevent or reduce the probability of using a vehicle to breach a security perimeter.

a. Ditching (Option A-1a): Ditches of various configurations can be utilized as barriers although there may be associated environmental problems and a ditch and/or berm provides a potential fortification for adversaries. Ditches are effective against most vehicles, including motorcycles, if at least one wall is sufficiently steep. The cost of ditching is highly variable depending on local geology. Reference #16, 28 and 51.

b. Concrete Highway Divider (Option A-1b): Installed parallel to a security perimeter, concrete dividers offer substantial resistance to vehicle access. Removal would likely require the use of explosives and cutting tools. Tests have been conducted on this device using vehicles as large as buses (Reference #21).

c. Concrete Blocks (Option A-1c): Concrete blocks, rubble or boulders provide a good barrier to vehicle intrusion. Spacing between barrier material is important with 5 feet (1.5 meters) minimum spacing center to center considered optimum (References #16 and 28).

d. Impalements (Option A-1d): Impalements consisting of steel pipe, rails, I-Beams, telephone poles and materials with similar structural characteristics provide resistance to vehicle access although they are removable by torches, explosives or chain saws.

e. Steel Guard Rails (Option A-1e): This barrier is identical to that utilized for some highway systems. Although not tested for head-on impact, if the rails were welded together and then to a heavy duty post, this system could provide substantial resistance to light vehicles. Removal with explosives or cutting torches is possible (Reference #49).

f. Heavy Equipment Tires (Option A-1f): Considerable resistance to vehicle penetration has been demonstrated by partially (halfway) burying 7 to 8 foot diameter heavy equipment tires in a vertical position (Reference #16).

g. Stone Filled Fence (Option A-1g): A specially designed fence, fabricated and tested, includes using stones and telephone poles. It has been determined to be effective against light vehicles (Reference #16).

h. Chain Link Fence (Option A-1h): These fences afford a visual deterrent but offer little resistance even to light vehicles from a forced entry standpoint. They can be cut in a very short time.

i. Cable Aided Chain Link (Option A-1i): Tests indicate that a single 3/4 inch aircraft-type cable attached to a chain link fence can withstand the force of a light vehicle (4,000 lb/1,800 kg) moving at approximately 50 MPH (80 kph). However, the cable and fence are susceptible to relatively easy removal with hand tools (Reference #16).

j. Cable Guard (Option A-1j): The design of this barrier is similar to that shown in Figure 10. Although not tested for head-on penetration characteristics, vehicles are resisted upon approach from 25° angle. Cable systems may be removed with hand tools, torches or explosives (References #28, 49, 50).

2. Portal Barriers

Options for eliminating or reducing the possibility of using a vehicle to force entry through a gate or portal.

a. Center of Road Block (Option A-2a): A hydraulically operated, remotely-activated concrete block positioned in a gateway or portal and activated from inside the Protected Area would prevent vehicles from driving through. The gate would have to be narrow enough to prevent bypassing the block (Reference #28).

b. Access Road Modifications (Option A-2b): Access roads modified to provide a sharp curve (90°) near the vehicle access gate requiring vehicles to slow down at the approach. This would reduce the vehicle's speed and energy and improve the observation time available to security personnel at the gate.

c. Vehicle Blocked Passageway (Option A-2c): Parking a vehicle across a passageway, in a roadway, or in front of a gate or door and keeping it locked with keys removed can provide an effective barrier.

d. Dock Plate Barrier (Option A-2d): This concept is essentially a "draw bridge" approach using commercially available equipment (Reference #28).

e. Net (Option A-2e): A nylon net might be utilized to entrap vehicles (Reference #25). Nets of this type can usually withstand forces in the range of 100,000 pounds, however, they are susceptible to cutting or removal.

f. Double Gate (Option A-2f): The double gate concept provides a closed environment for vehicle access and control. This can also afford some protection for security personnel conducting a search by excluding other personnel and vehicles from the area prior to any search efforts.

g. Steel Gate with Penetrators (Option A-2g): This gate configuration would damage and entangle any vehicle attempting a forced entry and would provide a formidable appearance. The design should be substantial enough to insure against the inertia of light or heavy vehicles (Reference #28).

h. Steel Pipe Gate (Option A-2h): A very substantial gate fabricated from steel pipe or an I-Beam could provide an effective barrier against light vehicles. This device is untested, but it is probable that a good design would stop a light vehicle (Reference #28).

i. Chain Link Gates (Option A-2i): Most chain link-type gates with or without power operators are secured with relatively light hardware such as a chain and padlock. Typical yield strength of this type of gate and hardware is only a few thousand pounds (Reference #16). Therefore, gates of this type are essentially ineffective against vehicles other than motorcycles.

j. Flag Gate (Option A-2j): A flag-type gate may be useful in initially stopping vehicles for interrogation or access by a card key device; however it offers no resistance to vehicle inertia.

k. Rail Car Derail/Stops (Option A-2k): Derail devices provide reasonably efficient protection against unauthorized entry or exit by railroad rolling stock. These devices are made in portable and fixed designs and may be alarmed. Rail car stops are effective for rail cars moving at low velocities but have yield-strength limitations.

3. Walls and Doors

Alternatives for protection against vehicle intrusion. Many commercial products are similar except for minor features which have a significant security impact. The alternatives are particularly significant around buildings housing Material Access Areas or Vital Areas.

a. Special Steel Doors (Option A-3a): Special-design steel doors, such as vault doors and specialty doors fabricated for prisons, are of sufficient strength for resisting most vehicles (Reference #28).

b. Reinforced Concrete Wall (Option A-3b): Reinforced concrete walls offer significant resistance to vehicles. An eight-inch thickness should resist penetration of heavy vehicles.

c. Concrete Block Wall (Option A-3c): Depending on the extent of steel reinforcing, concrete block construction offers moderate resistance to penetration by light vehicles as compared to reinforced concrete. Without steel reinforcing, a vehicle could successfully be used to open a hole for subsequent access.

d. Brick/Concrete Block Wall (Option A-3d): Dependent upon the steel reinforcement involved, brick/concrete walls offer fair protection against vehicle penetration, but less than that offered by reinforced concrete or masonry block.

e. Metal Building Wall (Option A-3e): Depending on design (placement of columns, etc.) the pre-engineered metal-skin type buildings offer only marginal resistance to vehicles.

f. Steel Doors (Option A-3f): Standard industrial steel doors are not designed to withstand forces which can be imparted by vehicles. These doors are normally hung on the inside and the hardware (hinges and locks) generally are only sufficient to withstand design wind loads.

g. Concrete/Steel Door Protector (Option A-3g): This is essentially a steel and concrete "beam" designed to be slotted between an existing building door and two steel/concrete-filled posts. It would prohibit vehicle access through an otherwise unprotected door but would require a forklift to remove it for access (Reference #28).

h. Closed Gate/Door (Option A-3h): When vehicle doors or gates are not immediately being used for entry or exit, it is essential to keep them closed and locked regardless of their design. Probably the simplest barrier, they are contravened by failure to secure them properly.

4. "Spiking" Nuclear Material

A method for quickly and correctly indicating the presence of special nuclear material to reduce or eliminate the possibility of concealment. The method would also involve radiation at a sufficiently high level to preclude handling in other than special purpose facilities.

a. Spiking Special Nuclear Material (Option A-4a): Plutonium has inherent hazards if improperly utilized. Some study has been made relative to radioactively "spiking" the material. If resultant dose rates are great enough, detection probability is increased (Reference #22). Studies on this are inconclusive and the concept is not presently adaptable for application.

5. "Dummy" Devices

Fake or mock equipment used as a psychological deterrent. Used extensively in commercial applications, the success factor is difficult to determine.

a. Mock Video Systems (Option A-5a): Mock video cameras are available or genuine unwired cameras can be used. Properly installed, it is almost impossible to tell whether the camera is "live". Utilized in areas where they are purposely obvious, they may be installed on towers, walls, or roofs indicating coverage of entire areas or access portals. They may be fixed or animated (scanning) and can be mixed with "live" systems. Mock cameras offer some degree of deterrence at low cost. However, no real surveillance is acquired and employees are likely to discover the true nature of the equipment. Adversaries may test the installation for real response prior to an actual penetration action.

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b. Mock Film Camera Systems (Option A-5b): Mock film cameras are available for purchase as a commercial item or can be devised from an unloaded functional camera. These could be installed on walls, towers, posts, and fences where they are obvious and where real cameras would normally be expected. This is a relatively low cost option with some degree of deterrence but it provides no real surveillance, and there is potential for discovery of the non-functional aspect.

c. Dummy Security Devices (Option A-5c): Phony security devices can provide a reasonably effective deterrent. These include false one-way mirrors, false signs such as "high voltage fence", etc. which could indicate to a potential adversary that unencumbered access was not possible or at least, hazardous.

6. Warning Signs

Visual deterrents based on the theory that the psychological factor will impede or preclude access. While the success factor is debatable, some signs may be required by law or regulation.

a. Warning Signs on Vehicle Access Routes (Option A-6a): A posted notice that all vehicles should travel on designated routes and park in designated areas would offer some psychological deterrent to travel in unauthorized areas. It is acknowledged that signs might be ignored, either unintentionally or purposely. It is expected that non-adversaries would generally follow instructions. Therefore, any vehicle not following instructions would be suspect.

b. Warning Signs at Vehicle Access Points (Option A-6b): This method would require notice that all vehicles (including the cargo, drivers and passengers) are subject to search upon entering the area, while within the area, and upon leaving the area. Legal aspects of trespass or unauthorized entry when signs are used must be considered on a case-by-case basis. However, advantages are the psychological deterrent factor and the fact that notice of intent to search theoretically establishes consent to search.

c. Warning Signs at Vehicle Parking Areas (Option A-6c): Visual notice that keys are to be removed from vehicles and vehicles locked may serve as a deterrent to vehicle use by a potential adversary. It may also have some effect in protecting property. Locking would deny unauthorized vehicle use (barring a specific "break-in" effort.) Signs conceivably may be ignored but non-adversaries could normally be expected to follow instructions.

d. Radiation and Hazard Signs (Option A-6d): Signs at vehicle access points which indicate that radiation, high voltage and similar industrial hazards exist in the area, provide some protection against trespass. Such signs serve as a deterrent, provide some liability protection, and are usually required for general safety reasons. However, signs are not always read or noticed and adversaries would probably be aware of, and prepared to cope with, the hazard.

e. Other Posted Instructions (Option A-6e): Specific instructions for drivers making pickup and delivery, subcontractors, job applicants, and visitors, provide a norm for vehicle activity from which deviations can be more readily identified. The deterrent advantage occurs in that those not following instructions can anticipate early recognition and security reaction.

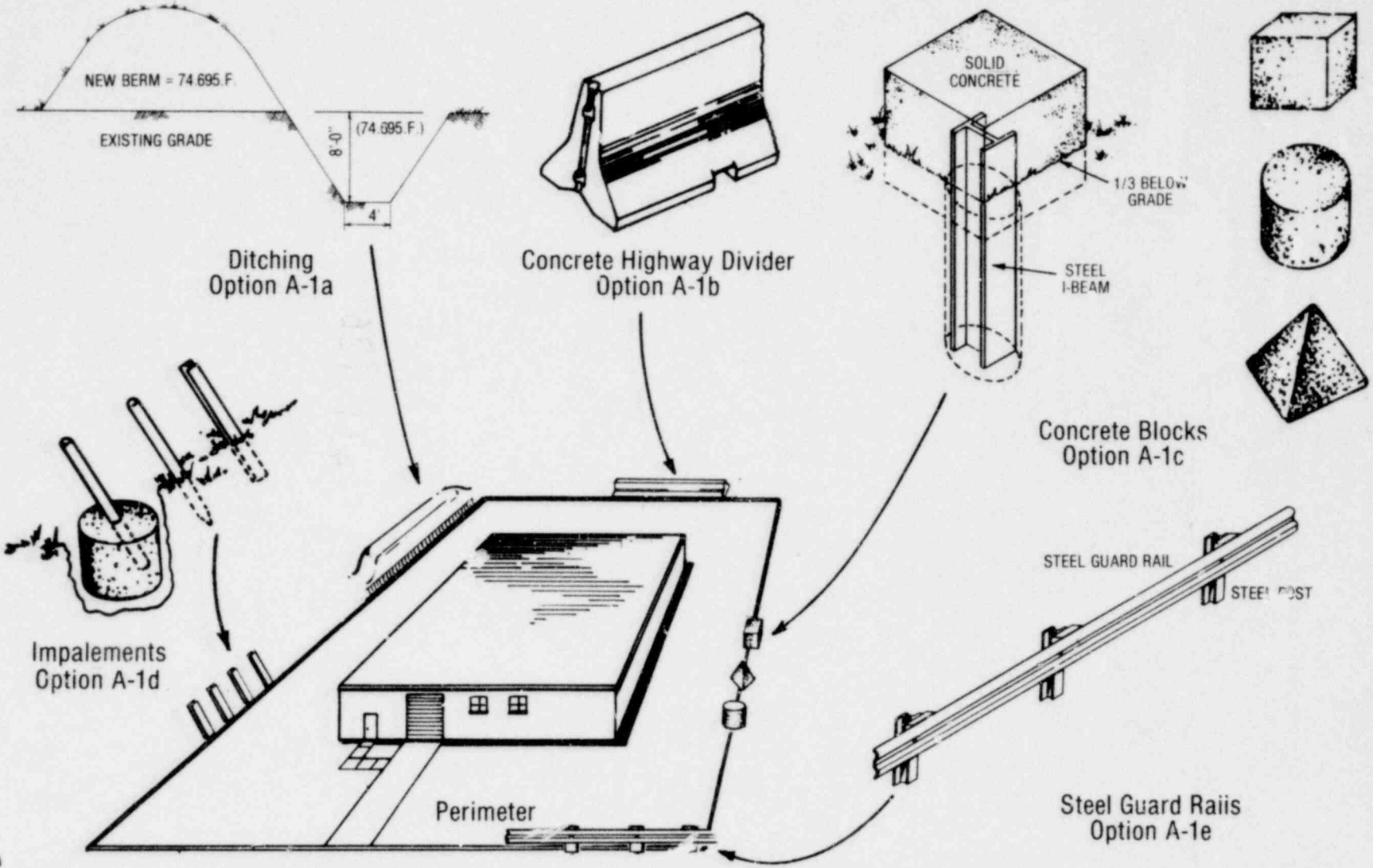
Illustrations of the various options described are presented in Figures 9 through 16.

7. Education Programs

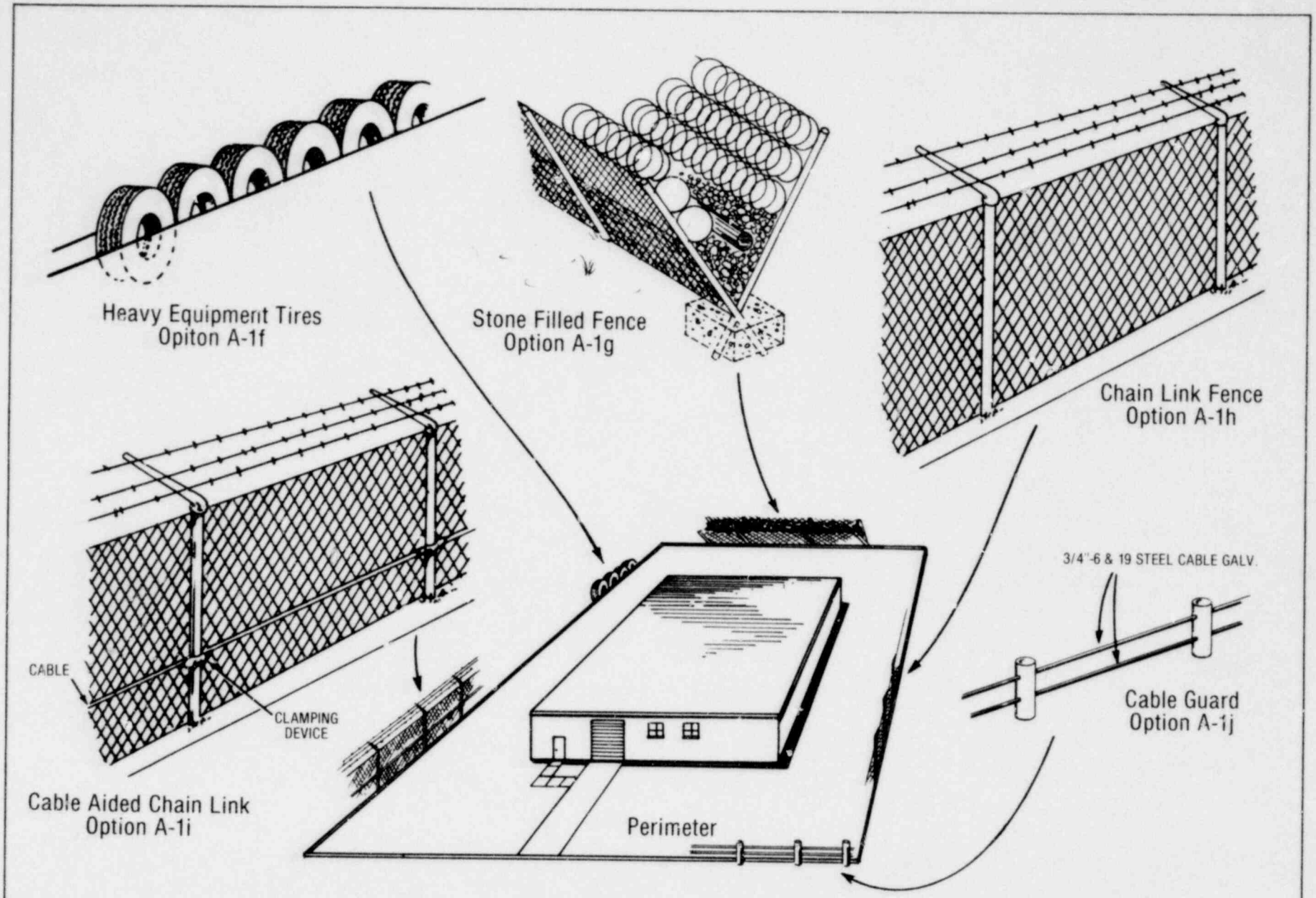
a. Education Programs (Option A-7a): Security education regarding vehicles can be somewhat effective. Orientation of employees and visitors through meetings, licensee house organs (newspaper, bulletins), and/or periodic handouts concerning traffic rules may be used. Visitors and vehicle operators may be required to read and sign a brief summary of regulations prior to access authorization. This provides an opportunity for all authorized vehicle operators to conform to prescribed rules which could minimize false alarms created by violations due to ignorance.

8. Other Devices

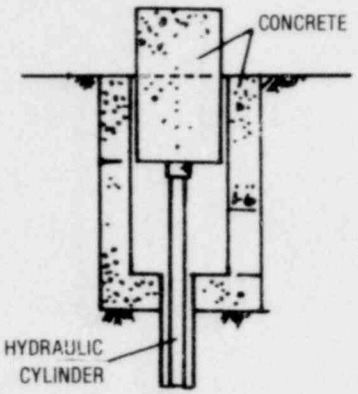
a. Other Devices (Option A-8a): Because of potential public outcry and maintenance problems, it is not deemed appropriate to consider vehicle deterrents such as mine fields, lethal electric fences, traps or other physical restraints, although these certainly could be effective.



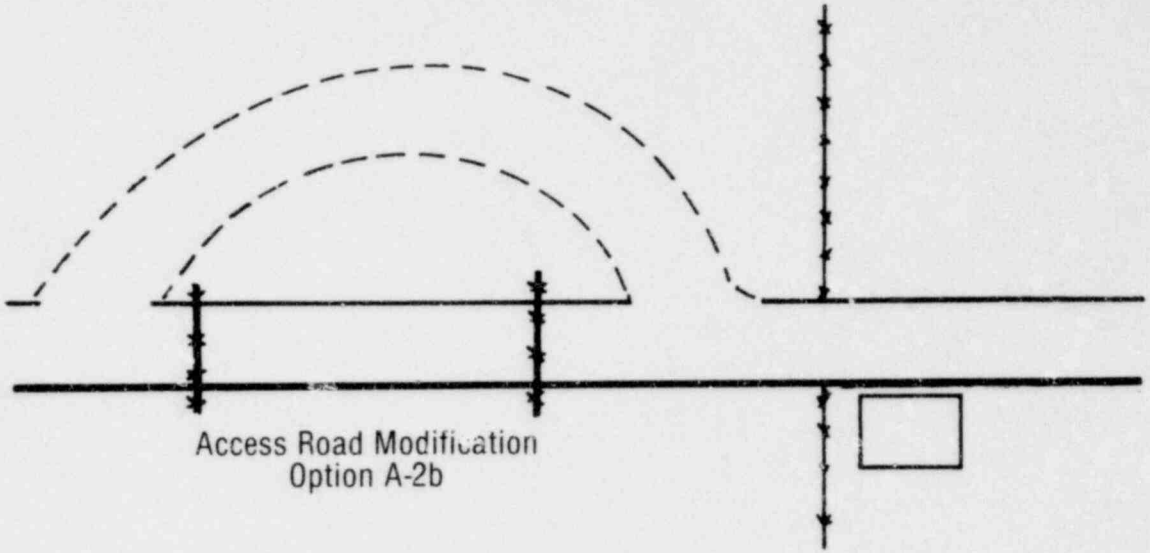
PERIMETER BARRIERS
Figure 9



PERIMETER BARRIERS
Figure 10

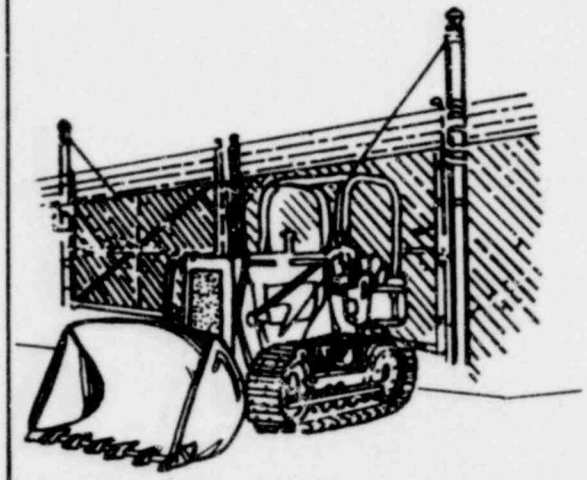


Center of Road Block
Option A-2a

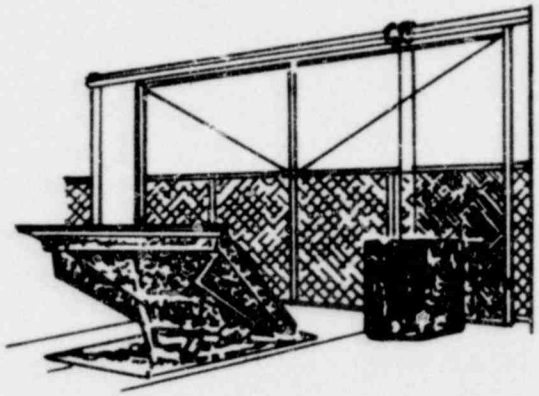


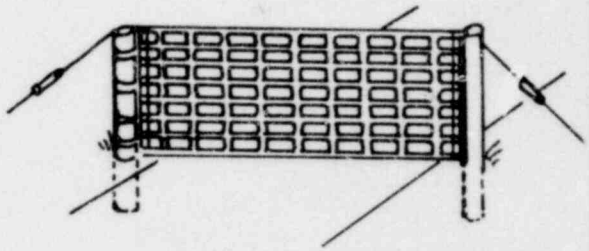
Access Road Modification
Option A-2b

Dock Plate Barrier
Option A-2d



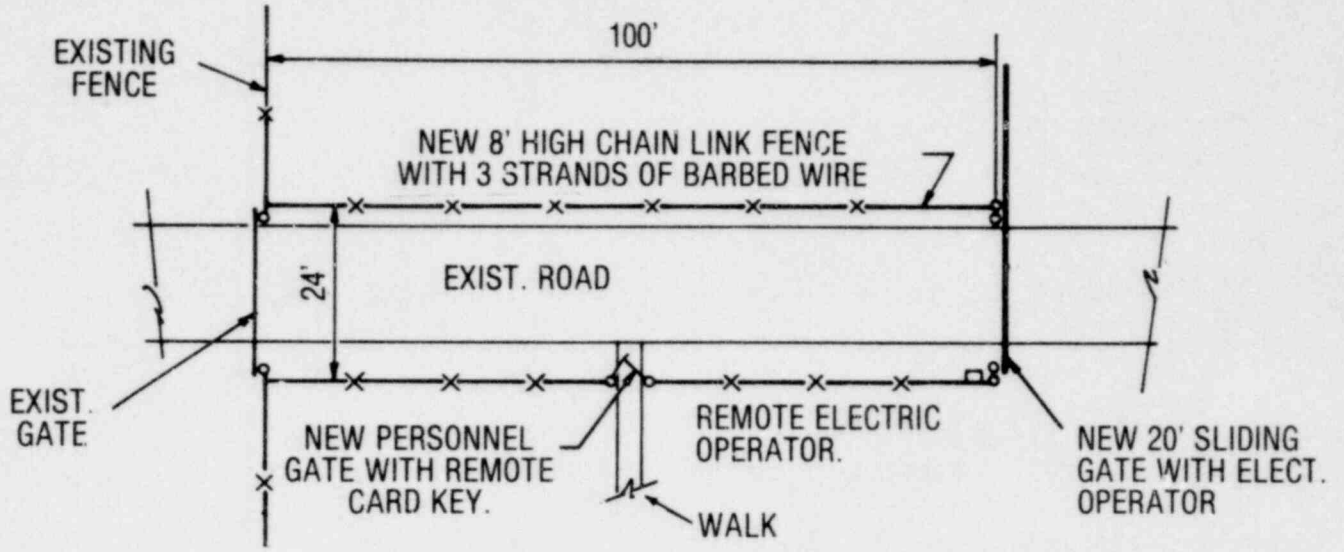
Vehicle Blocked Passageway
Option A-2c



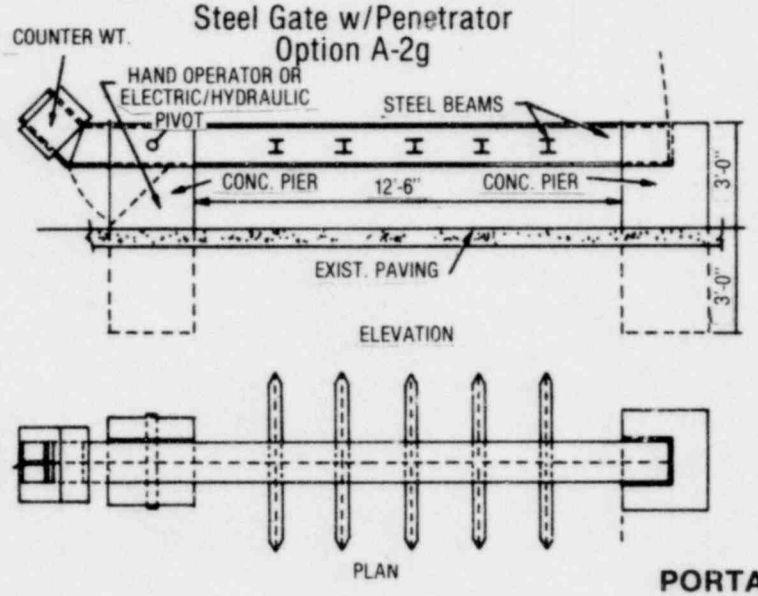


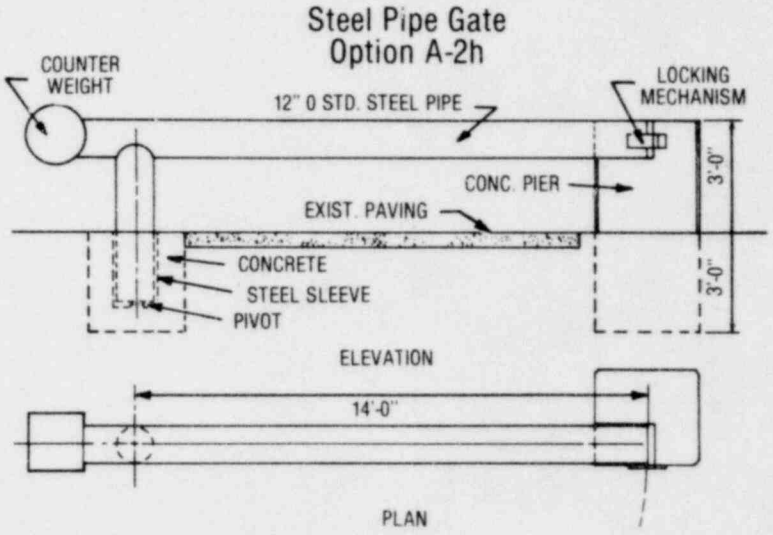
Net
Option A-2e

PORTAL BARRIERS
Figure 11



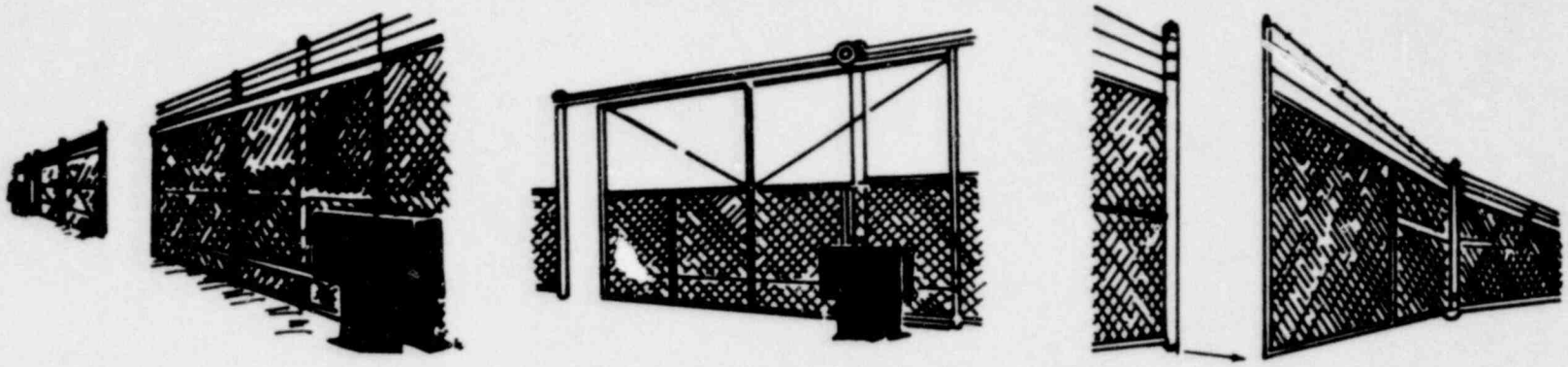
Double Gate
Option A-2f



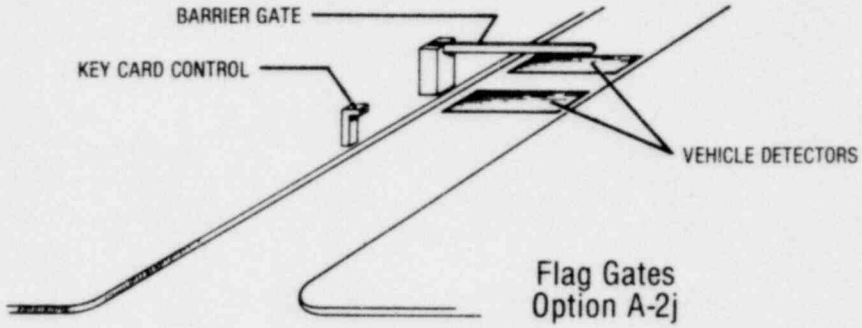


PORTAL BARRIERS

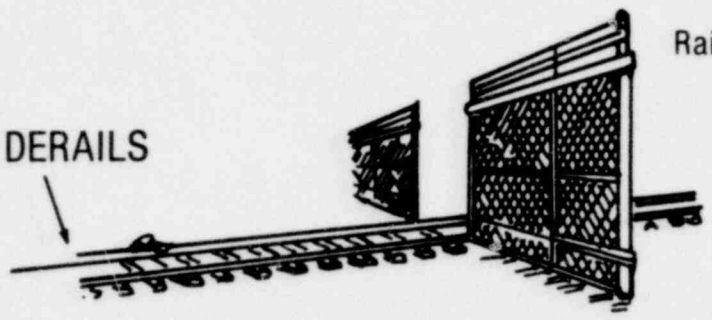
Figure 12



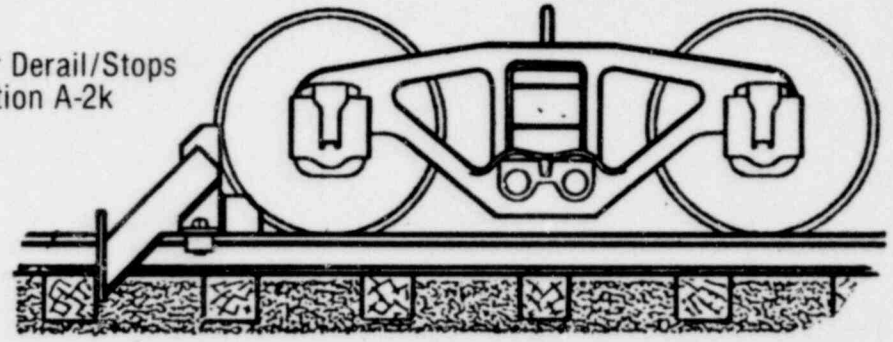
Chain Link Gates (with/without power operator)
Option A-2i



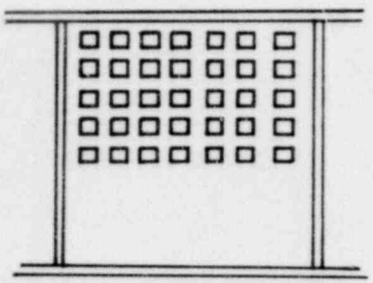
Flag Gates
Option A-2j



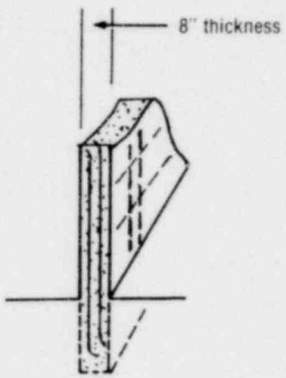
Rail Car Derail/Stops
Option A-2k



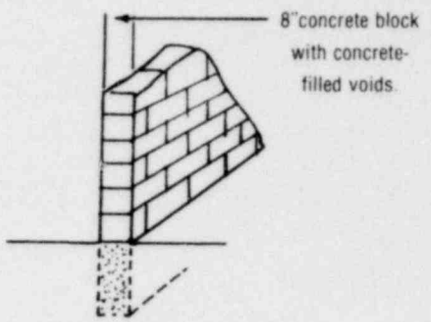
PORTAL BARRIERS
Figure 13



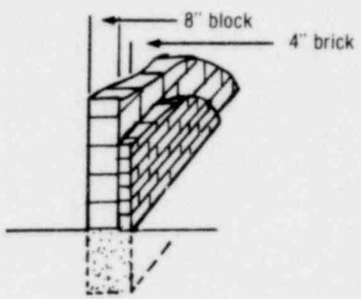
Special Steel Doors
Option A-3a



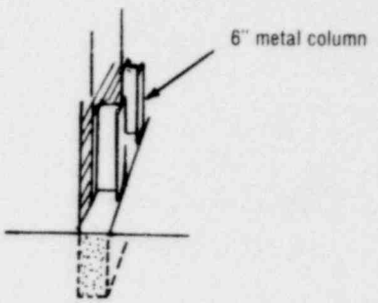
Reinforced Concrete Wall
Option A-3b



Concrete Block Wall
Option A-3c



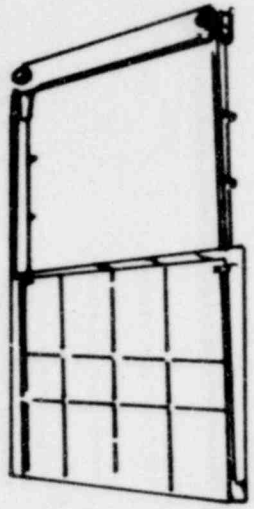
Brick/Concrete Block Wall
Option A-3d

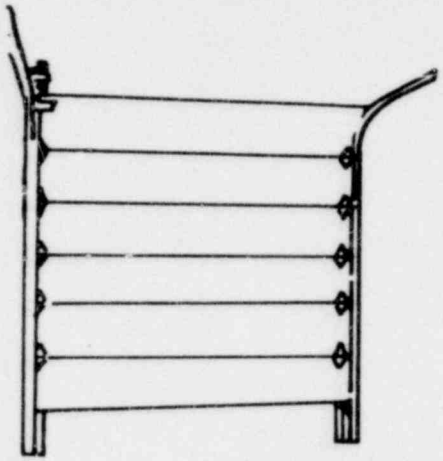


Steel Building Wall
Option A-3e

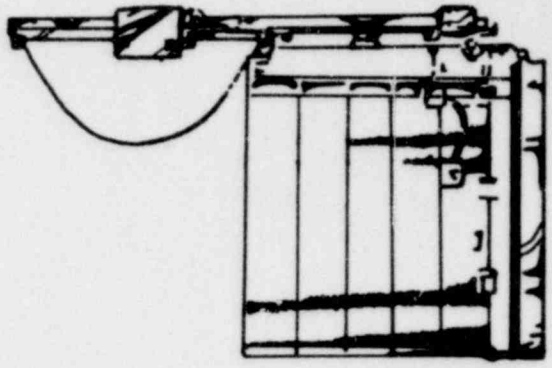
WALL AND DOOR BARRIERS

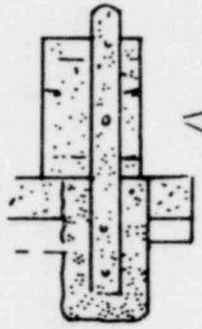
Figure 14



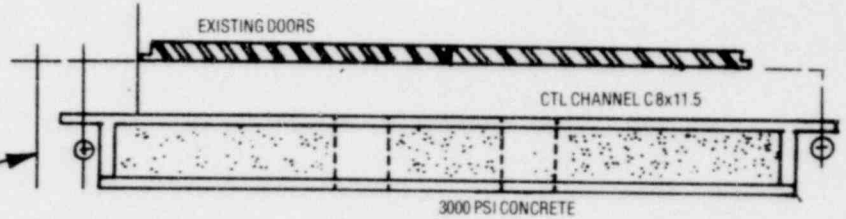


Steel Doors
Option A-3f

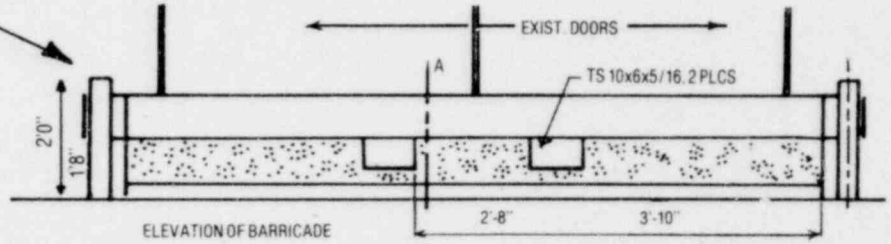




DETAIL OF
POST INSTALLATION



PLAN OF BARRICADE



ELEVATION OF BARRICADE

Concrete/Steel Door Protector
Option A-3g

WALL AND DOOR BARRIERS

Figure 15

NOTICE!
Travel and
park only
in Designated
Areas

Option A-6a

NOTICE!

.....vehicles, passengers and cargos
are subject to search upon entering this area,
while in the area and or when exiting the area....

Option A-6b

NOTICE!

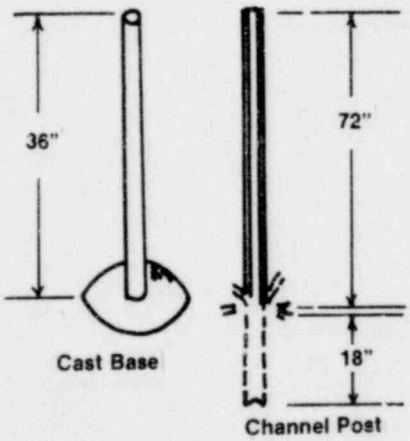
For Security Reasons as
well as your own protection
Please lock your vehicles

Option A-6c

DANGER
KEEP OUT

Radiation & Hazard Signs
Option A-6d

NO
Vehicles
Beyond
This
Point!



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WARNING SIGNS

Figure 16

C. Search (Category "B" Countermeasure Options)

1. Search Countermeasures

Search countermeasures suitable for detecting weapons, people or explosives may not detect special nuclear material and the converse is also true. While some search options may be useful in several stituations, the technique required for discovery of different items is not necessarily the same. Failing to understand search techniques essential to discovering items with different characteristics may generate a false sense of assurance. Possibilities for concealment are numerous, and include concealment in the cavities of the human body and the use of substitute "look alike" vehicle components, among others. A necessary element in search procedure is the "random" factor wherein different modes and techniques should be used to provide maximum assurance.

In addressing vehicle access and control situations, the search of persons is not specifically addressed. Although drivers and passengers are involved, it is presumed that vehicle occupants would be subject to procedures applicable to pedestrian employees and visitors. However, all passengers and drivers should be dismounted from the vehicle to minimize interference with vehicle search; avoid the possibility of embarrassment or verbal confrontation; assure that vehicle occupants are not under duress; and to isolate the occupants from a possible vehicle-concealed weapon.

2. Methods of Search

Seven general methods of search are addressed:

a. the hands-on search technique which primarily involves the physical senses of the searching party; vision, touch, smell, and hearing coupled with suspicion;

b. use of electronic detection devices such as metal detectors;

c. nuclear material sensing devices;

d. X-ray equipment;

e. animals, particularly dogs;

f. stress analysis devices; and

g. purging.

Vehicle searches designed to reveal hidden persons include the physical-hand search; the electronic, acoustic, seismic or body locator mode; animal or bio-assisted technique; a stress analysis of the occupants; or "purging" the vehicle.

Agencies with the most experience in this area (prisons, border patrol, etc.) report a broad range of smuggling techniques including the concealment of persons in engine compartments and false truck-trailer panels.

Discovery of weapons, such as firearms, customarily involves the physical/hand search technique. Other methods include the use of animals, X-ray and other mechanical/electronic devices.

Detection of concealed special nuclear material may involve the use of electronics, physical/hand search, personnel stress analysis, and visual identification of nuclear material and/or containers.

Techniques to disclose explosives/incendiaries are essentially the same as those used for discovery of personnel, weapons and Special Nuclear Material; however the character of explosives is distinctly different in many ways and requires special considerations depending on the chemical composition of materials.

Search processes related to parcels and cargo pose a special problem. Title 10 CFR Part 73 requires a random search of all packages prior to entry into Protected Areas. A potential conflict can occur where the Postal Service, United Parcel Service, common carriers, and others are involved, since the licensee may not have the legal right to open parcels or the driver may not have the authority to consent to search. Understanding these limitations affects the parcel and cargo search situation.

3. Effectiveness of Search Operations

The effectiveness of search operations is related to the detail and attention applied, the specific techniques employed, the time expended and the curiousity and suspicious nature of the individual conducting the search. Searches may be considered as occurring with four levels of intensity.

a. Level 1 includes a general examination of a vehicle's main compartments (engine, truck, cargo, passenger, cab, undercarriage, etc.) and may be supported with the use of a Special Nuclear Material detector and/or explosive detector. Failure of the vehicle to pass this search could result in certain alternatives (access denial, arrest, Level 2, 3, or 4 seaches, or impoundment as appropriate).

b. Level 2 includes a thorough and deliberate search of all parts of a vehicle which are visually accessible and accessible by design (opening trunks, tire compartments, engine, trunk, cargo compartments, glove compartments, etc.) The search is to be conducted with mirrors, flashlights, flex-scopes, etc., to assure coverage and may also be supported with the use of a Special Nuclear Material detector or explosive detector.

c. Level 3 includes the Level 2 search plus non-destructive disassembly of the vehicle, as required, based on judgment factors. There should be specific justification for this search including suspicious activities of the vehicle driver and/or passenger, failures in vehicle surveillance, positive indications from a Special Nuclear Material or explosive detector, search dogs, etc. The search should include, for example, removal of hubcaps, air

cleaners, head and tail light lenses, panels, etc., which can be accomplished with hand tools and without damage to the vehicle (X-ray operations are possible). This search should be authorized by the onsite security supervisor. Assistance from local law enforcement agencies and/or notification may be prudent if owned vehicles are involved.

d. Level 4 includes the previous search procedures plus destructive disassembly and might include cutting into upholstery, oil filters, tires, etc. The procedure should only be resorted to after verifying beyond a reasonable doubt that unauthorized activity is being attempted.

Since a Level 3 or Level 4 search might be beyond the latitude of a licensee to authorize, it would be appropriate to simply deny vehicle access into the Protected Area if suspicion warranted.

Figures 17 through 23 illustrate details of the various options described.

4. Physical/Hand Searches

a. Personnel Detection (Option B-1a): The Level 1 search would normally be expected to provide reasonable confidence of revealing any unauthorized persons in or on a vehicle. A Level 2 search, with careful observation of areas having the potential for concealing personnel, would be more desirable. The search would be accomplished simultaneously with the search for explosives, weapons and Special Nuclear Material. There are inconveniences to visitors and resourceful adversaries could conceivably escape detection if only the Level 1 search is employed. Cost is very low for elementary equipment and depends on the selection of low cost mirrors, flashlights, etc. Estimates of effectiveness of varying search levels are provided in Figure 17. Figure 18 indicates some comparative times and costs for different levels of search.

b. Weapon and Tool Detection (Option B-1b): The extended details of physical/hand search indicated in Option B-1a are similar to that applicable to weapons, tools and explosives. As a supplement to "hands-on" search, other methods which improve the process include X-ray, trained animals, electronic explosives detectors, and metal detectors.

c. Explosive/Incendiary Detection (Option B-1c): Searches for explosives and incendiaries are subject to the same limiting factors as those described for detection of personnel, weapons, tools and special nuclear material, i.e., intensity of observation, visual ability, applied techniques and equipment characteristics.

The Level 1 procedure is perhaps only half as effective as a Level 2 search. Information gained from Reference #11 indicates a Level 2 search may be 70% effective, but there may be as much as a 30% variation due to differences in the thoroughness of the search, variations in vehicle designs and sophistication of an adversary's techiques. Effectiveness will vary when weather is inclement, time elements are imposed, or attention of the searcher is diverted.

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d. Special Nuclear Material Detection (Option B-1d): Physical/hand search techniques for special nuclear material detection are similar to those applied for explosvies and weapons.

e. Personal Items (Option B-1e): Hand carried and personal items such as purses, briefcases and lunch kits should be searched in the same manner as required for pedestrians. Vehicle drivers and passengers should remove parcels from the vehicle and submit the parcel for search. Packages which must remain in or on the vehicle, should be searched prior to entry and exit. A packaged item should be unwrapped. A thorough inspection should be accomplished in, around, under and over non-packaged items.

5. Electronics Search

a. Weapons/Tools (Option B-2a): Most metal detectors for both ferrous and non-ferrous metals are designed for use in non-metallic environments or indicate significant changes in quantities of metals. The application of this medium is, therefore, very limited for vehicles since vehicular construction involves various metals in infinitely changing densities and configurations. Searching vehicle seats, for example, would largely be a frustrating endeavor.

b. Personnel Detection (OptionB-2b): Two basic electronic systems are considered here; however, neither is presently developed to the extent of availability. In the first case, development work on acoustic/seismic detection of personnel in vehicles has been accomplished and laboratory models developed which indicate the feasibility of signal pickup and processing relative to human body motion. Essentially, a pickup device is attached to the vehicle, the signal amplified and processed to cause an alarm if certain patterns are recognized.

Other developments have been accomplished relative to cadaver location in which body-emitted chemicals, such as ammonia or concentrations of CO^2, are utilized (References #52, 53 and 54).

c. Explosives-Incendiaries (Option B-2c): Little documentation exists concerning actual field testing of electronic explosive detectors and discussion with manufacturers did not provide encouraging data. In one case, information indicates that of 69 "plants" of dynamite made in an aircraft-type environment, 33 were detected. When normalized for the percent of bombs which are not made from dynamite, an overall effectiveness of 15% is indicated for explosive detectors. Some tests conducted indicate that when packaged in paper bags, boxes, plastic bags, etc., dynamite detection (without opening the container) was poor to nill. Indications are that explosives in enclosed areas are more easily detectable, but more data is needed to confirm this.

A variety of electronic explosive detectors of the "electron capture" type are commercially available, each with different sensitivites and capabilities. Evaluations have been performed, including those noted in References #11, 23, 60, 91, 92, 93 and 94. Presently, the only electronic detection equipment with potential for detecting explosives is the electron

capture/explosive vapor technique. These devices have sensitivity (in different degrees) to air conditioners, soaps in windshield washers, diesel fuel exhaust, gasoline and anti-freeze. Most instrument testing has been of a laboratory type with very limited field testing. Tests indicate that typical vapor detector instruments will alarm in garages and in the open air when in proximity to running vehicles and engines.

Other methods are either commercially unavailable or consist of laboratory-type instrumentation not adaptable or suitable for vehicle purposes. These include optical techniques, enzymatic techniques, thermal neutron activation analysis, nuclear magnetic resonance, nuclear quadrapole resonance, infra-red radiation, and microwave systems. Some of these techniques, such as neutron activation analysis, may be developed for package and baggage searches but not for vehicles.

Figure 19 outlines the expectation of discovery using electronic explosive detectors and the time and cost comparisons for different vehicle configurations.

6. Nuclear Material Search

a. Special Nuclear Material Portable Gamma Detector (Option B-3a): Portable/ hand-held detectors have been developed with capabilities of detecting 0.2 grams of plutonium or 10 grams of Uranium-235 (unshielded) at a distance of 12 inches (0.3 meters) with a scan rate of 17 inches per second (0.5m/sec.). These are currently available at a cost of about $1,000 each. One device, National Nuclear Corp., Model HN-1, has been approved by the Department of Energy (DOE), although several others have similar characteristics. The probability of detection in a vehicle application, using the hand-held monitor described above, is 90% for Plutonium and 60% for Uranium-235 for unshielded material when the detector is properly utilized and calibrated. Figure 20 indicates approximate times and costs for special nuclear material portable detectors on various vehicle types.

Primarily useful for a direct search of vehicles leaving controlled areas (Reference #18), portable units may also be used to check parcels as they are loaded or unloaded. Another application suggests use in a "roadside" situation at random undisclosed places with a simple telemetry system for alarm (Reference #73 and 74). Still others may be modified to simultaneously alarm and activate a camera or other device (Reference #75). Should a special nuclear material theft attempt be detected, there is an advantage to having the alarm annunciate in a protected security area, to avoid alerting the driver or passenger (adversary). A radio "link" (Reference #73) or an extension cord from an area protected by security personnel to the search area, coupled with a duress alarm, would be advantageous in the event a suspicious item or activity was noted. This could be accomplished using a "garage door opener" type transmitter attached to the portable special nuclear material monitor and/or wired into the circuit with the receiver and alarming in the protected security area (Figure 21). This system, for a manual duress alarm, is in use at several DOE sites.

Some performance testing has been done on a prototype hand-held special nuclear material monitor (Reference #76), which is similar to the personnel/vehicle monitor reported in Reference #89 except for the method of alarm trip level determination logic. Identified as the Delta Rate Monitor, the newer monitor should have some significant advantages in areas of high background. It is likely that a commercial version will be available if tests are favorable. This will be the most sensitive method of special nuclear material detection when properly used , and will offer relatively low cost and high assurance of detecting unshielded special nuclear material.

Properly shielded, special nuclear material cannot be easily detected and distance from the potential source and rate of search can significantly degrade the effectiveness of the search (Reference #77 and 78). Information indicates that the proper use of portable special nuclear material detectors is highly effective for detecting non-shielded special nuclear material. However, no current information provides good statistical data on actual field testing with vehicles.

b. Fixed Portal Monitor (Option B-3b): Most door-way type monitors are set up for a doorway width of approximately 30 inches (77cm) which is inadequate for the passage of most vehicles. However, one manufactured unit is capable of being adjusted to a width of 48 inches (120cm) which is adequate for small vehicle passage (Reference 23 and 79). Some modification may be required during installation to provide sufficient vertical clearance. It can be configured to alarm locally and/or at a protected security area. Advantages include short exposure time; more consistency than a hand-held monitor; and DOE approval.

Fixed portal monitors are less sensitive than hand-held devices. Effectiveness indicates a probability of detection of 100% for one gram of Pu^{239} (unshielded) and 37% for 10 grams of U^{235} (unshielded). A vehicle may shield the special nuclear material and significantly reduce this factor. Operating time per vehicle passage is only a few seconds, minimizing actual search time.

c. Special Nuclear Material Variable-Width Gate Monitor (Option B-3c): In 1974 Dow Chemical Company at Rocky Flats designed a vehicular gate monitor which was subsequently commercialized to be used on gates up to 24 feet (7.3m) (Reference #80).

For best sensitivity, vehicle speeds must be kept below 5 mph, (7ft/sec). With a provision to make one of the detectors movable so that the gate width could be reduced to the minimum necessary for each vehicle, an increased probability of detection could be achieved. The alarm may annunciate locally or remotely, and it consistently scans entire vehicles in a few seconds. A disadvantage is that it is less sensitive than a hand-held device. The effectiveness achieved with a variable-width capability is shown here:

Probability of Detection:	
24 Foot Width Opening	2.5 Kilograms of U-235=60% (est.) 50 grams of plutonium =90% (est.)
Width Opening Reduced to 9 Feet	350 grams of U-235= 60% (est.) 7 grams of plutonium = 90% (est.)

d. Special Nuclear Material Special Portal Monitor (Option B-3d): One DOE site has been using a gamma detector to monitor passage of strategic quantities of special nuclear material through vehicle gates. This device consists of a small shielded sodium iodide (NaI) detector with an Eberline RM-19 instrumentation unit. The sodium iodide detector is aimed across the vehicle passage path and alarms when strategic quantities of special nuclear material pass the monitor point. This system's relatively low cost and high reliability is offset by the fact that it is not sensitive to small quantities of special nuclear material. The instrument provides almost 100% probability for detection of strategic quantities of special nuclear material through gates up to 24 feet wide (7.3m). This unit is not commercially available but may be fabricated from standard components (Reference #81).

e. Special Nuclear Material Neutron Portal Monitor (Option B-3e): For several years, a gate monitor designed to detect neutron eminations from special nuclear material has been tested at one DOE site. However, it has not been effective in actual use for detecting strategic quantities of special nuclear material passing in vehicles (Reference #82).

f. Special Nuclear Material Thermal Scan (Option B-3f): Thermal neutron activation detection systems have been researched. However, it is not likely that systems will be developed to scan entire vehicles (Reference #23). For comparison purposes, gamma detection sensitivies of different equipment are indicated in Figure 22.

7. Radiographic Search

a. Weapons/Tools (X-ray) (Option B-4a): It is generally impractical to X-ray entire vehicles. Available portable X-ray devices can radiograph portions of vehicles, such as door panels or seats, and are capable of producing positive radiographs up to 10" to 12" using Polaroid film. Portable battery-operated equipment would provide back-up capability in searching suspect vehicles or parcels.

In some cases, this method could replace a Level 3 search or a Level 4 search in that areas can be viewed and recorded which are not otherwise visible without disassembly. Disadvantages include "set-up" time, the necessity for coverage of small areas in increments, and some potential radiation hazard. This method would probably be close to 100% effective in the context considered (Reference #64).

b. Weapons & Tools, Other (Option B-4b): X-ray fluorescence is one of several systems which have been developed for parcel and baggage searches. Presently, however, it is not adaptable to vehicles (Reference #72).

c. Explosives/Incendiaries (Option B-4c): The method described in Option B-4a is equally applicable to this option.

d. Parcel/Cargo Inspection (Option B-4d): Problems associated with parcel searches will be encountered when vehicles with a large number of packages may have to be detained for a significant period. High level assurance is very difficult to achieve for bulk materials or other packages which must remain sealed (oil drums, chemical bags, canned items or cylinders). Waste and damage may result if unpacked at the entry portal. Upon egress, arrangements might be necessary to package or repackage subsequent to search.

During times of maintenance at reactor sites or construction at larger fuel cycle sites, several people may be involved in the shipping and receiving activity.

There are essentially three types of parcels or cargos of concern:

(1) Parcels or cargo to be delivered into the Protected Areas which are the property of the licensee.

(2) Parcels or cargo which are in or on private vehicles and common carriers, etc. which are not to be delivered and are not property of the licensee but are part of the delivery vehicle load.

(3) Parcels which are of a "service" nature including lunch kits, tool boxes and compartments, fuel cans, briefcases, purses, etc.

Upon entry of vehicles, either of two possiblities exist:

(1) A physical/hand search which requires opening containers and disassembly of packing to a degree or extent which will disclose firearms, explosives, other incendiaries with a high degree of assurance.

(2) The use of an X-ray system with specifications equal to those utilized by the Federal Aviation Administration (Federal Air Regulation Part 122-538a). The X-ray procedure would require off-loading and reloading.

On egress of vehicles either of two possibilities exist:

(1) A combination of a physical/hand search supplemented with a special nuclear material monitor.

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(2) A combination of an X-ray search supplemented with a special nuclear material monitor. The X-ray would require off-loading and reloading.

Generally the choices related to vehicle-carried parcels and cargo are:

(1) Deny access to all vehicles into secured areas.

(2) Do not permit vehicles with unsearched parcels to enter the Protected Area.

(3) Search vehicle cargo and parcels at the point and times of entry.

(References #3, 43, 96, 97, 99 and 100).

8. Animal-Assisted Search

a. Personnel Detection (Option B-5a): A number of different animals can be trained to detect the presence of people. Canines have demonstrated this well-developed talent, however some vehicles are difficult to enter with dogs. Most vehicles may already be significantly contaminated with human scent and other odors from the occupants which would cause a false alarm. It is theoretically possible to utilize a single dog for both personnel and explosives detection although there is no strong evidence of this combined activity (Reference #55, 56, 57 and 58).

b. Weapons & Tools (Option B-5b): Dogs specifically trained in firearms discovery (Reference #55 and 65) have been useful in detecting firearms by scenting gun oils, paraffin coatings on cartridges, powders, and firing residue. If dogs have been trained and used for explosives detection there is some spin-off capability for firearm detection. However, experienced trainers have indicated that dogs trained to detect very low threshold levels of vapors from firearms may also tend to false alarm on non-weapon items. The specific use of dogs for firearms detection in vehicles apparently has not been tested. (References #56, 58, 66, 67, 68, 69, 70, and 71).

c. Explosives/Incendiaries (Option B-5c): Dogs can detect a variety of explosives which might not be discovered in a Level 1 or 2 physical/hand search. Trained and capable of detecting C-4, TNT, primacord, dynamite, smokeless powder, PETN and ammonium nitrate and related explosives, dogs can search larger areas more quickly than can be accomplished with electronic or hand searches.

People may object to dogs getting into and out of their private vehicles, animals in general may not be "acceptable", or dogs may induce fear. Extreme odor "masking" can inhibit the animal's detection ability and success and proficiency is highly dependent upon the trainer. Effectiveness is diminished in extreme heat or cold or if animal health problems exist. The handler cannot perform a hand search while the dog

is being used as the animal requires continued and undivided attention. One trainer/dog team with refresher training and daily exercise is considered essential to success.

Trials and evaluation conducted by the United Kingdom, by the USAF for the Federal Aviation Administration, by Southwest Research Institute, and by Canadian agencies indicate that the effectiveness of dog search teams range from 29 to 100% "find" rates with 0 to 8% false alarms. The largest quantity of information available on canine teams is from the Federal Aviation Administration (evaluated by the Air Force). Teams are trained and certified on dynamite, C-4, TNT, smokeless powder and primacord with quantities of one-half to several pounds and up to distances of 15 feet (5 m). A typical small vehicle requires about one minute to search and larger vehicles (truck trailers, etc.) may require up to five minutes. Information available indicates the overall "find" rate is approximately 82% for explosives in non-sealed configurations. Federal Aviation Administration canine team evaluations indicate find rates exceeding 95%.

Explosives detection dogs are trained at Lackland Air Force Base for Department of Defense agencies, for the Law Enforcement Assistance Administration; for local law enforcement agencies, and for the Federal Aviation Administration. The U.S. Air Force is responsible for certification and evaluation of all canine teams used to meet Federal Aviation Administration requirements. Some dogs are trained by private trainers and extensive research and training in animal sensory work has been accomplished by Southwest Research Institute. Currently, there is no established "commercial" supplier of explosives-detection dogs and the Air Force does not have authority to train or evaluate dogs for private industry.

By request and negotiation, it might be possible for Licensees to arrange for this. Southwest Research Institute indicates the possibility that they could supply dogs and training in significant numbers if the demand existed. Other than Federal Aviation Administration requirements, there are no performance specifications for an explosives search dog (References #11, 55, 56, 57, 58, 65, 67, 68, 69, 70, 71, 83, 84, 85, 86, 87, 88, 89 and 90).

Initial cost is reported to range from $10,500 per dog by the U.S. Air Force to $15,000 for two dogs by Southwest Research Institute to perhaps as little as $1,500 per dog from private trainers, including handler training. Training and selection time may vary from approximately five to eight months. Additional costs may include kennel care and/or monthly reimbursement for travel, subsistence and lodging for the handler. The annual cost of a dog for food and veterinary care is estimated at $340. Training, proficiency checks and certification (two each year) costs an additional $2,000 annually when provided by the U.S. Air Force. The total annual cost, based on an estimated five year "service life" for the animal, is indicated as $4,500 per year when trained and supported by the U.S. Air Force to meet Federal Aviation Administration specifications. If only

"certified", then the annual cost may be as little as $2,500 per year. The effectiveness and cost of using dogs for explosive detection is shown in Figure 23.

Explosive Detection /Animals, General (Option B-5d): Animals, other than dogs, including gerbils, are being trained to detect explosives. Some success is indicated in laboratory situations but none are commercially available or in use. The possibilities merit continued observation. (References #60, 66, 95).

9. Stress Analysis

a. Personnel (Option B-6a): It is possible to detect human stress by general observation of personnel; by polygraph; using psychological stress evaluators, and with bio-sensors.

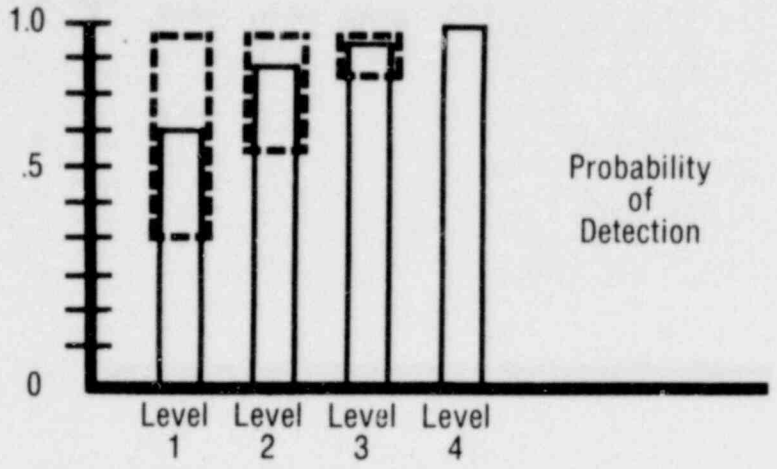
A vehicle application would presume that a driver or passenger knowingly participating in a covert activity would be under significant stress. By initially detecting this, a more comprehensive screening could subsequently be applied or access could be denied.

Work has been reported which indicates the feasibility of stress detection using gerbils in a "progammable bio-electronic" application. This involves the animal detecting excessive adrenalin in less than one second from a hand placed over a sampling box. The individual would not, therefore, be subjected to any invasion of privacy from questioning (References #59 and 60).

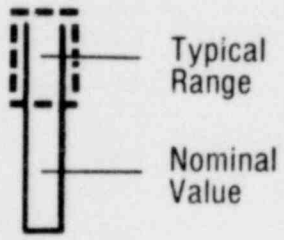
b. Explosives-Incendiaries (Option B-6b): Psychological stress evaluators (voice analysis equipment) represents an available technology not entirely proven or accepted. Legality and labor contracts would have to be considered. Theoretically, vehicle drivers could be questioned with a combination of sensitive and insensitive questions, providing both a permanent record of voice and analysis as well as an immediate signal indicating a stress question. Accomplished remotely without the individual being aware of the analysis, this has some potential for search applications. (Reference #61 and 62).

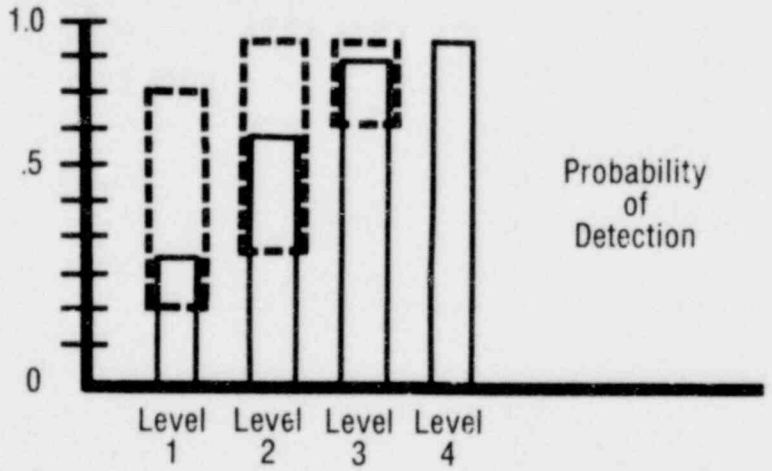
10. Purging

a. Personnel (Option B-7a): "Purging" a vehicle would subject occupants to physiologically uncomfortable environments and could be accomplished with heat, intense noise, and/or irritant gas. This is not recommended due to the possible adverse effects, including irritant residue and physiological damage (Reference #63).



Personnel Detection (Physical/Hand Search)
Option B-1a





Weapon and Tool Detection (Physical/Hand Search)
(Option B-1b)

Explosive/Incendiary Detection (Physical/Hand Searches)
(Option B-1c)

SNM Detection (Physical/Hand Search)
(Option B-1d)

EFFECTIVENESS OF PHYSICAL/HAND SEARCHES

Figure 17

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APPROXIMATIONS OF TIME AND COST INVOLVED IN FOUR LEVELS OF SEARCH
(By Vehicle Type)

Type of Vehicle	Level 1		Level 2		Level 3		Level 4	
	Time	Cost	Time	Cost	Time	Cost	Time	Cost
Automobile, Pickup,	5 min	$0.83	14	$2.34	(a)	-	(a)	-
Truck	7 min	1.17	18	3.00	"	-	"	-
Rail Car	6 min	1.0	16	2.66	"	-	"	-
Special Equipment	5 min	.83	14	2.34	"	-	"	-
Average Site Mix	6 min	1.0	15	2.50	"	-	"	-

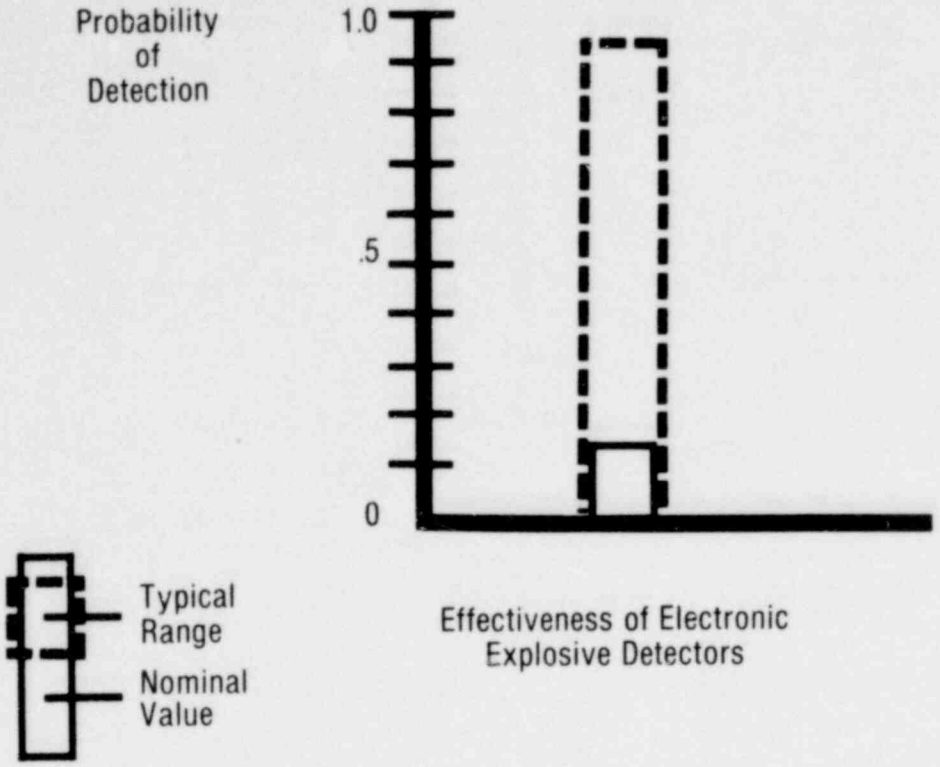
NOTES:

(a) Time estimates are not indicated nor estimated since these search levels could involve the removal of one or more major vehicle components.

(b) Costs are indicated in 1978 dollars (unesculated) based on wages for a security person — using $20,000 per man year or $10.00/hour. Should be adjusted for specific sites.

PHYSICAL/HAND SEARCH TIME AND COST DATA

Figure 18



Effectiveness of Electronic
Explosive Detectors

Vehicle Type	Time (in minutes)	Cost
Sedan, pickup truck etc.	1.0 min	$0.17
Truck (stake body, etc.)	4.0 min	.67
Equipment Types	1.0 min	.17
Railroad Car	4.0 min	.67
Typical "Mix"	2.5 min	$0.42

EXPLOSIVES-INCENDIARIES (ELECTRONICS SEARCH)
OPTION B-2c

Figure 19

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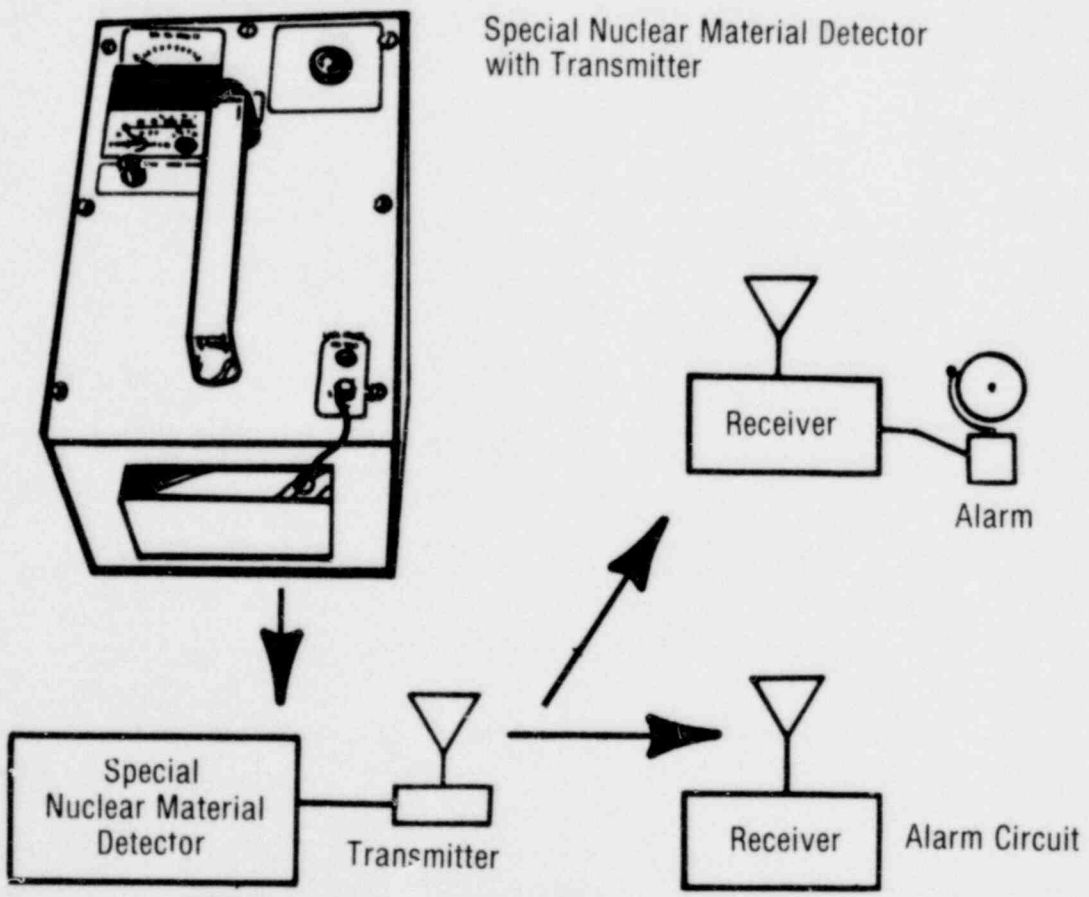
Vehicle Types	Time	Cost Per Search
Sedan, Station Wagon, Pickup	2-3 min	$0.41
Tractor-Trailer	8-12 min	1.60
Railroad Car (flat car)	6-10 min	1.33
Railroad Car (box car)	15-21 min	3.00

OPERATING COST FOR SPECIAL NUCLEAR MATERIAL SEARCH USING PORTABLE HAND-HELD GAMMA DETECTOR

Figure 20



SPECIAL NUCLEAR MATERIAL DETECTION (PORTABLE GAMMA DETECTOR - HAND HELD) OPTION B-3a

Figure 21

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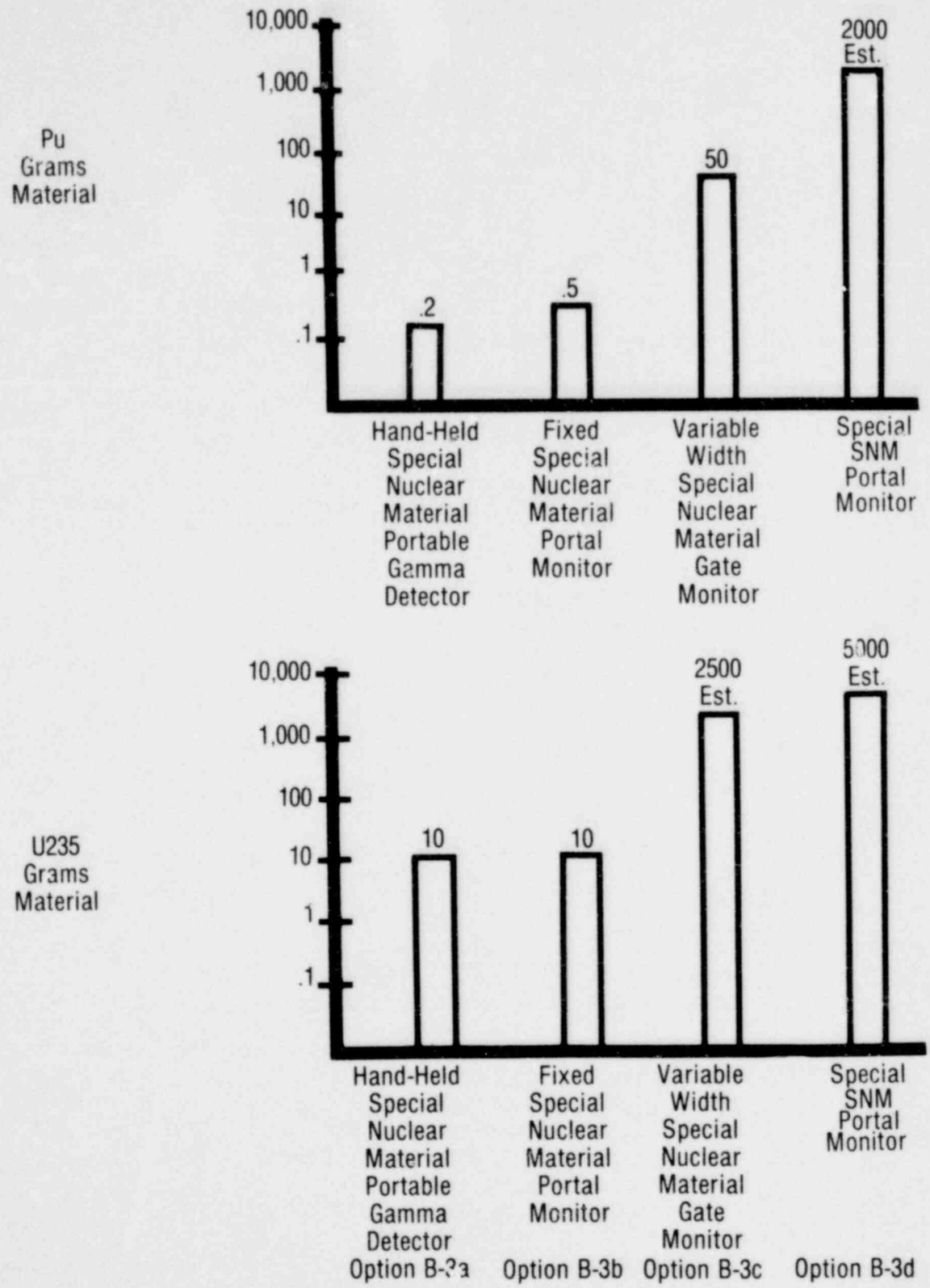

SPECIAL NUCLEAR MATERIAL DETECTION EQUIPMENT SENSITIVIES
Figure 22

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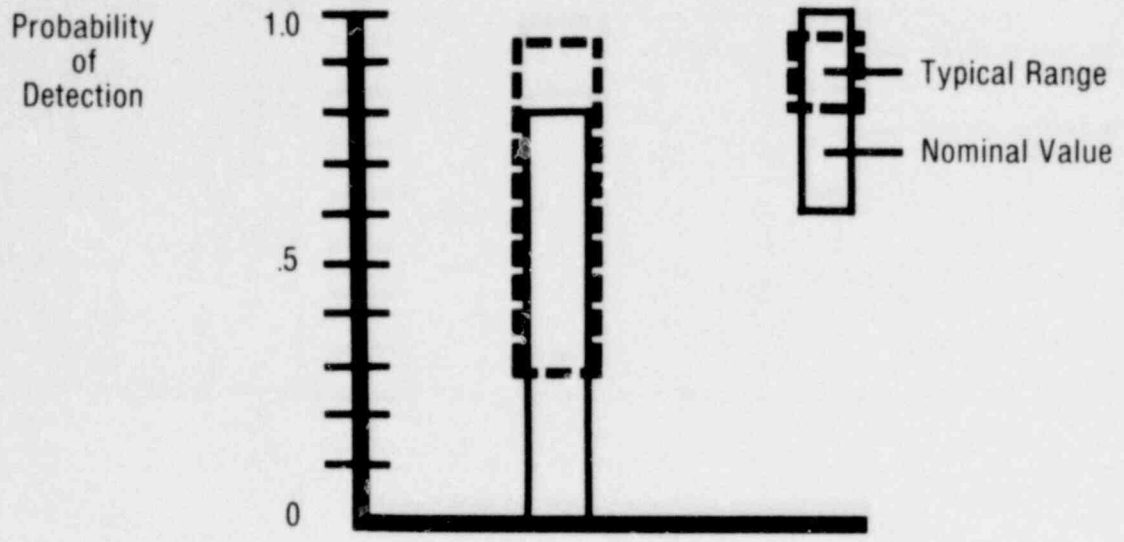

Effectiveness of Explosives
Search Dogs

Vehicle Types	Search Time	Cost Per Search
Sedan, Pickup Truck, etc.	1.0 min	$0.17
Truck (stake body, etc.)	4.0 min	.67
Equipment (construction, etc.)	1.0 min	.17
Railroad Car	4.0 min	.67
Typical Mix	2.5 min	$0.42

Note: Cost per search is dog handler time only. This cost is additive to time and costs necessary for any physical/hand search operation.

EXPLOSIVE/INCENDIARY SEARCH (DOGS)
OPTION B-5c

Figure 23

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D. Surveillance (Category "C" Countermeasure Options)

1. Continuing Surveillance

a. Continuing surveillance (observation) is necessary for assurance against a vehicle-related surreptitious action. In vehicle access and control applications, surveillance is considered in three areas: (1) site perimeters, (2) roadways/passageways, and (3) designated parking areas. For each of these, the surveillance options are occasionally different.

b. Available options occur in several combinations of the following: personal escort; visual; microwave; seismic, wire, sonic, vibration, photo-electric, infra-red; vehicle alarms and use of seals. Due to inherent failures associated with each mode, the best choices appear to be armed "double" escort of the vehicle and occupants or a combination of several modes. Figure 24 illustrates concepts of the various options.

c. Vehicle attempts to breach the perimeter are generally considered to be "covered" if the licensee has a perimeter detection system. This may not be satisfactory if the detection system is a "fence type" or narrow beam since a vehicle near the fence may be used for placing persons over the fence.

d. The provision for designated parking areas where all vehicles are located together (indoor or outdoor) under surveillance enhances the control of access to vehicles. Such surveillance can thus assist in assuring that personnel cannot have undetected access to vehicles (particularly important for vehicles required to go in and out of the Protected Area). Preferred systems would not permit personnel to get close to the vehicle without detection. Typical effective concepts are a "pen" or an electronic "envelope" monitored by microwave or capacitance.

e. Systems for observation and surveillance of in-transit vehicles with on-site "passageways" and/or specified routes are numerous. The majority of these are treated in References #23, 24 and 25 and application includes early warning, control of non-access areas and general vehicle observation.

f. Surveillance of vehicles and occupants may be accomplished mechanically by closed circuit television or visually by security personnel from stations or towers. Several possible options are described here.

2. Escort

a. Two Escorts (Option C-1a): Double coverage of the vehicle and occupants is provided,thereby defeating threats of "one insider plus outsiders".

b. One Escort (Option C-1b): This assumes one armed escort with a radio or duress alarm during an 8 hour day shift. The escort would cover both vehicle and occupants unless (1) occupants depart the vehicle and are otherwise escorted or (2) no escort was required for some reason. All

unsecured vehicles would be escorted. Costs would depend on the duration of each escort (avg. 28 minutes) times the number of vehicle entries as indicated in Figure 25. (Reference #3, 26, 27)

3. Visual

   a. Security Patrol (Option C-2a): Patrols are typically random, scheduled or a combination of both. These may be effective for periodic perimeter checks and alarm response but do not provide continuous coverage or attention to vehicles. Guard orders should include checks of vehicles.

   b. Security Post, Existing (Option C-2b): Vehicle surveillance by observation from existing security posts may be satisfactory if vehicles remain within sight. Under this condition, the option might be considered as one "remote" visual escort.

   c. Security Tower, Hardened (Option C-2c): This would presume continuous surveillance of vehicles while in the Protected Area, allowing "back-up" visual capability and essentially meeting the "two escort" option as long as the vehicles remain in sight (Reference #28).

   d. Closed Circuit Television (Option C-2d): Within limitations, closed circuit television is useful in monitoring vehicle access. It may also be used to monitor vehicles in parking areas or to function as a remote "escort" for vehicles provided constant attention is directed to the monitor (Reference #25, 29 and 31).

   e. Closed Circuit Television with Motion Detector (Option C-2e): Television monitors in conjunction with motion detectors enhance the utility of closed circuit television. Area and point-type motion detector systems, coupled with television coverage, could provide a remote surveillance/escort method (Reference #25 and 31).

4. Microwave

   a. Microwave, Bi-static (Option C-3a): Bi-static microwave systems are effective for vehicle intrusion detection at a perimeter, on roadways, and in parking areas. A vehicle surveillance mode for vehicle parking area system would require a minimum of three to four units (Reference #24, 25 and 29).

   b. Microwave, Monostatic (Option C-3b): Monostatic microwave systems are effective for surveillance of roadways and are available with capabilities for monitoring vehicle areas approximating 2400 square feet (15 x 15m). Most effective indoors, with careful installation they can also be used outdoors (Reference #24, 25, 29 and 37).

   c. Microwave, Moving Target (Option C-3c): Moving target microwave refers to "radar" (radio direction and ranging). Utilized by the military, border patrol, and others, systems include the PPS-5, PPS-12, PPS-20, "ORCHRIST", (FOPEN) and AIL Auto Sentry. Known as "gap filler" radars, the PPS-15 is a typical portable unit with permanent installation potential.

It uses a manual or motorized 180° sweep with a beep alarm, red light, or audio output. It can detect people moving at a range of approximately 1600 to 3200 feet (0.5-1 km). These are considered "narrow beam" radars but are effective for instrusion detection when properly applied. Systems such as the PPS-15 are suitable for vehicle surveillance on roadways.

d. Microwave, Post Sentry (Option C-3d): Post sentry microwave refers to sentry radar systems developed for military applications. These include Camp Sentinel Radar III (multibeam), AIL Rapid and Aircraft Sentry Radar (omni directional). Equipment costs are very high. Currently of questionable maintainability and reliability, new efforts are reportedly being carried out by laboratories with government contract affiliations and others (Reference #29 and 46).

5. Seismic

a. Seismic Point (Option C-4a): Buried seismic detectors can detect vehicle or personnel intrusions at a specific location. The use of this medium could detect movement of a vehicle past a specific point (Reference #24, 25, 29 and 41).

b. Seismic (Option C-4b): Underground seismic systems to detect vehicle movement around perimeters, over roadways and inside large areas offer remote vehicle surveillance opportunities (Reference #24 and 25).

6. Wire

a. Capacitance, Indoor (Option C-5a): Capacitance detectors provide a capability for remote surveillance and are used in alarming vehicles in indoor designated parking areas. Forklifts and other similar equipment must be insulated from the ground (Reference #24, 25 and 29).

b. Capacitance, Outdoor (Option C-5b): Capacitance alarms are effective for alarming vehicles in outdoor parking areas or for remote surveillance. The same limitations as required for indoor capacitance detectors apply (Reference #24, 25, 29 and 30).

c. Electric Field (Option C-5c): The "E-Field" fence is adaptable for defining a parking area, for use as a roadside vehicle detector, as a perimeter intrusion detection device, and for remote vehicle surveillance (Reference #24, 25, 29 and 32).

d. Electret (Option C-5d): Otherwise known as "tape on ground", Electret is commonly applied as a fence protection device. Experiments have also been conducted using it as an underground seismic detector (Reference #24, 25, 33, 34, 35 and 36).

e. Electromagnetic Field Point Sensor (Option C-5e): Reasonably portable units are available and can be utilized as roadside detectors or for alarming and monitoring a vehicle parking area. In the parking area context, coverage approximates 1,076 square feet (100 square meters) and offers a means of remote surveillance (Reference #24, 25, 29 and 37).

f. Metal Detectors, Point (Option C-5f): Portable, roadside and under road metal detectors are available. Installation could be considered as an early warning vehicle detection/surveillance device (Reference #24, 25 and 39).

g. Metal Detectors, Perimeter (Option C-5g): Metal detectors and magnetic/seismic detectors are vehicle intrusion detection mediums suitable for outdoor/underground applications. Use on a perimeter, roadway, or boundary of a parking area would provide remote vehicle surveillance (Reference #24, 25 and 39).

h. Tape Switches, etc. (Option C-5h): Tape switches and mats will effectively detect vehicles passing over them. Access to a vehicle might not be observed as tapes and mats can be overstepped by persons if seen.

i. Enclosed Wire, Pulsed Mode (Option C-5i): a "wire-in-a-tube" concept being developed by Honeywell and others is a perimeter intrusion system using time domain reflectometer techniques. If development proves successful, the concept will relate to perimeter vehicle intrusion detection and vehicle parking areas (Reference #44).

j. Leaky Co-Axial Cable (Option C-5j): Such systems, as "Guidar" manufactured by Computing Devices Company, have been developed and installed at several locations. The system is a two-cable configuration used for vehicle intrusion detection or detecting vehicle movement in parking areas. The cables can be installed approximately five feet apart, above or below ground, and cover distances from a few hundred feet to one mile (Reference #29 and 131).

k. RF Cable (Other) (Option C-5k): Intrusion detection cable systems using VHF (Very High Frequency) have been under development. These include concepts such as the "End-Fed Mode", "Transmission-Line Mode", and a "Two-Wire Mode". If commercially available, they could be used in vehicle movement applications on perimeters and in vehicle parking areas (Reference #29 and 37).

7. Sonic

a. Acoustic, Passive (Option C-6a): This method provides a capability for placing vehicles under "audio surveillance". It is most effective in quiet areas and would be suitable for locations where access to vehicles in a parking area is anticipated (Reference #24 and 25).

b. Acoustic, Low Frequency (Option C-6b): Low frequency sonic sensors are generally limited to indoor use. They would provide a method for surveil-

lance of indoor parking areas up to approximately 50 feet (15 m) square (Reference #24 and 25).

c. Ultrasonic (Option C-6c): Ultrasonic detectors are most suitable indoors, typically to cover an area approximately 10 by 26 feet (3 x 8 meters). They can be applied to control of vehicle access in small parking areas but are basically limited to indoor situations due to motion problems generated by outdoor environment, wind for example (Reference #23, 25 and 36).

8. Vibration

a. Taut Wire (Option C-7a): Taut wire systems are designed essentially to detect fence vibrations and are effective for detection of vehicle access in this respect (Reference #24 and 25).

b. Fence Vibration Systems (Option C-7b): Vibration alarms will readily detect vehicle intrusion through a fence. Its characteristics would also allow detection of other tampering (Reference #24 and 25).

c. Unique Fluidic, Classification (Option C-7c): Although not available commercially, developmental systems have been devised to pick up vibrations from vehicles as they pass a prescribed point. By utilizing a computer system and comparing the vehicle signal to a standard signal, the vehicle theoretically could be classified by "type" providing an identification medium (Reference #48).

9. Photo Electric

a. Photo Electric (Option C-8a): Photo electric systems are capable of detecting vehicle passage and their use is potentially best applied to roadway vehicle monitoring.

10. Infra-Red

a. Active infra-red (Option C-9a): Active infra-red systems detect infra-red attenuation between a source and detector.

Three to four units may be required for an application such as a designated parking area (Reference #24 and 25).

b. Passive infra-red (Option C-9b): This method would require consideration of the area's environmental features to be alarmed. Applied to indoor designated vehicle parking areas, an area of approximately 1080 square feet (100 square meters) can be covered. "Hot spots" on vehicles may cause false alarm problems (References #24, 25 and 38).

11. Vehicle Alarm

    a. Vehicle Alarms (Option C-10a): Various alarm products are available. Typically operated by switches to activate by door opening or by motion detection (vibration and ultrasonics), they provide notice of intrusion into vehicles. They are not sensitive enough to detect all exterior tampering. Some, provided with "paging" devices carried on the person, provide an alarm while the driver is away from the vehicle.

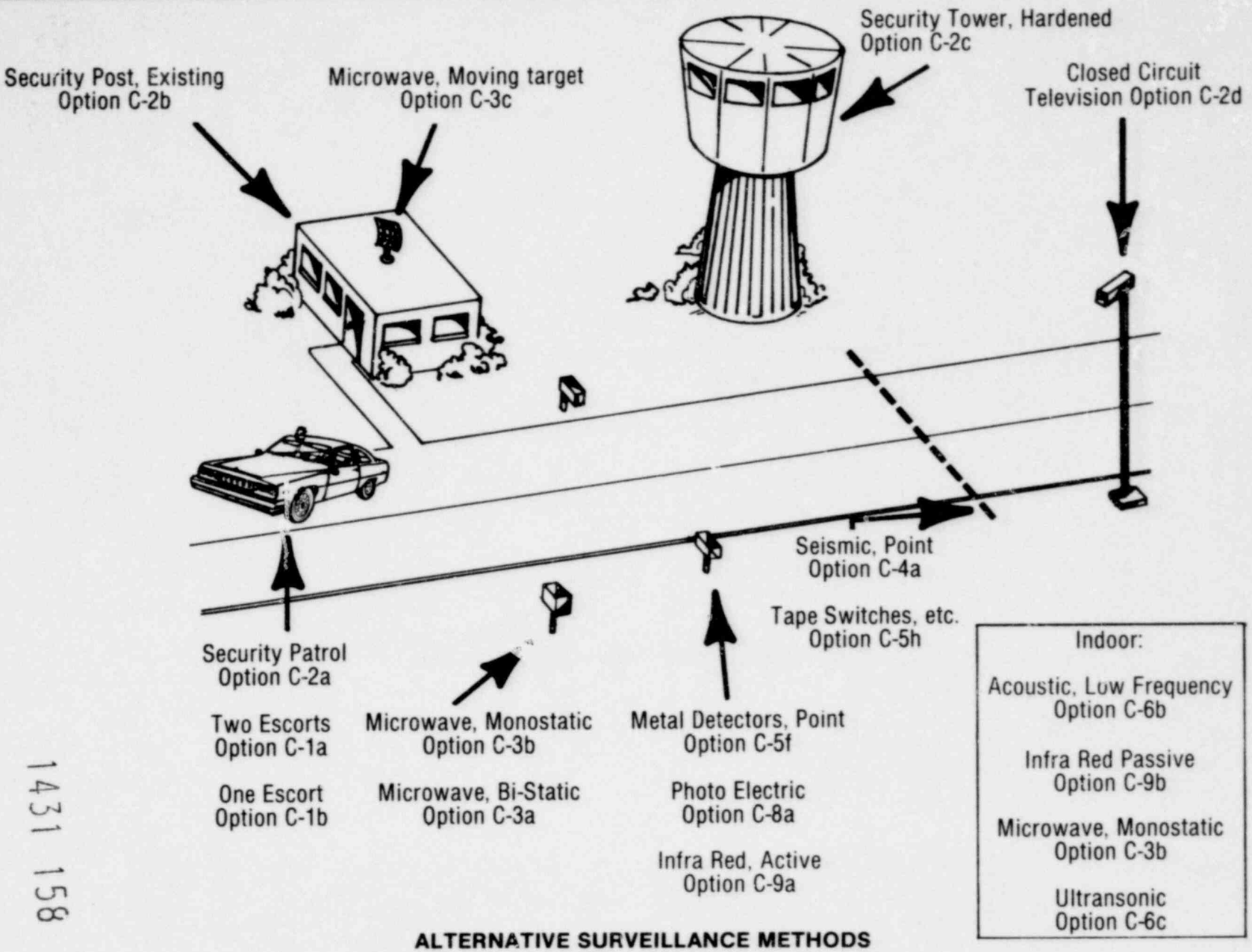
12. Seals

    a. Seals (Option C-11a): Seals approved for use by NRC licensees are described in Regulatory Guides 5.10, 5.12 and 5.15. Figure 26 depicts the application of seals in a vehicle access and control situation. For licensee-owned vehicles, "permanent" seals may be applied. For non-licensee vehicles, pressure sensitive (peel-off) seals might be used, insuring that the seal was removed prior to departure from a security area. All seals should be consistently serialized and logged (Reference #5, 7, 42 and 43).

13. Miscellaneous

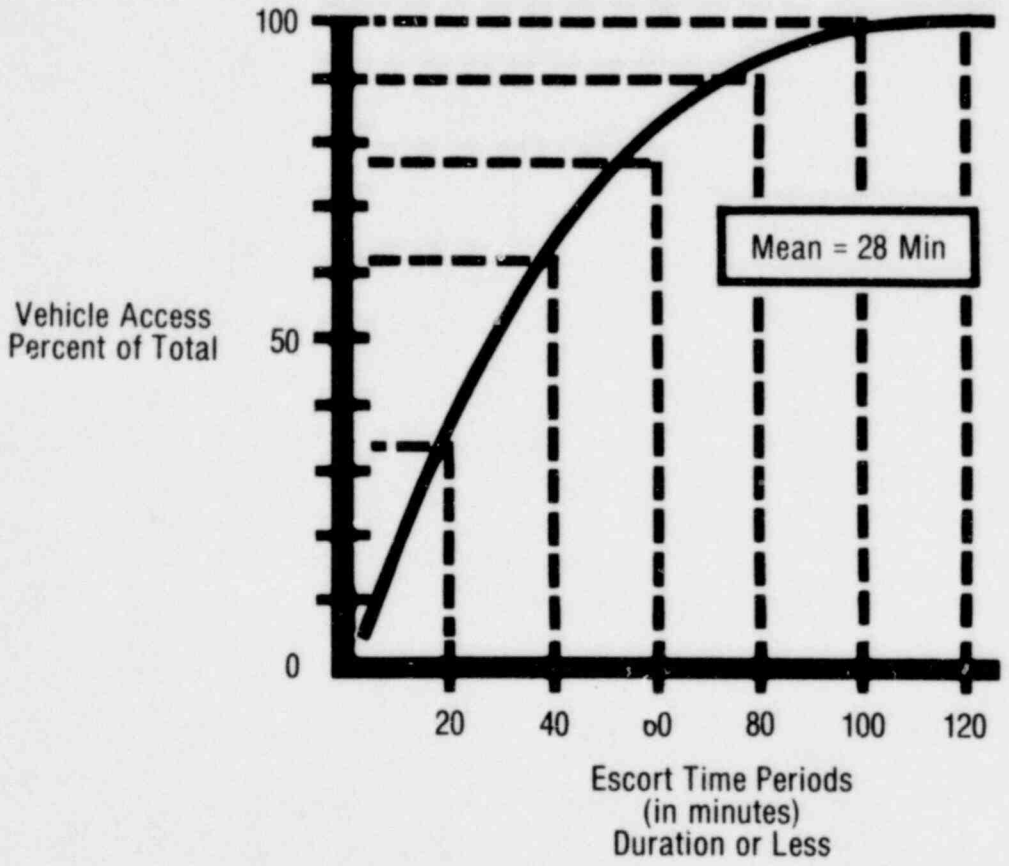
    a. Gamma Intrusion (Option 12a): This concept is essentially a system intended to detect gamma attenuation between a source and sensor. It is not currently available (Reference #29 and 45).

    b. Laser (Option C-12b): Laser systems are basically capable of the same applications as photo or infra-red systems (Reference #47).



ALTERNATIVE SURVEILLANCE METHODS

Figure 24



SURVEILLANCE (ESCORT)
OPTIONS C-1a and C-1b

Figure 25

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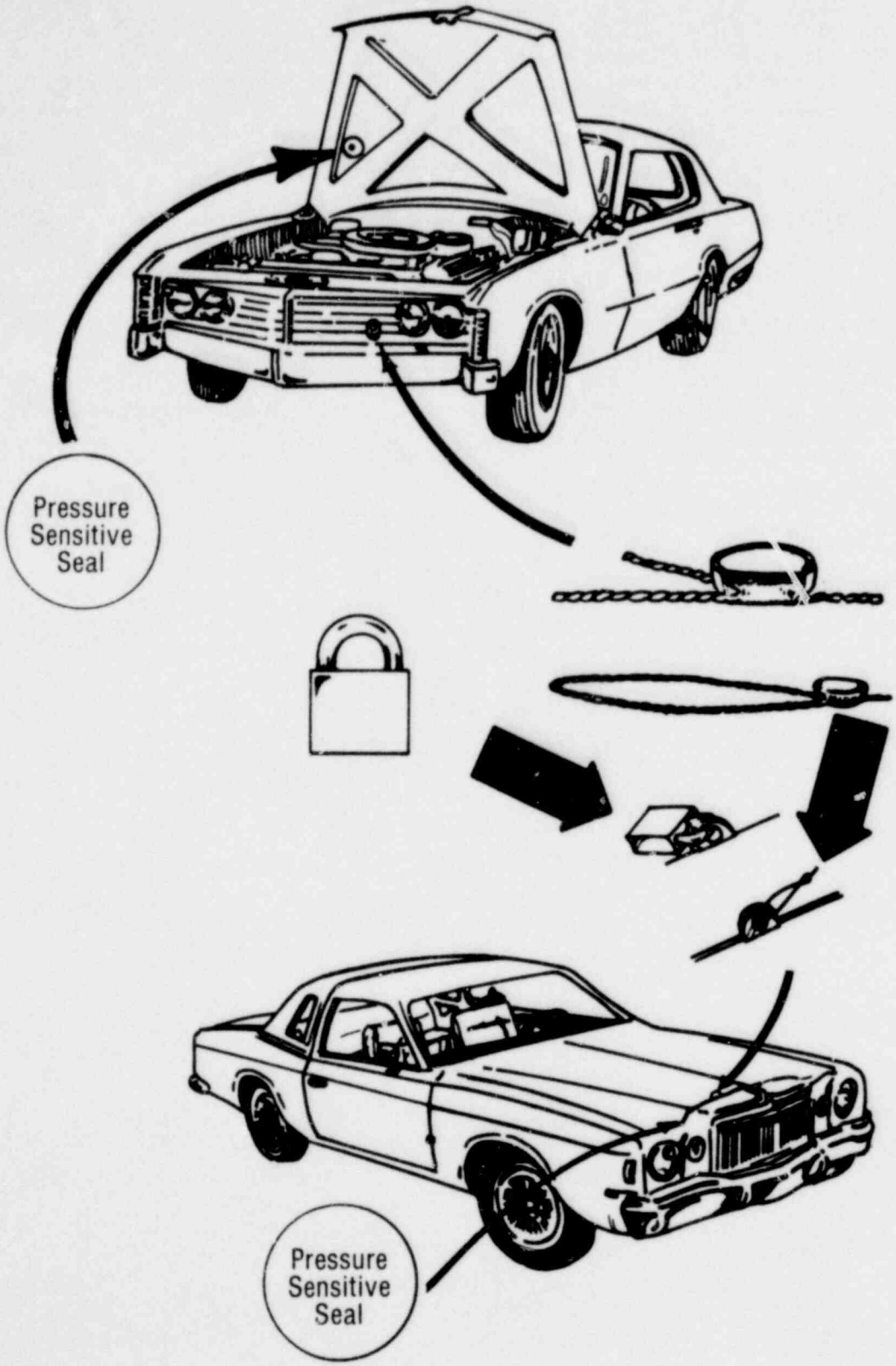

USE OF SEALS FOR VEHICLE SURVEILLANCE PURPOSES

Figure 26

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E. Control (Category "D" Countermeasure Options)

1. Vehicle Control

a. Vehicle Denial: The greatest assurance against using vehicles for unauthorized conveyance of materials or devices intended for radiological sabotage or unauthorized removal of strategic quantities of special nuclear material is to totally prohibit vehicles from entry. Since this is impractical, other control means must be considered.

b. Vehicle Captivity: The access and control problem is minimized if vehicles remain "captive" within the Protected Area with minimum frequency of entry/exit.

c. Operator Identification: Driver/passenger control addresses several aspects of managing vehicle access. On the premise that vehicle occupants should conform to the same basic requirements of access and control applied to pedestrians, there are several options to be considered (Reference #27 and 100).

d. Vehicle Identification: Vehicles having access to licensee sites must be positively identified, particularly if the vehicle has recurring access within the Protected Area. There is also reason to conceal the identity of such vehicles so that they do not become known to possible adversaries. Sophisticated identification methods have included a fluorescent code in the windshield, an attached coded transponder, a concealed trace of very low level nuclear material, or fluorescent numbers painted on vehicle components. Since license plates can be changed readily, it is appropriate that at least one additional method be selected and used for vehicles with continuing access. It is not reliable to depend on paint patterns and logos since they are easily duplicated by professional criminals. If fact, about 80% of drug smugglers use false identification (Reference #3, 96, 97, 99, 102, 103, 104, 105, 106 and 107).

e. Immobilization: Many security publications encourage that vehicles be kept in a locked garage or other inaccessible area; that gas tank caps be locked; and that executive parking spaces be identified by number, not name. Primarily intended for prevention of terrorist crimes, these concepts also apply to denying vehicle access to power plants and fuel cycle facilities. (Reference #101). Several options are indicated here to control vehicle access and prevent the use of fuel as an incendiary medium, for example.

f. Transaction Record: Minimum requirements for visitor registration are included in 10 CFR 73.50 (c) (5) relative to Protected Area access and in Title 10 CRF 73.70 (b) and (d) regarding Vital and Material Access areas.

The additional use of vehicle logs is a valid consideration. Film and/or video records also provide some control in vehicle access as well as a record of activities in case of a security (or safety) incident. Photographic records provide valuable recall data (Reference #127, 128, 129 and 130). Non-visible light cameras and films are available for unique applications

and infra-red flash can be effective up to about 700 feet (213 m). Light amplification and passive infra-red techniques offer identification potential as a vehicle generally presents an excellent infra-red target from inherent heat radiation. Any of the film or video systems can be activated remotely or by events such as doors opening, alarms being activated, remote duress alarm, special nuclear material detection or explosive detection.

g. Tracking: Vehicle control measures for recording location, route and destination could also provide for identifying on-site vehicles and "tracking" them to assure that they only traverse authorized areas. Most Automatic Vehicle Locator systems are designed to cover large fleet activities or areas not entirely typical of NRC licensee sites. There is conflicting information on location accuracies and some may be inappropriate due to cost. Descriptions are presented for the purpose of illustrating these concepts.

h. Miscellaneous Control: Vehicle access involves determining whether or not a specific vehicle (or class/group of vehicles) is to be permitted on site and how it is to be controlled. The range of control spreads from "no access" through "captive vehicles" (limited area of movement), "designated vehicles" (specific authority on a continuing basis) "temporary access" (as required) to "emergency only" (fire or disorder). Access may require control by a single verbal justification, verification by one or two additional people, examination of documentation pertinent to the vehicle and load, or a combination of these and additional facilities.

2. Vehicle Denial

a. Vehicle Access Denial (Special Nuclear Material Vaults/Vault-type Rooms) (Option D-1a): Vehicle access denial is reasonable for special nuclear material vaults as vehicles for maintenance or other purposes are not essential in these locaions. MOX fuel pins and containers are of a size suitable for manual handling and HTGR fuel rods are kept in small containers or on portable trays. The transfer of special nuclear material in the proximity to the vault door is governed by Title 10 CFR 73.35 "Transfer of Special Nuclear Material" paragraph (b) which details the procedure for special nuclear material loading and unloading. Under the surveillance of a member of the security force plus one or more other employees, special nuclear material transfer at the door is the most appropriate place to accomplish the task.

Vault-type rooms are typically staging areas for special nuclear material being received into or shipped from vaults. Trucks should be backed up to doorways and forklifts or similar material handling equipment used to unload the containers. Powered forklifts are vehicles and, as used in this situation, are not necessarily dedicated and captive to the area. To eliminate the forklift as a vehicle (by definition), a non-powered "shoplifer", "worklifter", conveyor, skid or hoist might be substituted to handle all but massive casks (Figure 27). These units could then be dedicated to the area with four desirable results: (1) the equipment could be continually confined to the area; (2) the equipment would have

insufficient power to "ram" vault doors and walls effectively; (3) search, if required, is simplified; and (4) incendiary fuel or other similar energy source is not available in the area for sabotage purposes. Manual operations might require more time, although transactions are infrequent.

b. Vehicle Access Denial (Material Access Areas) (Option D-1b): Other than vaults and vault-type rooms, Material Access Areas may require the use of material handling equipment for material production, supply, and movement. It is difficult to predict if operations could continue effectively at all sites without powered equipment such as forklifts. Vehicle access with associated material shipments/receipt at NRC sites should be confined to limited access to a secured door or portal. If shipment includes nuclear material, it is subject to Title 10 CFR 73.35 (b).

   If vehicles were restricted from Material Access Areas and operations could be accomplished with non-powered equipment, certain advantages would result: non-powered material handling devices (Figure 27) minimize potential use for forcible exit or entry; searches would not be required since vehicles are not in the area nor do they enter or exit; and incendiary energy and fuel sources are eliminated. The concept may be impractical at some sites due to size, weight and frequency of material movement.

c. Vehicle Access Denial (Vital Areas) (Option D-1c): Vehicle access to Vital Areas varies from site to site. Procedures for pickups and deliveries are occasionally a matter of local practice as opposed to being dictated by physical differences in site facilities and building configuration. Vehicles are primarily required in Vital Areas for material handling (casks, in some cases). The elimination of vehicle access in some Vital Areas could require significant modifications to cask handling cranes, and the adaptation of hand operated material lifts (Figure 28). However, the advantages are identical to those indicated in Option D-1b. The desired result is to deny access to all vehicles. A more practical but less effective alternate is to allow escorted access for large shipments only, treating the vehicle as an integral unit of the fuel cask delivery or pickup.

d. Vehicle Access Denial (Protected Areas) (Option D-1d): Presuming that elimination of all traffic into Protected Areas is impractical, it is possible to significantly reduce vehicle access. Reductions in traffic can be accomplished by (1) providing a load-unload area "straddling" the Protected Area Boundary and/or (2) instituting the "captive vehicle concept". This would eliminate the larger portion of vehicle traffic into and out of the Protected Area and minimize search and escort requirements. Vendor and service personnel complaints and additional capital investment are possible. However, the favorable result would be a reduction of vehicle access and control problems.

e. Vehicle Access Denial (Shipping/Receiving Areas) (Option D-1e): Vehicle traffic in and out of Protected Areas can be reduced by utilizing "external" shipping and receiving areas which are totally outside the Protected Area and by unloading all incoming material from vehicles outside of the Protected Area. (Figure 29). Subsequent to a package search on arrival,

cargo may then be loaded onto other escorted vehicles and moved into the Protected Area with outbound shipping following a reverse order.

If inbound material could not be immediately moved into the Protected Area it could be "staged" in a lockable, caged compound under the control of two designated employees. This minimizes and may eliminate the need for vehicle search (all packages would be kept outside of the Protected Area until search is, in fact, accomplished). This may require additional facilities and double handling of materials but could be offset by a substantial reduction of non-licensee vehicle traffic. To accomplish this would require the designation of appropriate space or facilities specifically for the purpose of shipping and receiving with facilities for locking and sealing or a specifically designed open Temporary Storage Facility (Roof). This type of facility would provide a covered area (basically a floor, roof and chain-link "wall") of relatively low cost affording minimal weather protection but capable of staging approximately three full trailers. The facility should be capable of being locked and sealed. An alternate design could provide a closed area with increased weather protection and improved security.

3. Vehicle Captivity

   a. Captive Vehicles (Option D-2a): "Captive" vehicles are considered to be those primarily dedicated to Protected Areas without ingress or egress except for emergencies or maintenance. The concept would require permanent and continuing assignment of specific support vehicles and material handling equipment. Outside service and transport vehicles could not conform to this requirement and certain equipment, such as tractors and mowers, may occassionally be needed both inside and outside of the Protected Areas. Nevertheless, a list of captive vehicles, maintained and monitored at vehicle portals, would permit vehicle identification and confirmation when emergency or maintenance purposes arose, with justification for exit and entry validated by at least two persons. During unusual periods of extensive modification or construction, it may be desirable or necessary to temporarily modify the rules. Still, this would minimize traffic in and out of security areas, reduce the probability of unauthorized transfer of materials, equipment or personnel, and eliminate many opportunities for covert use of vehicles and the need for searching and escorting most contruction-related vehicles.

   b. Access Corridor/Envelope (Option D-2b): It is a common practice to utilize a temporary fence during construction periods to isolate security areas. The corridor-envelope concept envisions an enclosed access route from the Protected Area boundary up to buildings within that perimeter.

      Several considerations should be taken into account, specifically: (1) the fenced corridor must be the same specification as the Protected Area boundary, (2) access to the corridor must be controlled at the "terminal" end while the vehicle is in the area, (3) topography should be considered to avoid dumping liquid incendiaries with possible drainage toward Vital and Material Access Areas. If the entry point of the corridor is close to Vital and Material Access Areas the concept may be undesireable when considering explosive distances.

This option would preclude a vehicle from unrestricted movement within a Protected Area. Capital costs could be more favorable if this concept were incorporated during construction periods. This concept is illustrated in Figure 30.

c. Designated Parking Areas (Option D-2c): Designated parking areas are those which are readily adaptive for continued surveillance and isolated from areas vulnerable to sabotage or theft. The quantity and size of these areas should be reduced to minimize surveillance effort. Figure 31 indicates various modes.

4. Operator Identification

a. Access Authority Validation (Driver) (Option D-3a): This requires only that the driver state reason and justification for vehicle access. If the driver is not "badged" or the driver/vehicle specifically authorized for access, only general rules may be available to security personnel and their decision to permit access would be a matter of judgement, dependent on the driver's word. This method is ineffective and least appropriate for non-employees (strangers).

b. Access Authority Validation (Driver and Documentation) (Option D-3b): This option would require a member of the security force at the vehicle portal to make specific inquiry regarding the driver's purpose and to examine accompanying documentation such as shipping orders, "pick up" request or service orders. This could require a call to the driver's dispatcher, if a document is suspect or not available for inspection. Additional assurance can be gained if verifying documentation is required for vehicle access.

Since forgery is possible, the documentation required will not necessarily prevent an outside adversary from gaining access.

c. Access Authority Validation (Driver/Documentation and Single Verification) (Option D-3c): Requiring supplementary verification by an appropriate licensee employee that vehicle access or egress is authorized (accomplished by calling the person responsible for the origination of requirements) would minimize the possibility of an insider or outsider from acting in collusion. The provision for an additional check on the individual and documents supporting the need for access could generate some additional time in locating a person to validate the need. However, the delay could also induce some trepidation on the part of a potential intruder. An insider/outsider combination could defeat this action in a surreptitious situation.

d. Access Authority Validation (Driver/Documentation and Double Verification) (Option D-3d): This option would require double verification of a need for vehicle access by checking both the dispatcher of the vehicle and the potential recipient of the vehicle service. For a non-employee, this involves a call to the person or company who dispatched the vehicle as well as a call to the person expecting to receive the service or material,

decreasing the probability of collusion between an insider and outsider. This would require rather sophisticated adversary planning to defeat the system.

5. Vehicle Identification

   a. Vehicle Log (Type 1) (Option D-4a): This log (Figure 32) includes a very minimum of information designed to identify vehicle access. Primarily, it identifies the vehicle by association with the driver. However, it is the least desirable data file insofar as vehicle control is concerned.

   b. Vehicle Log (Type 2) (Option D-4b): The Type 2 vehicle log is designed to identify the vehicle together with the driver and occupant. In case of an event, additional vehicle information is available for notification purposes or pursuit. The log serves as an added deterrent in attempting unauthorized access and permits identification of vehicles not owned by employees. However, if license plates were substituted, security personnel would not likely detect this. Typical of a "hotel registration", this log is an improvement in security posture over a Type 1 log (Figure 32).

   c. Vehicle Log (Type 3) (Option D-4c): A Type 3 log (Figure 33) is intended as the requirement for a vehicle to gain access to facilities within the Protected Area. Meeting minimum visitor "registration" requirements, it also includes vehicle data and "check and search" information, necessitating additional risk or effort on the part of a potential adversary.

   d. Vehicle Log (Type 4) (Option D-4d): The Type 4 log is a more comprehensive document to record driver, passenger/helper, carrier and vehicle information including a description of the vehicle, a driver's license check, a carrier address and phone number. (A driver's license check should necessitate additional supplementary personnel identification for assurance as the "legal driver"). Should an incident occur, the "carrier" information would allow "tracing" (Figure 33).

   e. Vehicle Control Number (Option D-4e): This option proposes the stamping or painting of "control" numbers on the vehicle in a location which is not readily visible. Most appropriate for licensee vehicles, it could not be unilaterally adapted to other transient vehicles.

   f. Vehicle Chassis/Motor Number (Option D-4f): For non-licensee vehicles, this is the most appropriate method since it does not alter the vehicle in any way (corresponds to standard "VID" number). Adaptable to licensee vehicles, as well, the concept is illustrated in Figure 34.

   g. Vehicle Bumper Stickers (Option D-4g): Stickers may assist in vehicle control within the Licensee Controlled Area but would not be appropriate for Protected Areas since the sticker could be duplicated.

   h. Vehicle Markers/Strobe Lights (Option D-4h): Vehicles within the Protected Area which were not in designated parking areas or under direct escort would be visually obvious if a removable strobe light were applied to the roof of the vehicle upon entering the area. This would identify it as one

which has potential off-site access readily indicating it to observers as a "strange" vehicle requiring more than casual notice. Magnetically mounted, these lights can be battery powered (Figure 34).

6. Immobilization

   a. Ignition Locks (Option D-5a): A choice of several items to lock vehicle ignition systems are available. A common device is a separate and concealed lock which allows the factory installed mechanism to remain (inoperable) as a "decoy". Other choices include switches wired in series, or adding an extra switch which grounds the negative side of the ignition coil (Figure 35).

   b. Locking Vehicle Doors/Compartments/Ignition (Option D-5b): Locking vehicles is a matter of procedure and discipline. Recommended by law enforcement agencies as a deterrent against vehicle theft, it is frequently ignored and invites unlawful use.

   c. Coded Access (Option D-5c): Coded systems include electronic push-button-type switches which permit starting the vehicle by entering the right code.

   d. Fuel Shut-Off (Option D-5d): Fuel Starvation mechanisms consists essentially of key-activated in-line fuel locks, incorporating a valve which blocks fuel flow to the carburetor. The unit typically mounts in the floorboard and is operable from inside the vehicle (Figure 35).

   e. Wheel Chocks (Option D-5e): Using fixed or moveable chocks, wheels may be chained to permanently fastened objects, precluding wheel rotation. A number of configurations are adaptable for conventional wheeled vehicles and rail cars (Figure 35).

   f. Chain Down (Option D-5f): A simple chain and padlock mechanism is useful to fasten a vehicle to a fixed and immovable object such as a post, wall, building, etc. An alternate scheme might include chaining wheels of several vehicles together (Figure 35).

   g. Steering Lock (Option D-5g): Locking and immobilizing the vehicle steering column may be coupled with a standard ignition lock or separately installed as an optional locking collar or "crook bar" (Figure 35).

   h. Fuel Tank Lock (Option D-5h): Two varieties of lockable fuel tank caps are common. One device locks the hinged gas tank door—another secures the cap at the filler neck. Both are simple key systems advocated as initial and basic security to discourage vehicle and fuel theft (Figure 35).

   i. Special Door Locks (Option D-5i): These replace the standard interior door lock by installation of "theft-proof" lifters without flared heads, defying manual grasping of the lock shaft (Figure 35).

7. Transaction Record

   a. Microfilm (16mm) (Option D-6a): This camera application provides for simultaneously recording a combination of vehicle/visitor pass information, driver's licenses, shipping order/bill of lading, driver/passenger and vehicle identification. It would require surrendering all documentation. However, the result would provide a permanent record of vehicle, persons and documents related to any transaction with recall capability. Some people might object to being photographed. However, the deterrent factor would be improved. A microfilm camera at the entrance to the Protected Area would improve the vehicle/shipment record process (Figure 36).

   b. Film-Other (Option D-6b): Motion picture film camera systems, illustrated in Figure 36, can be used to record pictures of vehicle and driver or passengers but are not particularly adaptable for photographing documents. Hand-held cameras or fixed security cameras can be triggered manually or automatically upon approach of a vehicle. Cameras focusing on one plane would provide greater resolution and print quality. This mode would not integrate pictures of documents, however the "sequence-action" feature might be advantageous when reviewed.

   c. Video Records (Option D-6c): A video-tape recorder system to monitor vehicle access portals could be utilized for permanent playback of a vehicle transaction. This application could be enhanced by reading certain information from the transaction record while the camera scans and records the vehicle and occupants (Figure 36).

8. Tracking

   a. Route/Destination Surveillance (Option D-7a): Routes and destinations of vehicles may be pre-determined, monitored and controlled. Methods might include "bordering" controlled routes with barriers eliminating access to unauthorized areas or tracking the vehicle remotely (Figure 37).

      Costs can be minimized if advantage is taken of other security measures, for example, parking vehicles in areas which are already alarmed or designating routes which are within the line of sight of security personnel observation (References #3, 27, 43, 96, 97, 98, 99, 100 and 107).

   b. Vehicle Route Marking (Option D-7b): This can be accomplished by utilizing a combination of signs and road markers. Road markers may be color-coded to designate the route of various types of vehicles, providing a "norm" for drivers so that deviations from the marked path can be observed. Instructions would be provided to drivers at the point of entry and visual surveillance should follow departure.

   c. Location Systems (Option D-7c): Commonly called "AVLs" (Automatic Vehicle Location Systems) or "AVM" (Automatic Vehicle Monitoring), these are normally considered most applicable to fleet or truck-haul operations. Some adaptation for a small number of vehicles is possible. They are

costly, technical by nature, and have failure potential (Figure 37) (Reference #33, 41, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 131, 133, 123, 124, 125 and 126).

9. Miscellaneous Control

   a. Vehicle/Passenger Separation During Search (Option D-8a): Physical separation of personnel from vehicles is advocated in that (1) a vehicle can be more efficiently searched if distraction from driver/passengers is removed; (2) the possibility of embarrassment to vehicle occupants is reduced; (3) occupants are then denied ready access to concealed weapons; and (4) assurance is gained that neither the driver nor passengers are under a duress situation. Occupants should be allowed to observe the search to minimize allegations that damage was done or items removed without their knowledge.

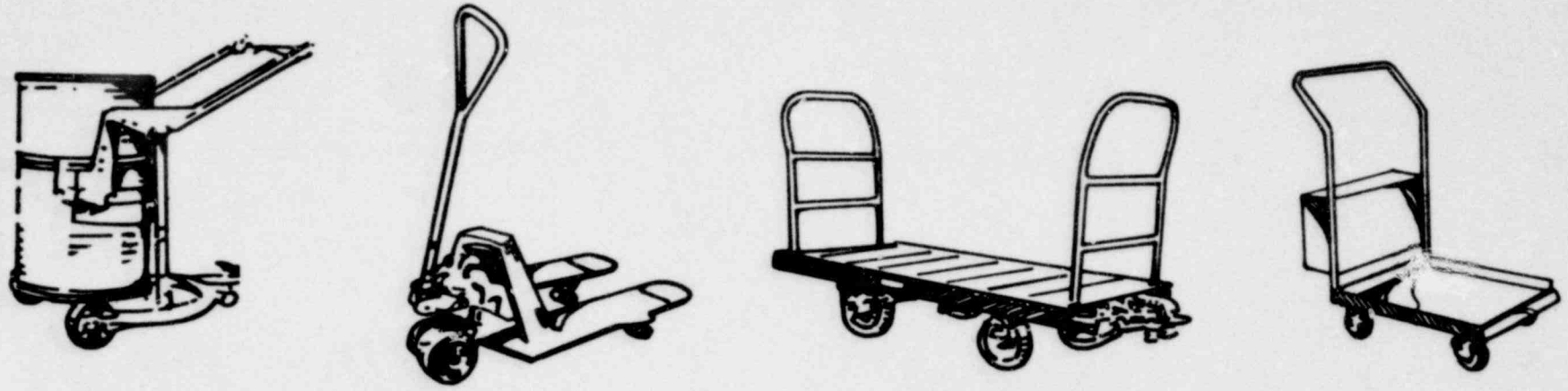
   b. Minimum Vehicle Occupancy (Option D-8b): It is appropriate to permit only a minimum number of vehicle occupants, essential to the vehicle mission in the Protected Area. The possibility of using a site employee as a transition driver is advantageous but some liability may be involved if the licensee's employees operate a non-licensee vehicle.

   c. Post-Search Vehicle Access (Option D-8c): After a vehicle has been searched, subsequent access by any person should be observable. Access should then be limited to that which is necessary.

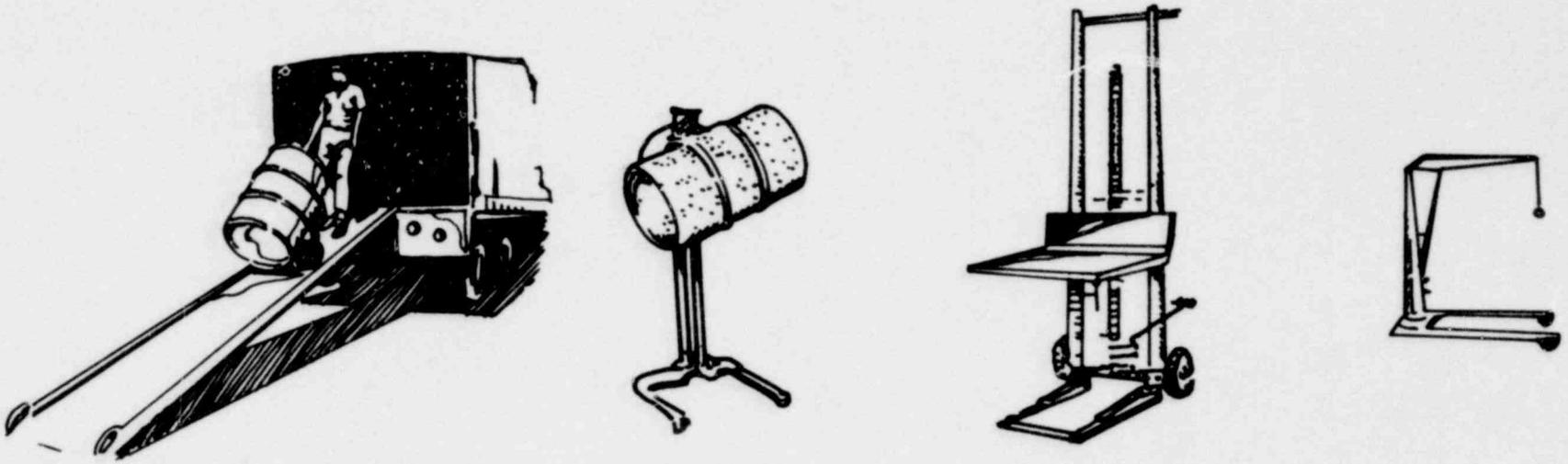
   d. Vehicle Occupant Control at Destination (Option D-8d): Consistent with the requirements of Title 10 CFR Part 73.50 (c) and Regulatory Guides, occupants of vehicles are not to be permitted into security areas any further than necessary. If a vehicle is in the proximity of a Protected Area gate or a Material Access Area gate/door, the escort and surveillance should insure that the vehicle occupants do not have access beyond that point.

   e. Vehicle Occupant Escort (Option D-8e): Escort of vehicles and occupants are separate requirements. As long as the two are physically in the same immediate area and visible to the escort it is reasonable to consider this a single escort requirement. If occupants depart the vehicle within the Protected Area, control and surveillance should be required for both.

   f. Other Vehicle Occupant Control Measures (Option D-8f): Provisions for vehicle occupant "separation" areas is an alternative which has merit if suitable facilities were available. Such an area could provide a comfort/rest accommodation for a driver/passenger as well as positively separating a potential adversary.

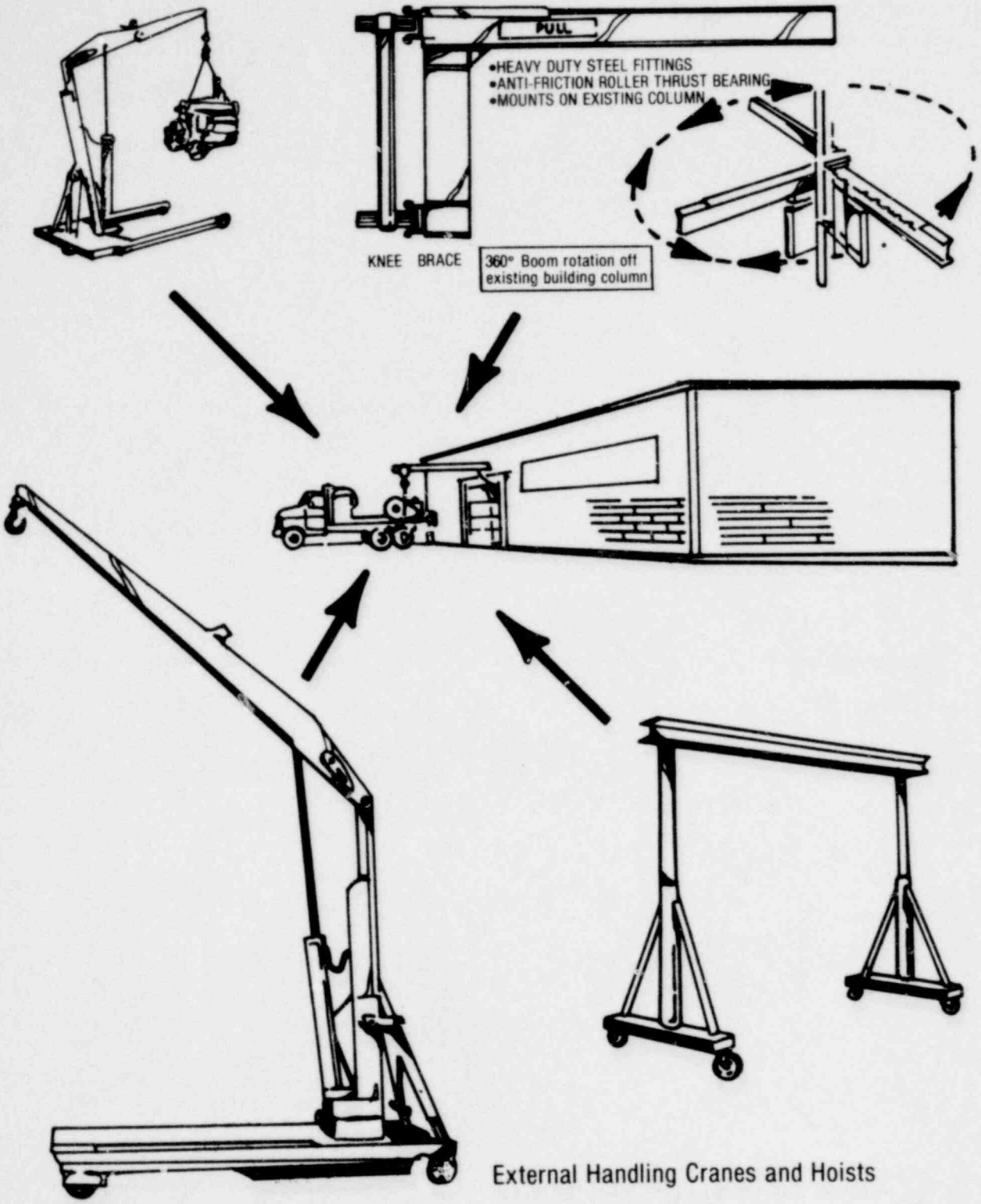


Vehicle Access Denial (Special Nuclear Material Vaults/Vault-type Rooms)
(Option D-1a)



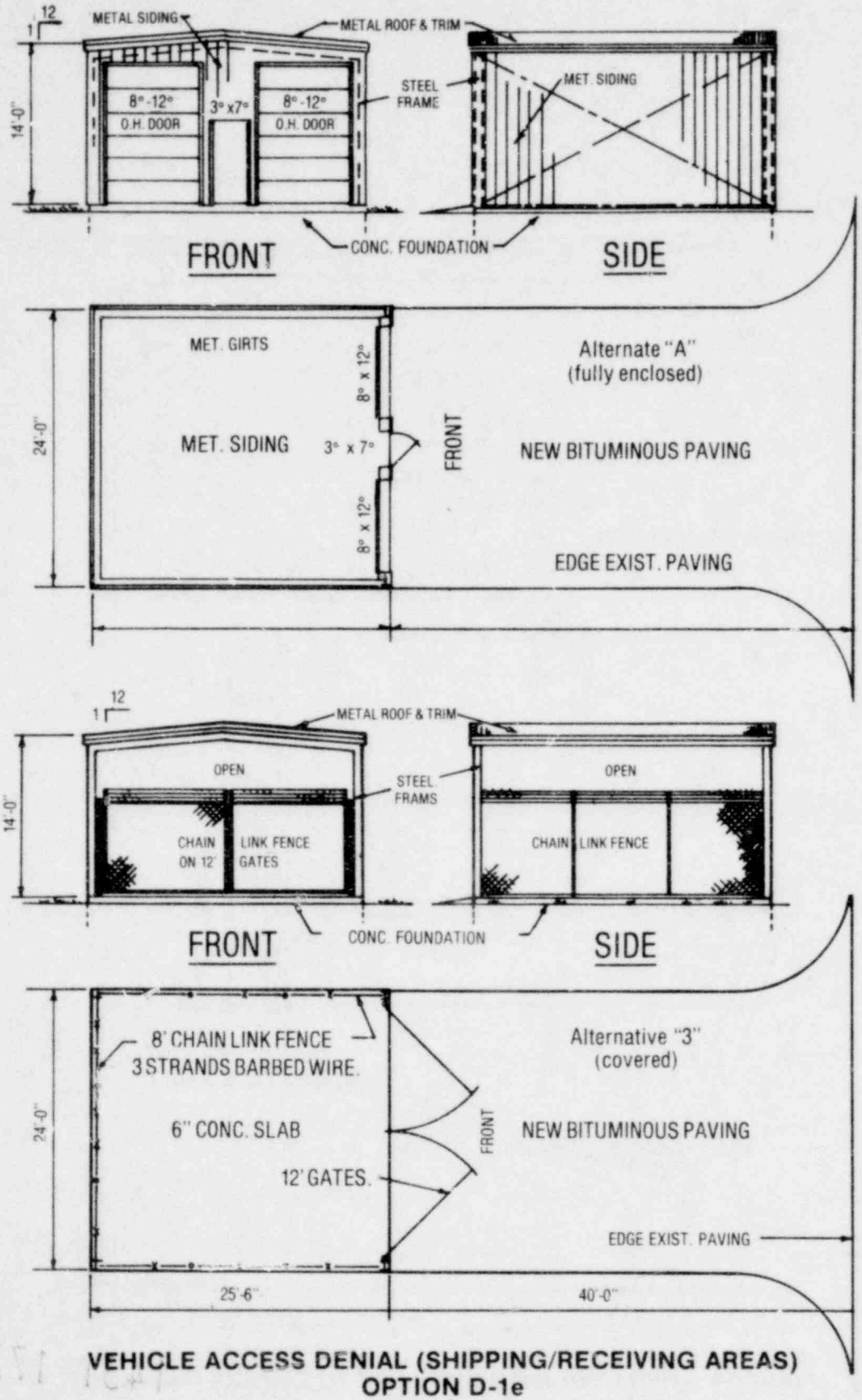
VEHICLE ACCESS DENIAL (MATERIAL ACCESS AREAS)
OPTION D-1b

Figure 27



VEHICLE ACCESS DENIAL (VITAL AREAS)
OPTION D-1c

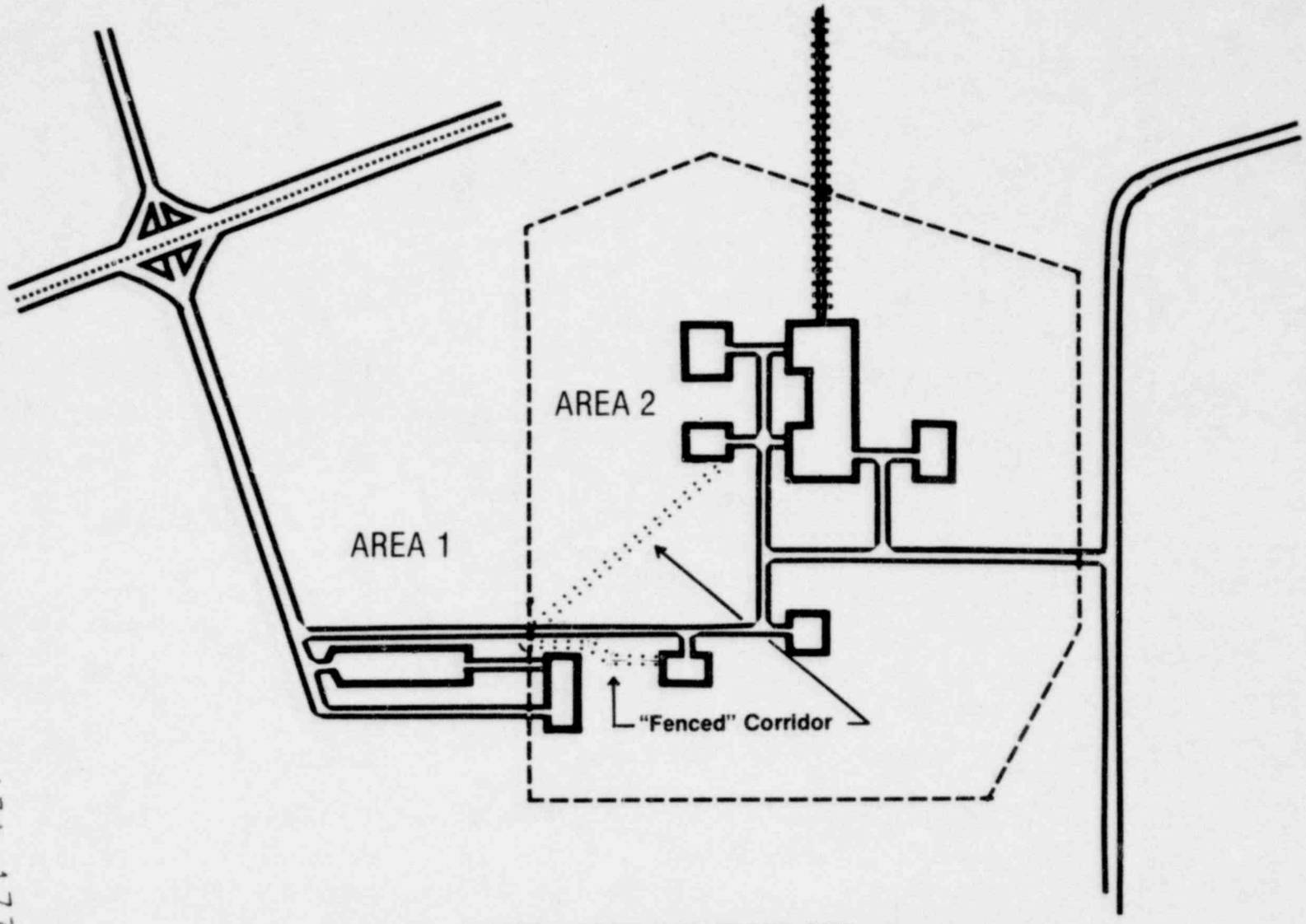
Figure 28



VEHICLE ACCESS DENIAL (SHIPPING/RECEIVING AREAS)
OPTION D-1e

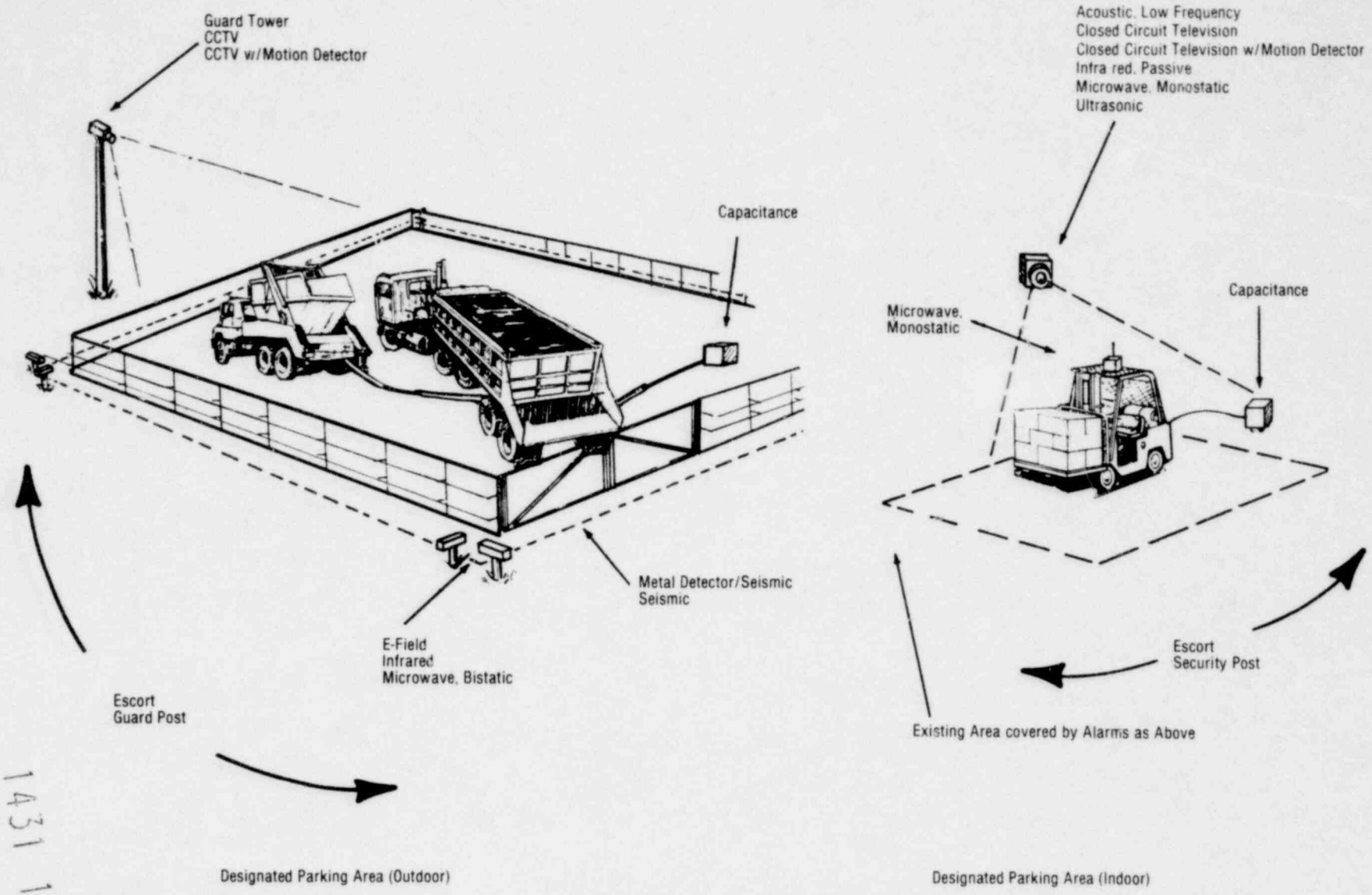
Figure 29

1431 172



ACCESS CORRIDOR/ENVELOPE
OPTION D-2b

Figure 30



DESIGNATED VEHICLE PARKING AREAS
OPTION D-2c

Figure 31

Name _____

Date _____ Time In _____ Time Out _____

Purpose _____

Employer _____

Escort Name _____ Badge No. _____

Individual To Contact _____

U.S. Citizen? Yes _____ No _____ Sign _____

Visitor Badge No. Assigned _____

Vehicle Log (Type 1)
Option D-4a

Name _____ Date _____

Time In _____ Time Out _____ Veh. License No. _____

Veh. Desc. Make _____ Mod _____ Color _____

Purpose _____

Employer _____

Individual Contact _____

Escort Name _____ Badge No. _____

U.S. Citizen? Yes _____ No _____ Sign _____

Visitor Badge No. Assigned _____

Vehicle Log (Type 2)
Option D-4b

VEHICLE IDENTIFICATION

Figure 32

Vehicle Pass-instructions on Back
Driver Name_____ U.S. Citizen? _____
Sign_____ Badge No. _____
Helper Name_____ U.S. Citizen? _____
Sign_____ Badge No. _____
Name of Co._____
Date_____ Time In_____ Time Out_____
License No. _____
Destination_____
Purpose _____
Guard Checked In_____ Searched By_____
Guard Checked Out_____ Searched By _____
Escort_____ Badge No. _____

Vehicle Record (Type 3)
Option D-4c

Instructions

1. Return to guard upon exit.
2. Park only in designated areas or as instructed.
3. Drive only in designated areas or as instructed.
4. Speed limit 10 M.P.H.
5. All vehicles, drivers, passengers and parcels are subject to search upon entry, exit and or while in the area.
6. Stay within direct sight of escort.
7. Follow escorts instructions explicitly.

Drive Carefully

Vehicle Pass-Instructions on Back
Driver Name_____ U.S. Citizen? _____
Sign_____ License No._____Badge No. _____
Helper Name_____ U.S. Citizen?_____
Sign_____ License No._____ Badge No._____
Name of Company _____
Address_____ Phone No._____
Date_____ Time In_____ Time Out_____
Vehicle License No._____ Vehicle No. _____
Description_____
Destination_____
Purpose _____
Guard Checked In_____ Searched By_____
Guard Checked Out_____ Searched By _____
Escort Name_____ Badge No. _____

Vehicle Log (Type 4)
Option D-4d

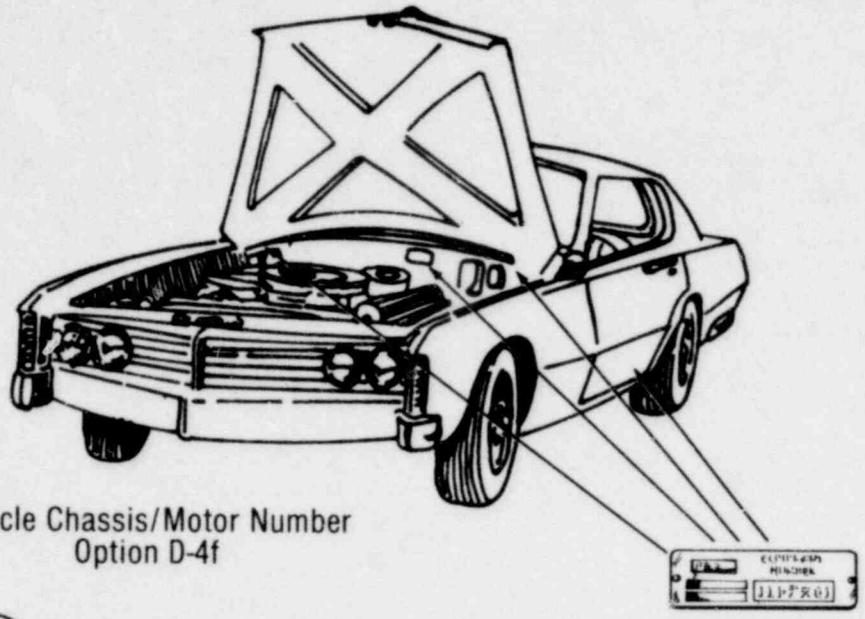
Instructions

1. Return to guard upon exit.
2. Drive only in designated areas or as instructed.
3. Park only in designated areas or as instructed.
4. Speed limit 10 M.P.H.
5. All vehicles, drivers, passengers and parcels subject to search upon entry, exit or while in area.
6. Stay within direct sight of escort.
7. Follow escort instructions explicitly.

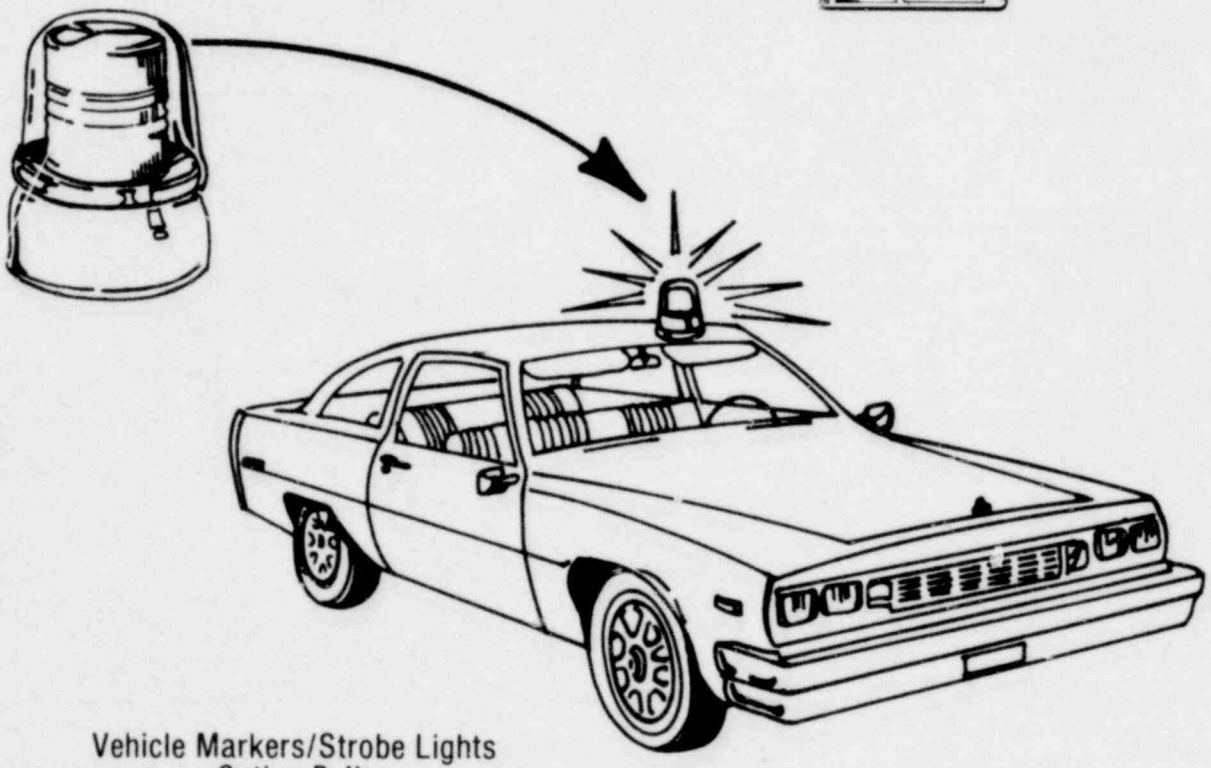
Drive Carefully

VEHICLE IDENTIFICATION
Figure 33

1431 176



Vehicle Chassis/Motor Number
Option D-4f

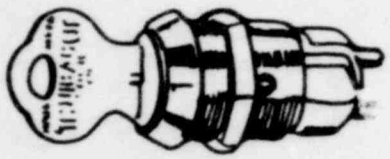


Vehicle Markers/Strobe Lights
Option D-4h

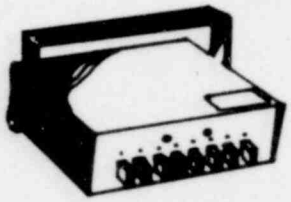
VEHICLE IDENTIFICATION

Figure 34

1431 177



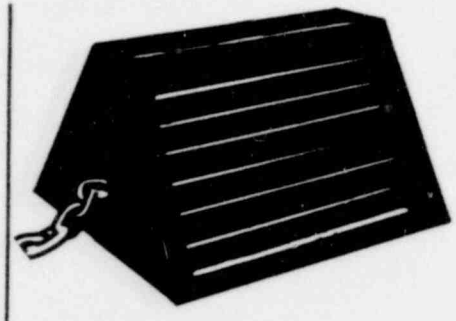
Concealed Ignition Lock



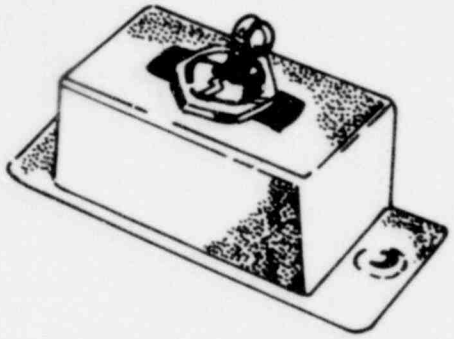
Coded Ignition Lock
Option D-5a

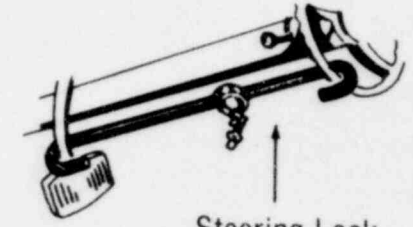
Concealed
Ignition with
Delayed Cut Off

Fuel Shut-Off
Option D-5d

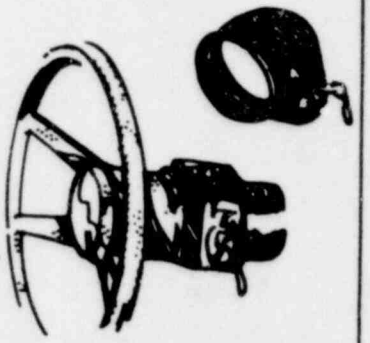


Car or Truck Chock



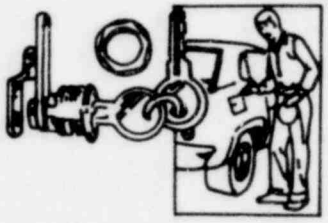


Steering Lock
Option D-5g



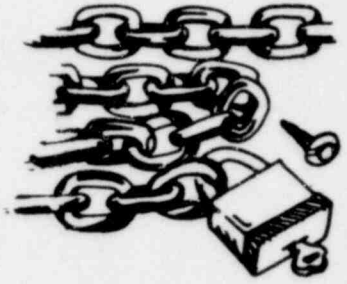
Rail Car Chock

Wheel Chocks
Option D-5e



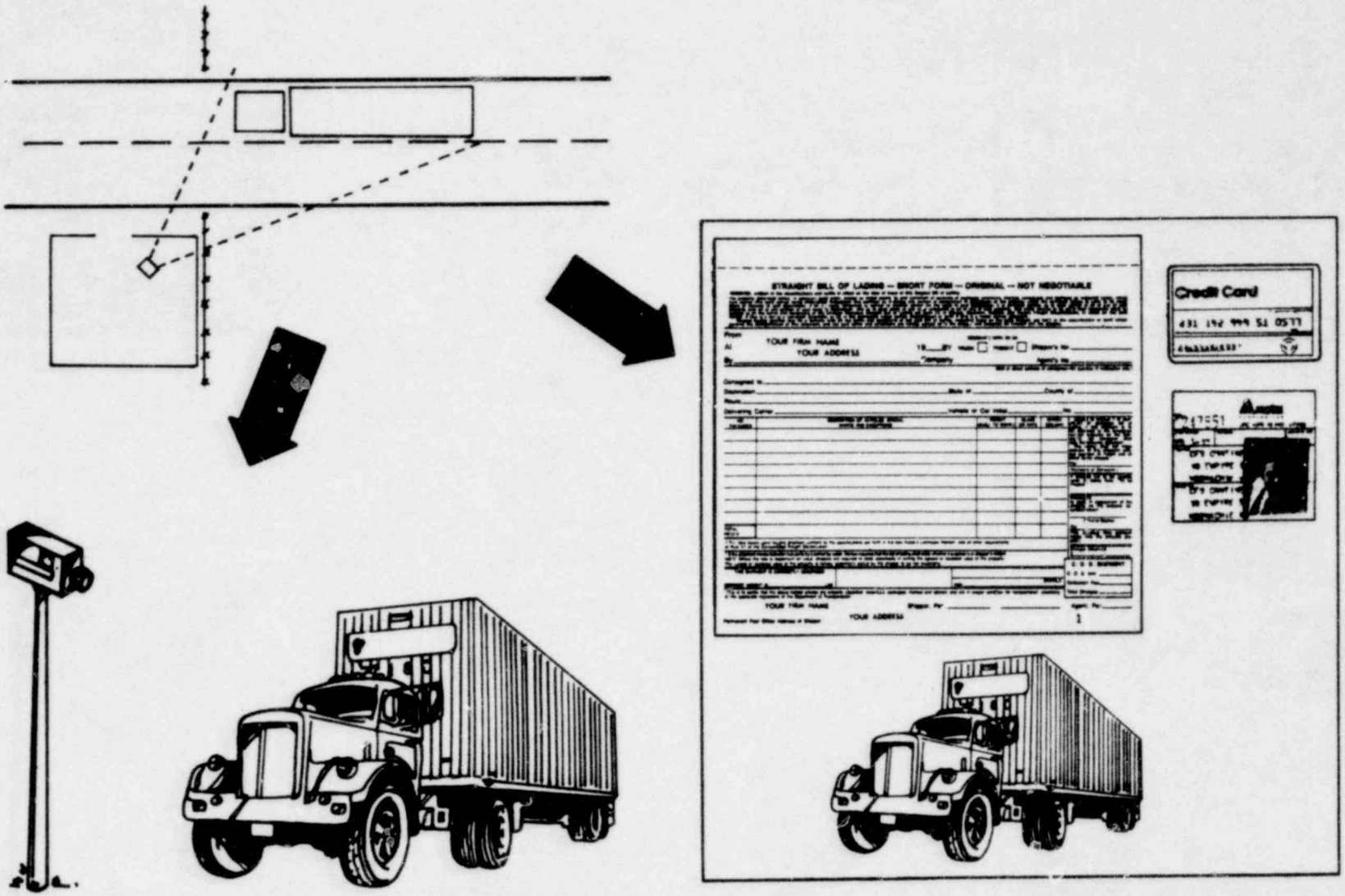
Fuel Tank Lock
Option D-5h

Special Door Locks
Option D-5i



Chain Down
Option D-5f

VEHICLE IMMOBILIZATION DEVICES
Figure 35

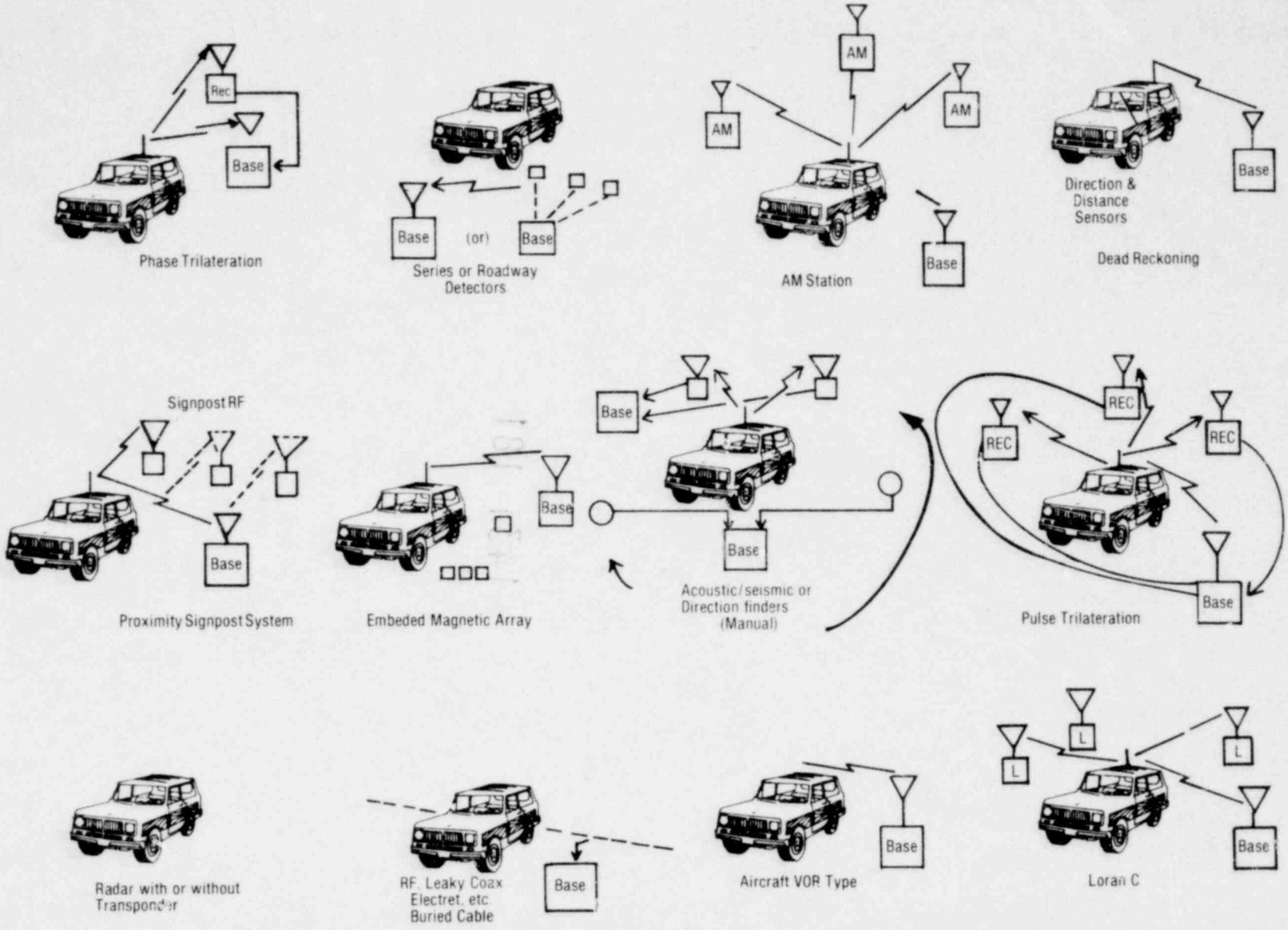


Film/Video Record
Option D-6b Option D-6c

Microfilm
Option D-6a

VEHICLE TRANSACTION RECORD

Figure 36



VEHICLE ROUTE/DESTINATION SURVEILLANCE AND LOCATION SYSTEMS
(OPTION D-7a and D-7c)
Figure 37

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PART X

COST COMPARISONS & ANALYSIS

A. Developing Cost Factors

1. General

In developing an analysis of the alternative for vehicle threat countermeasures and their related costs and benefits, several conditions must be acknowledged.

First, the adoption of any alternative is affected by site configuration, location, area, mission, personnel complement, traffic, operating hours, corporate policy of the Licensee, provisions of the NRC license and legal consideration. Insofar as possible, these distinctive situations were considered in developing cost factors. For example, the range of costs which might be incurred for fencing, earthwork, roadwork, etc., were extended to typical locations where geological characteristics differed widely.

Second, the various alternatives indicated are based on a range of cost expectations. In cases where equipment is discussed, expected "order-of-magnitude" costs were gleaned from literature, advertisements, conversation with sales representative and personnel in various engineering disciplines. To select a preferable option or alternative, a refined cost must be developed and "tailored" to a precise situation at a particular site.

2. Alternatives

For the purpose of analyzing various countermeasure options, these are classified in three alternative groups reflecting:

a. Vehicle threat countermeasures which, in themselves, are most effective although they may not be adaptable at specific sites and may be very costly.

b. Reasonably effective countermeasures, based on a combination of judgement factors; consultation with personnel actively engaged in security applications, and; interpretations of NRC requirements. These are determined to be generally useful in responding to the vehicle threat although there are acknowledged limitations in their application.

c. Least effective measures represent an improvement over no security at all, but have serious weaknesses if relied upon as the sole countermeasure mode. These should be used in conjunction with other devices or as back-up measures when primary systems are inoperative.

3. Cost Data

The Vehicle Countermeasure Option & Cost Comparison schedules in this section are grouped in three ranges of "first costs" and are classified as "high", "moderate" and "low".

"High" costs are those in which a single application exceeds an estimated price of $10,000.

"Moderate" costs require a $5,000 to $10,000 investment for a single application.

"Low" costs are those options estimated at less that $5,000 per application.

For the purpose of this presentation, all costs are in terms of 1978 dollars. Maintenance costs are shown in dollars per annum for a single application. Additional labor and time costs, if applicable, are indicated. Since maintenance and labor costs are extremely variable according to geographic areas, figures are presented for initial comparison and planning purposes. True evaluations must be calculated on a case-by-case basis specific to each site.

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "A" DETERRENCE	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Ditching (Option A-1a)	o			X			$123-$305/LF	90¢/LF	included
Concrete Highway Divider (Option A-1b)	o			X			$25-$32/LF	damage only	included
Concrete Blocks (Option A-1c)		o		X			$100-$200 ea.	damage only	included
Impalements (Option A-1d)		o				X	$20-$135/LF	-0-	included
Steel Guard Rails (Option A-1e)		o		X			$10-$30/LF	$1.50/LF	included
Heavy Equipment Tires (Option A-1f)	o			X			$5-$8/LF	replace only	included
Stone Filled Fence (Option A-1g)	o			X			$90-$115/LF	$1.82/LF	included
Chain Link Fence (Option A-1h)			o	X			$15-$25/LF	$1.50-$2.50/LF	included
Cable Aided Chain Link (Option A-1i)		o				X	$3-$5/LF	30¢/LF	included
Cable Guard (Option A-1j)		o				X	$15-$25/LF	40¢/LF	included
Center of Road Block (Option A-2a)	o			X			$5000-$7000	$300	included
Access Road Modification (Option A-2b)		o		X			$200-$400/LF	$10-$40/LF	included
Vehicle-Blocked Passageway (Option A-2c)	o					X	-0-	-0-	not est.
Dock Plate Barrier (Option A-2d)	o			X			$8,000-$12,000	$400-$600	included
Net (Option A-2e)	o			X			$10,000-$15,000	damage only	included
Double Gate (Option A-2f)		o		X			$9,000-$12,000	$600-$800	included
Steel Gate with Pentrators (Option A-2g)		o				X	$2700-$3700	$60-$80 ea.	included

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "A" DETERRENCE	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Steel Pipe Gate (Option A-2h)		o				X	$1800-$2400	$40-$53 ea.	included
Chain Link Gates (Option A-2i)			o			X	$2500-$3500	$350 ea (avg)	included
Flag Gate (Option A-2j)			o			X	$3000-$4000	$500 (avg)	included
Rail Car Derail/Stops (Option A-2k)	o				X		$3,000-$10,000	$60-$200	included
Special Steel Doors (Option A-3a)	o				X		$4000-$6000	$200	included
Reinforced Concrete Wall (Option A-3b)	o			X			$6-$10/SF	damage only	included
Concrete Block Wall (Option A-3c)		o		X			$4-$12/SF	damage only	included
Brick/Concrete Block Wall (Option A-3d)		o		X			$9-$12/SF	damage only	included
Metal Building Wall (Option A-3e)			o	X			$2-$5/SF	damage only	included
Steel Doors (Option A-3f)			o			X	$800-$1200	$100-$500 ea	included
Concrete/Steel Door Protector (Option A-3g)		o				X	$400-$600 ea	damage only	included
Closed Gate/Door (Option A-3h)			o			X	-0-	-0-	-0-
Spiking Special Nuclear Material (Option A-4a) (Not recommended)	-	-	-	-		-	---not estimated---		
Mock Video Systems (Option A-5a)			o			X	$50-$200 ea	$5-$20 ea	included
Mock Film Camera Systems (Option A-5b)			o			X	$50-$200 ea	$5-$20 ea	included
Dummy Security Devices (Option A-5c)			o			X	$20-$50 ea	-0-	included

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "A" DETERRENCE	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Warning Signs on Vehicle Access Routes (Option A-6a)			o			X	$10-$1000 ea	$2-$50 ea	included
Warning Signs at Vehicle Access Points (Option A-6b)			o			X	$50-$1000 ea	$2-$50 ea	included
Warning Signs at Vehicle Parking Areas (Option A-6c)			o			X	$10-$15 ea	$2-$3	included
Radiation and Hazard Signs (Option A-6d)			o			X	$10-$50 ea	$2-$2.50 ea	included
Other Posted Instructions (Option A-6e)			o			X	$10-$50 ea	$2-$2.50 ea	included
Education Programs (Option A-7a)			o		X		(widely variable --	not estimated)	
Other Devices (Option A-8a) (Not recommended)	-	-	-	-	-	-	---not estimated---		

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "B" SEARCH	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Personnel Detection (Physical/Hand Search) (Option B-1a)	o					X	$500-$2000	$50-$200	.83-$3.00 per search
Weapon and Tool Detection (Physical/ Hand Search) (Option B-1b)		o				X	$500-$2000	$50-$200	.83-$3.00 per search
Explosive/Incendiary Detection (Physical /Hand Searches) (Option B-1c)		o				X	$500-$2000	$50-$200	.83-$3.00 per search
Special Nuclear Material Detection (Physical/Hand Search) (Option B-1d)		o				X	$500-$2000	$50-$200	.83-$3.00 per search
Personal Items (Option B-1e)		o		(Variable)			Depends upon method/	extent of search	
Weapons/Tools (Option B-2a)			o			X	$200-$600	$20-$60	.41-$3.00 per search
Personnel Detection (Option B-2b) (Not recommended)	-	-	-				---	Not Estimated	---
Explosives-Incendiaries (Electronics) (Option B-2c)		o		X			$7500-$20,500	$1500-$4100	.17-.67 per search
Special Nuclear Material Portable Gamma Detector (Option B-3a)		o				X	$1000 approx	$100	.41-$3.00 per search
Special Nuclear Material Fixed Portal Monitor (Option B-3b)		o		X			$12,500	$625	no added cost
Special Nuclear Material Variable-Width Gate Monitor (Option B-3c)		o		X			$12,500-$13,500	$625-$675	no added cost
Special Nuclear Material Special Portal Monitor (Option B-3d)		o				X	$1000-$1500	$150-$225	no added cost

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "B" SEARCH	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Special Nuclear Material Neutron Portal Monitor (Option B-3e) (Not recommended)	-	-	-				---	Not Estimated	---
Special Nuclear Material Thermal Scan (Option B-3f) (Not recommended)	-	-	-				---	Not Estimated	---
Weapons/Tools (X-ray) (Option B-4a)		o				X	$4700	$235-$470	$5.00/photo
Weapons &Tools, Other (Option B-4b) (Not recommended)	-	-	-				---	Not Estimated	---
Explosives/Incendiaries (Option B-4c)			o	X			$4700-$30,000	$470-$3,000	$0.30/minute (assume)
Parcel/Cargo Inspection (Option B-4d)	o			X			Variable	(Not Calculated)	(Not Calculated)
Personnel Detection (Option B-5a)		o			X		$5000-$7500	$2500-$4500	.17-.67 per search
Weapons & Tools (Option B-5b)			o		X		$5000-$7500	$2500-$4500	.17-.67 per search
Explosives/Incendiaries (Option B-5c)		o			X		$5000-$7500	$2500-$4500	.17-.67 per search
Explosive Detection (Animals, General) (Option B-5d) (Not recommended)	-	-	-				---	Not Estimated	---
Personnel (Option B-6a)		o		X			$2000-$13,000	$200-$1300	$20,000/yr
Explosives-Incendiaries (Option B-6b)		o		X			$2000-$13,000	$200-$1300	$20,000/yr
Personnel (Option B-7a) (Not recommended)	-	-	-				---	Not Estimated	---

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "C" SURVEILLANCE	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Two Escorts (Option C-1a)	o			X			$40,000	$1400	$40,000/yr
One Escort (Option C-1b)		o		X			$20,000	$700	$20,000/yr
Security Patrol (Option C-2a)		o				X	-0-	-0-	Variable
Security Post, Existing (Option C-2b)		o				X	-0-	-0-	Variable
Security Tower, Hardened (Option C-2c)		o		X			$75,000	$3,750	Variable
Closed Circuit Television (Option C-2d)		o		X			$500-$13,000	$25-$625	no added cost
Closed Circuit Television w/Motion Detector (Option C-2e)		o		X			$1500-$14,000	$75-$700	no added cost
Microwave, Bi-static (Option C-3a)		o				X	$2400-$5200	$120-$260	included
Microwave, Monostatic (Option C-3b)		o				X	$2000-$1500	$10-$75	included
Microwave, Moving Target (Option C-3c)		o		X			$12,000-$20,000	$600-$1000	included
Microwave, Post Sentry (Option C-3d) (Not recommended)	-	-	-				---	Not Estimated	---
Seismic Point (Option C-4a)		o				X	$50-$1000	$5-$100	included
Seismic (Option C-4b)		o			X		$7500-$8000	$375-$400	included
Capacitance, Indoor (Option C-5a)		o				X	$250-$1000	$25-$100	included
Capacitance, Outdoor (Option C-5b)		o				X	$4000-$6000	$400-$600	included
Electric Field (Option C-5c)		o				X	$800-$1800	$80-$180	included
Electret (Option C-5d)		o				X	$3000-$4000	$300-$400	included

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "C" SURVEILLANCE	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Electromagnetic Field Point Sensor (Option C-5e)		o				X	$300-$500	$30-$50	included
Metal Detectors, Point (Option C-5f)		o				X	$200	$20	included
Metal Detectors, Perimeter (Option C-5g)		o		X			$10,000-$18,000	$500-$900	included
Tape Switches, etc. (Option C-5h)		o				X	$50-$150	$5-$15	included
Enclosed Wire, Pulsed Mode (Option C-5i) (Not recommended)	-	-	-				---	Not Estimated	---
Leaky Co-axial (Option C-5j) (Not recommended)	-	-	-				---	Not Estimated	---
RF Cable (Other) (Option C-5k) (Not recommended)	-	-	-				---	Not Estimated	---
Acoustic, Passive (Option C-6a)		o				X	$50-$200	$5-$20	included
Acoustic, Low Frequency (Option C-6b)		o				X	$800-$1200	$80-$120	included
Ultrasonic (Option C-6c)		o				X	$100-$1000	$10-$100	included
Taut Wire (Option C-7a)		o				X	$400-$2000	$40-$200	included
Fence Vibration Systems (Option C-7b)		o				X	$50-$3000	$5-$300	included
Unique Fluidic, Classification (Option C-7c) (Not recommended)	-	-	-				---	Not Estimated	---
Photo Electric (Option C-8a)		o				X	$50-$200	$5-$20	included
Active Infra red (Option C-9a)		o				X	$150-$300	$15-$30	included

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "C" SURVEILLANCE	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Passive Infra red (Option C-9b)		o				X	$100-$500	$10-$50	included
Vehicle Alarms (Option C-10a)			o			X	$50-$200	$5-$20	included
Seals (Option C-11a)		o				X	$250-$500	$250-$500	5 min/seal
Gamma Intrusion (Option C-12a) (Not recommended)	-	-	-				---	Not Estimated	---
Laser (Option C-12b)		o				X	$600-$1800	$60-$180	included

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "D" CONTROL	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Vehicle Access Denial (Special Nuclear Material Vaults/Vault-type Rooms) (Option D-1a)	o					X	$200-$1500	$20-$150	no added cost anticipated
Vehicle Access Denial (Material Access Areas) (Option D-1b)	o			X			Dependent upon specific site opns.		
Vehicle Access Denial (Vital Area) (Option D-1c)	o			X			Dependent upon specific site opns.		
Vehicle Access Denial (Protected Areas) (Option D-1d)	o			X			Dependent upon specific site opns.		
Vehicle Access Denial (Shipping/ Receiving Areas) (Option D-1e)	o			X			$16,000-$20,000	$800-$1000	100% add if material double/handled
Captive Vehicles (Option D-2a)		o		X			Variable--depends on vehicles required		
Access Corridor/Envelope (Option D-2b)		o		X			Variable--depends on site configuration		
Designated Parking Areas (Option D-2c)		o		X			Variable--dependent on specific needs		
Access Authority Validation (Driver) (Option D-3a) (Not recommended)	-	-	-				---	Not Estimated	---
Access Authority Validation (Driver and Documentation) (Option D-3b) (Not recommended)	-	-	-				---	Not Estimated	---
Access Authority Validation (Driver/ Documentation and Single Verification) (Option D-3c)			0			X	Variable in relation to vehicle traffic		

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "D" CONTROL	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Access Authority Validation (Driver/ Documentation and Double Verification) (Option D-3d)	o					X	Variable in relation to vehicle traffic		
Vehicle Log (Type 1) (Option D-4a)			o			X	$50-$100	$50-$100	5 min/veh.
Vehicle Log (Type 2) (Option D-4b)			o			X	$50-$100	$50-$100	5 min/veh.
Vehicle Log (Type 3) (Option D-4c)		o				X	$250-$500	$250-$500	10 min/veh.
Vehicle Log (Type 4) (Option D-4d)		o				X	$250-$500	$250-$500	20 min/veh.
Vehicle Control Number (Option D-4e)		o				X	$50-$100	-0-	$10/veh.
Vehicle Chassis/Motor Number (Option D-4f)			o			X	-0-	-0-	5 min/veh.
Vehicle Bumper Sticker (Option D-4g)			o			X	$300-$500	$100-$175	10 min/veh.
Vehicle Markers/Strobe Lights (Option D-4h)		o				X	$100-$250	$10-$25	-0-
Ignition Locks (Option D-5a)		o				X	$14-$30	minimal	included
Locking Vehicle Doors/Compartments/ Ignition (Option D-5b)			o			X	-0-	-0-	-0-
Coded Access (Option D-5c)		o				X	$50-$100	minimal	included
Fuel Shut-Off (Option D-5d)			o			X	$20-$30	minimal	included
Wheel Chocks (Option D-5e)		o				X	$50-$100	minimal	as req'd to apply
Chain Down (Option D-5f)		o				X	$25-$50	minimal	as req'd to apply

VEHICLE COUNTERMEASURE OPTION & COST COMPARISON									
CATEGORY "D" CONTROL	ALTERNATIVE			COST			EST. INITIAL COST RANGE (PER UNIT) (1978)	ANNUAL MAINTENANCE COST (EST.)	LABOR OR TIME COST
	A	B	C	Hi	M	Lo			
Steering Lock (Option D-5g)		o				X	$20-$30	minimal	included
Fuel Tank Lock (Option D-5h)			o			X	$10-$15	-0-	included
Special Door Locks (Option D-5i)			o			X	$10-$15	-0-	included
Microfilm (16mm) (Option D-6a)		o				X	$1000-$1500	$100-$150	15 min/veh.
Film-Other (Option D-6b)		o				X	$500-$1000	$500-$1000	-0-
Video Records (Option D-6c)		o			X		$5000-$7000	$250-$350	depends on mode
Route/Destination Surveillance (Option D-7a)		o		X			(High cost--dependent upon mode)		
Vehicle Route Marking (Option D-7b)		o		X			$5000/mile	$500	included
Location Systems (Option D-7c) (Not recommended)	-	-	-				---	Not Estimated	---
Vehicle/Passenger Separation During Search (Option D-8a)		o				X	-0-	-0-	-0-
Minimum Vehicle Occupancy (Option D-8b)		o				X	-0-	-0-	-0-
Post-Search Vehicle Access (Option D-8c)		o				X	-0-	-0-	-0-
Vehicle Occupant Control at Destination (Option D-8d)		o				X	-0-	-0-	-0-
Vehicle Occupant Escort (Option D-8e)		o			X		-0-	-0-	-0-
Other Vehicle Occupant Control Measures (Option D-8f)		o				X	---	Not Estimated	---

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PART XI

SUMMARY

In compiling material for this document, attention was directed to the parameters of vehicle-related threats to reactor sites and fuel cycle facilities. Particular attention was devoted to separating the search and access of people from the vehicle aspect. This material does not treat the subject of personnel access and control although this is a related and integrated problem. However, if appropraite measures are applied to vehicles, some advantages are gained in addressing the personnel access situation. Conversely, some additional problems may be generated.

Briefly summarized, the foregoing sections of this document reveal the following:

A vehicle provides a useful (if not essential) device for an adversary action and the potential exists at reactor sites and fuel cycle facilities for disruptive acts by a dedicated adversary.

If the detailed control and surveillance of vehicle activity is not addressed properly, there can be no reasonable assurance that material useful for sabotage could not be introduced onto a site. Similiarly, the vehicle threat potential degrades assurance that special nuclear material could not be diverted from the site into unauthorized channels.

In some cases an improved security posture can be provided at NRC Licensee sites with little impact on operations costs. In other situations there would be substantial cost/time impact.

A variety of options are available for achieving security objectives related to vehicle access and control. Their thoughtful selection and use can reduce vehicle-related threats to power plants and fuel cycle facilities.

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PART XII

GLOSSARY OF TERMS
(as used in this document)

1. Access: Ability or permission to approach or enter.

2. Adversary: Opponent or enemy (in this document, specifically, one intent upon a forceful or covert action to steal special nuclear material or initiate a radiological incident.)

3. Alarm: An audible or visual signal, actuated by electrical, electronic, nuclear, sonic or other sensing methods and designed to indicate a specific condition (usually an abnormality).

4. Authorized Individual: Any individual, including an employee, a consultant, or an agent of a Licensee, who has been designated in writing by the Licensee to have responsibility for surveillance of special nuclear material.

5. Barrier: Impediments to unrestricted movement, specifically devices and means used to inhibit vehicle entry into controlled access areas (also, see "Physical Barrier" and Title 10 CFR Part 73).

6. CCTV-"Closed Circuit Television": A locally installed dedicated network of cameras and monitors. (May be fixed for single point observation or moveable for selected examination as required.)

7. Continuous Visual Surveillance: Unobstructed view at all times of a vehicle or person and of all access to a temporary storage area or cargo compartment. (Title 10 CFR Part 73.2) Also see "Surveillance" in the glossary.

8. Control: In this document, a generic term used to indicate cognizance or awareness. Preceeded by an adjective where necessary for specificity. Also see Part IX of this document.

9. Controlled Access Area: Any temporarily or permanently established clearly demarcated area, access to which is controlled and which affords isolation of material, equipment or persons within it. (Title 10 CFR Part 73).

10. Countermeasure: An opposing measure or action designed to counter a vehicle-related threat.

11. Deceit: Methods used to attempt to gain unauthorized access or introduce or remove unauthorized materials where the attempt involves falsification to present the appearance of authorized access. (Title 10 CFR Part 73)

12. Deterrence: Application of various impediments designed to stop, interrupt or prevent an anticipated event.

13. Dummy (Device): An artifical, non-functional imitation designed to convey the impression of authenticity.

14. Escort (ed): Accompanied by an employee of the NRC Licensee.

15. Explosives: Chemical compounds potentially capable of causing damage as a result of explosion or burning. Includes "10W" explosives such as black powder or "high" explosives such as dynamite.

16. Force: Potentially violent methods used to attempt to gain unauthorized access or to introduce unauthorized materials into or remove strategic special nuclear material from Protected Areas, Vital Areas, Material Access Areas, Controlled Access Areas or transports. (Title 10 CFR Part 73)

17. Formula Quantity: Strategic special nuclear material in any combination in a quantity of 5,000 grams or more computed by the formula, grams = (grams contained U-235 + 2.5 (grams U-233 + grams plutonium). (Title 10 CFR Part 73).

18. Fuel Cycle Facility: In the same context as Title 10 CFR Part 70 defining a "Plutonium processing and fuel fabrication plant."

19. Security Personnel: A uniformed individuals armed with firearms whose primary duty is the protection of special nuclear material against theft, the protection of a plant against industrial sabotage, or both. (Title 10 CFR Part 73)

20. Hardened: Defensive position meeting Underwriter's Laboratory Standard UL 752,

21. Incendiary: Flammable material capable of producing intense heat upon ignition. "Incendiary Device" means any self-contained devise intended to create an intense fire that can damage normally flame resistant or retardent materials. (See Title 10 CFR Part 73).

22. Intrusion Alarm: A tamper-indicating electrical, electromechanical, electrooptical, electronic or similar device which will detect intrusion by an individual into a building, protected area, vital area, or material access area, and alert guards or watchmen by means of actuated visible and/or audible signals. (Title 10 CFR Part 73)

23. "Isolation Zone": Any area, clear of all objects which could conceal or shield an individual, adjacent to a physical barrier and which is monitored to detect the presence of individuals or vehicles within the area. (Title 10 CFR, Part 73)

24. License: A license issued pursuant to Title 10 CFR.

25. Licensee: The holder of a license issued pursuant to Title 10 CFR.

26. Lock (Locked): Identical to definition in Title 10 CFR Part 73.

27. Material Access Area (MAA): Any location which contains special nuclear material, in a vault or building, the roof, walls, and floor of which each

constitute a physical barrier. (Title 10 CFR, Part 73, Section 73).

28. Munitions: In this document, war material containing explosives capable of being diverted for radiological sabotage action.

29. "NRC": The Nuclear Regulatory Commission.

30. Perimeter: Boundary

31. "Physical Barrier": Identical to the definition specified in Title 10, CFR, Part 73.2.

32. "Physical Search": "Hands-on" methods of verification, including the use of mechanical devices, instrumentation, assistance by animals, etc.

33. Portal: Entrance

34. Power Plant Facility: See "Reactor Site"

35. Protected Area (PA): An area encompassed by physical barriers and to which access is controlled. Defined by Title 10 CFR, Part 73.

36. Radiological sabotage: Any deliberate act directed against a site in which an activity licensed pursuant to NRC regulations is conducted, or against a component of such a plant or transport which could directly or indirectly endanger the public health and safety by exposure to radiation. (See Title 10 CFR Part 73.2)

37. Reactor Site: An NRC-licensed installation operating a nuclear reactor.

38. Search: See "Physical Search"

39. Security Supervision: Persons, not necessarily uniformed or armed, whose primary duties are supervision and direction of security at the day-to-day operating level. (Title 10 CFR Part 73)

40. Shielding: Utilization of material (primarily metals) to impede radioactive emission and hide the presence of special nuclear material.

41. Site Authorized Personnel: Those employees of the Licensee or other personnel specifically allowed by the Licensee's security procedures to have access to the Licensee's site.

42. Special Nuclear Material: Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which pursuant to the provisions of the Atomic Energy Act, NRC determines to be special nuclear material or any material artifically enriched by any of the foregoing. (Does not include source material). See Title 10 CFR Part 70.

43. SSNM (Strategic special nuclear material): Uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium-233, or plutonium. (See "Formula quantity")

44. SST (Safe-Secure Transport): Specially designed wheeled vehicle units expressly used by DOE for over-the-road movement of nuclear material in specific configurations.

45. Surveillance: The act of watching, escorting, observing.

46. Threat (Vehicle): Dangerous activity implemented through the use of a vehicle.

47. Vault: A windowless enclosure constructed with walls, floor, roof and door(s) that will delay penetration appropriate to the response time of the local law enforcement authority that would respond to safeguards contingencies at the site. (Title 10 CFR Part 73)

48. Vault-type Room: A room with one or more doors, all capable of being locked, protected by an intrusion alarm which creates an alarm upon the entry of a person anywhere into the room and upon exit from the room or upon movement of an individual within the room. (Title 10 CFR Part 73)

49. Vehicle: Passenger automobile, truck, truck/trailer, van, railroad car, motorcycle, motorized construction equipment, powered material handling equipment.

50. Vital Area (VA): Any area which contains vital equipment. (Title 10 CFR, Part 73)

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PART XIII

LIST OF REFERENCES

1. E. Christopherson. PNL Nuclear Materials Safeguards Studies 1968-1975. Battelle-Pacific Northwest Labortories. BNWL-2082. August 1976.

2. Code of Federal Regulations - 10 CFR Energy.

3. Plant Security Force Duties. U. S. Nuclear Commission. Regulatory Guide, 5.43. January 1975.

4. Joint ERDA—NRC Task Force on Safeguards. NUREG 0095. July 1976.

5. S. Matteson. "What's Happening in Transport Security?" Security World. Volume 14, No. 8. August 1977.

6. Sourcebook of Criminal Justice Statistics - 1976. U.S. Department of Justice, Law Enforcement Assitance Administration. February 1977.

7. G. D. Wilson. Cargo Security Systems. Proceedings - 1975 Carnahan Conference on Crime Countermeasures.

8. W. Powell. The Anarchist Cookbook. Lyle Stuart Inc. May 1976.

9. C. R. Newhauser. Bomb Security Guidelines. The National Bomb Data Center.

10. "Security Digest". Security World. Volume 14, No. 9 September 1977.

11. G. Seman, L. Elias, Detection of Hidden Explosives on Passenger Aircraft Using Hand Searches, Bio-Sensors and Vapour Detectors. Proceedings - 1977 International Conference on Crime Countermeasures.

12. "N-Plant Bombed". Seattle Post-Intelligencer, October 10, 1977.

13. Disorders and Terrorism. Report of the Task Force on Disorders and Terrorism. National Advisory Committee on Criminal Justice Standards and Goals. 1976.

14. Explosives and Demolitions. U.S. Department of Army Field Manual, FM5-25.

15 Military Explosives. U.S. Department of Army. TM-9-1910.

16. Vehicle Barriers - Sandia Laboratories - "Barriers Handbook" in preparation. October 1977.

17. R. T. Moore. Barrier Pentration Tests. NBS Technical Note 837. June 1974.

18. W. E. Kunz, et. al. Hand Held Personnel and Vehicle Monitors. Los Alamos Scientific Laboratory, LA-6359. September 1976.

19. I. B. White, et.al. Personal Interview Relative to Barriers, Sandia Laboratories, 1977.

20. L. G. Gref, et.al. An Assessment of Some Safeguards Evaluation Techniques. U.S. Nuclear Regulatory Commission, NUREG-0141. February 1977.

21. Concrete Median Barrier Research, Volume 2. Federal Highway Administration. FHWA-RD-77-4. March 1976.

22. Denatured Plutonium: A Study of Deterrent Action. Prepared by General Electric Company for EPRI. EPRI-310. July 1975.

23. Entry-Control Systems Handbook. Sandia Laboratiories. SAND-77-1033. September 1977.

24. Intrusion Detection Systems Handbook - Volume I and II. Sandia Laboratories. SAND 76-0554. November 1976.

25. Catalog of Physical Protection Equipment. U.S. Nuclear Regulatory Commission. NUREG 0274. December 1976.

26. Training, Equipping, and Qualifying of Guards and Watchmen. U.S. Nuclear Regulatory Commission. Regulatory Guide 5.20. January 1974.

27. Visual Surveillance of Individuals in Material Access Areas. U.S. Nuclear Regulatory Commission. Regulatory Guide 5.14. November 1973.

28. Barrier Designs. Unpublished information prepared by Mason & Hanger-Silas Mason Co., Inc. December 1977.

29. W. T. Payne, O. B. Van Dyck. Electromagnetic Intrusion Detection Techniques for Air Base Defense, etc. Mitre Corporation. December 1972.

30. R. F. Bell. An Intrusion Detector for Parked Aircraft. Proceedings -1970 Carnahan Conference on Electronic Crime Countermeasures.

31. J. A. Prell. Basic Considerations for Assembling a Closed-Circuit Television System. Office of Standards Development, U.S. Nuclear Regulatory Commission. NUREG-0178. May 1977.

32. C. M. Hay, R. E. Moore. Development of Passive Electrostatic Field Effect Intrusion Device. Proceedings - 1970 Carnahan Conference on Electronic Crime Countermeasures.

33. R. L. McLean. LOCATES. Proceedings - 1973 Carnahan Conference on Electronic Crime Countermeasures.

34. G. K. Miller. Development of Electret Transducer Line Sensors. Proceedings - 1974 Carnahan and International Crime Countermeasures Conferences.

35. K. M. Duval, R. W. Scott. Development of a Perimeter Sensor Using a Buried Electret Cable. Proceedings - 1975 Carnahan Conference on Crime Countermeasures.

36. G. K. Miller. Active Ultrasonic Tape Perimeter Security System. Proceedings - 1976 Carnahan Conference on Crime Countermeasures.

37. N. V. Daras, P. R. Franchi, R. L. Fante. An R.F. Intrusion Sensor for Isolated Resources. March 1977.

38. F. Schwarz. Design and Application of a Widefield, Passive, Infrared Intrusion Detector. Proceedings - 1973 Carnahan Conference on Electronic Crime Countermeasures.

39. J. F. Haben, J. F. Scarzello. Law Enforcement Applications of Magnetic Sensors. Proceedings - 1972 Carnahan Conference on Electronic Crime Countermeasures.

40. D. W. Hardwick, Personal Interview on Moving Target Radar Status, December 1977.

41. J. G. Constantine, M. D. Dickinson. Acoustic Source Location Using Long Base Line Techniques. First International Electronic Crime Countermeasures Conference. 1973.

42. A Report to the President of the National Cargo Security Program. Secretary of Transportation. March 1977.

43. Security Seals for the Protection of Special Nuclear Material. U.S. Nuclear Regulatory Commission. Regulatory Guide 5.15. January 1975.

44. L. E. Koehler, T. Rahman, C. Tettemer. Pulsed-Mode Enclosed Wire Transducer. April 1977.

45. D. A. Close, R. B. Walton, A Gamma Ray Perimeter Alarm System.

46. "Microwave, Post Sentry," Minutes of IRS Meeting. January 1977.

47. J. O. Selland, A. Bark. A Mobile Laser Fence for Aircraft Security. Proceedings - 1973 Carnahan Conference on Electronic Crime Countermeasures.

48. R. M. Neilsen, R. J. Thompson, G. Weber. Vehicle Intrusion Sensor. Chrysler Corporation. January 1973.

49. Guide for Selecting, Locating and Designing Traffic Barriers. American Association of State Highway and Transportation Officials. 1977.

50. G. F. W. McCaffizey. Improvement in Cable Barrier Design. National Aeronautical Establishment. October 1972.

51. Field Fortifications. U.S. Department of Army. FM5-15. June 1972.

52. D. Keehan, Personal Interview. U.S. Army Mobility Equipment Research and Development Command. Ft. Belvoir, Virginia. 1977.

53. J. Piper. Personal Interview. INSCO. Springfield, Virginia. 1977.

54. A. T. Torlesse. Cadaver Detection. Proceedings - First International Electronic Crime Countermeasures Conference, 1973.

55. E. E. Dean. A Feasibility Study on Training Infantry Multipurpose Dogs. Southwest Research Institute. NTIS AD-746998. July 1972.

56. D. D. Greathouse, et.al. Personal Interview at Lackland Air Force Base, Military Dogs Studies Branch. January 1978.

57. E. E. Dean, et.al. Personal Interview at Southwest Research Institute, San Antonio, Texas. January 1978.

58. Military Working Dog Program. U.S. Air Force. AFM-125-5.

59. G. B. Biederman. The Detection of Stressful Individuals - A Feasibility Study. National Research Council, Canada. CAS 74/6. Restricted.

60. P. De L. Markham. The Probe and Other Development in Explosives Detection in Canada. National Aeronautical Establishment Committee on Aviation Security. CAS-77/2. Restricted.

61. J. W. Heisse. Audio Stress Analysis - A Validation and Reliability Study of Psychological Stress Evaluator. Proceedings - 1976 Carnahan Conference on Crime Countermeasures.

62. R. E. McGione. Test of Psychological Stress Evaluator (PSE) as a Lie and Stress Detector. Proceedings - 1975 Carnahan Conference on Crime Countermeasures.

63. H. Robeson, J. L. Birchfield. Robbery Protection Systems and Devices for Temporarily Disabling the Robber and Visibly Marking His Location. Proceedings - 1974 Carnahan and International Crime Countermeasures Conference.

64. The Prospector. A Brochure Prepared by S & D Security Ltd.

65. Narcotic-Explosive Detector Dogs. Southwest Research Institute. NTIS AD-756939.15L.

66. Olfactory Activity in Selected Animals-Conducted During the Period June 1972 to September 1974. Southwest Research Institute. NTIS Ad-787-495/156. September 1974.

67. D. S. Mitchell. Selection of Dogs for Landmine and Booby Trap Detection Training. U.S. Army Mobility Equipment Research and Development Command. DAAK02-73-C-0150. 1976.

68. D. S. Mitchell. Training and Employment of Landmine and Booby Trap Detector Dogs. U.S. Army Mobility Equipment Research and Development Command. DAAK02-73-C-0150.

69. D. S. Mitchell. User's Guide: Landmine and Booby Trap Detector Dogs. U.S. Army Mobility Equipment Research and Development Command. DAAK02-73-C-0150. 1976.

70. Patrol Dog Explosive Detection. A Study Guide Prepared by the USAF. USAF 3AZR81150A-2. March 1976.

71. Patrol Dogs, Explosives Detection. U.S. Air Force Film. FLC-16-0254.

72. A. A. Sterk, P. A. Johnson. Automatic Airline Baggage Weapons Detection System. Proceedings - 1973 Carnahan Conference on Electronic Crime Countermeasures.

73. G. M. Worth, et.al. A Portable Gamma-Ray Detection System for Location of Radioactive Sources. Los Alamos Scientific Laboratory. LA-UR-76-1241. June 1976.

74. T. E. Sampson. Gamma Ray Detector Optimization of Mobile Detectors. Los Alamos Scientific Laboratory. LA-UR-76-852. May 1976.

75. J. W. Campbell, J. J. Aragon. A Gamma Sensing Activatory For The Secure Surveillance Camera System-Model C. Sandia Laboratories. SAND 76-0420. September 1976.

76. C. Henry, E. J. Dowdy. Nuclear Safeguards Research and Development Program Status Report. Los Alamos Scientific Laboratory. LA-6849-PR August 1977.

77. Visa - A Method for Evaluating the Performance of Integrated Safeguards Systems at Nuclear Facilities - Volume II. Science Applications, Inc. SAI-77-590-LJ. June 1977.

78. Effects of Lead Shielding on 235U. Sandia Laboratories Unpublished Information. December 1977.

79. Technical Evaluation of IRT Corporation Model PRM-110 Doorway Monitor. Division of Safeguards and Security ERDA. March 1975.

80. J. L. Martinez, G. J. Cunningham. A Prototype Vehicular Gate Monitor. Dow Chemical Company. CRDL-950442-119. May 1974.

81. D. M. Ledbetter. "Description of a SNM Gate Monitor - Gamma."

82. D. M. Ledbetter. "Description of a SNM Gate Monitor - Neutron."

83. "Detection of Explosives by Dogs - Trials". R.A.R.D.E. Memorandum 29/73. December 1973.

84. "Analysis of the FY 1977 Explosive Detection K-9 Team Evaluations". Unpublished Information Provided by the U.S. Department of Transportation, FAA.

85. "Analysis of the FY 1976 Explosives Detection K-9 Team Evaluations." Unpublished Information Proivided by the U.S. Department of Transportation, FAA.

86. "Analysis of the FY 1975 Explosive Detection K-9 Team Evaluations." Unpublished Information Provided by the U.S. Department of Transportation, FAA.

87. D. D. Greathouse, Personal Correspondence, U.S.A.F. Military Dog Studies Branch. August 1977.

88. R. O. Heck, Personal Interview, Program Coordination, L.E.A.A., 1977.

89. F. Geary, Personal Interview, Rockville, Maryland. Police Department. August 1977.

90. Vapor Detection Systems for Explosives. General Information Bulletin 75-5 Prepared by National Bomb Data Center.

91. W. D. Williams, Personal Interview Relative to Undocumented Tests. Sandia Laboratories. January 1978.

92. D. D. Smith, "Explosive Detector Evaluations," Unpublished Reprint by Union Carbide, Oak Ridge, Tennessee. October 1977. Restricted Distribution.

93. L. Elias, M. Krzymien. Method of Evaluating Sensitivity of Explosives Vapor Detectors. National Aeronautical Establishment - Canada. January 1975.

94. Membrane Technology in Trace Gas Detection - Part II: Evaluation of the ITI Model 62 Explosives Detector/Identifier. U.S. Army Mobility Equipment Research and Development Center. AD B005-380L. March 1975. Restricted.

95. G. B. Biederman. Detection of Explosives by Animals in an Automated Setting-2. National Research Council, Canada. CAS 77/6. May 1977. Restricted.

96. Shipping and Receiving Control of Special Nuclear Material. U.S. Nuclear Regulatory Commission. Regulatory Guide 5.57. June 1976.

97. Procedures for Picking Up and Receiving Packages of Radioactive Material. U.S. Nuclear Regulatory Commission. Regulatory Guide 7.3. May 1975.

98. Special Nuclear Material Doorway Monitors. U.S. Nuclear Regulatory Commission. Regulatroy Guide 5.27. June 1974.

99. Internal Transfers of Special Nuclear Material. U.S. Nuclear Regulatory Commission. Regulatory Guide 5.49. March 1975.

100. Control of Personnel Access to Protected Areas, Vital Areas and Material Access Areas. U.S. Nuclear Regulatory Commission. Regulatory Guide 5.7. June 1973.

101. Prevention of Terroristic Crimes: Security Guidelines for Business, Industry and Other Organizations. Prepared by the Private Security Advisory Council to the Law Enforcement Assistance Administration. May 1976.

102. J. Jackson, et.al. An Electronic Tag for Theft Control. Proceedings - 1969 Carnahan Conference on Electronic Crime Countermeasures.

103. N. Freedman. Raytag, An Electronic Remote Data Readout System. Proceedings - 1973 Carnahan Conference on Electronic Crime Countermeasures.

104. P. DeBruyne. Coded Label Additional Security Protection System - CLASP First International Electronic Crime Countermeasures, 1973.

105. J. D. Maier, et.al. A Passive Electronic Tag System. Proceedings - 1976 Carnahan Conference on Crime Countermeasures.

106. T. P. Kabaservice. The Criminal Uses of False Identification - A Statement of a National Problem. Proceedings - 1976 Carnahan Conference on Crime Countermeasures.

107. Protection of Nuclear Power Plants Against Industrial Sabotage. U.S. Nuclear Regulatory Commission. Regulatory Guide 1.17.

108. J. M. Beukers. The Practical Application of Loran-C Radio Signals to the Precision Location and Tracking of Remote Objects. Proceedings - 1970 Carnahan Conference on Electronic Crime Countermeasures.

109. G. S. Kaplan, H. Staras. An X-Band Signpost Vehicle Location System. Proceedings - 1972 Carnahan Conference on Electronic Crime Countermeasures.

110. C. E. Wilent. Automatic Vehicle Surveillance Systems. Proceedings - 1972 Carnahan Confernce on Electronic Crime Countermeasures.

111. R. L. Saslaw. An Active TDOA Locate and Track System. Proceedings - 1973 Carnahan Conference on Crime Countermeasures.

112. C. R. Stobart. A Signpost Aided Dead Reckoning System for Automatic Vehicle Monitoring. Proceedings - 1974 Carnahan and International Crime Countermeasures Conference.

113. C. C. Freeny, O. A. Reichardt. An Economic AVM Stystem. Proceedings - 1974 Carnahan and International Crime Countermeasures Conference.

114. R. G. Furth. A Magnetic Array Proximity AVM System. Proceedings - 1974 Carnahan and International Crime Countermeasures Conference.

115. G. R. Hansen. AVM - Is There a System for Your City. Proceedings - 1974 Carnahan and International Crime Countermeasures Conference.

116. D. K. Belcher, R. W. Sellers. Vehicle Position Monitoring System. Proceedings - 1975 Carnahan Conference on Crime Countermeasures.

117. W. K. Vogeler. Vehicle Location with Loran-C. Proceedings - 1975 Carnahan Confernece on Crime Countermeasures.

118. J. E. Simes, J. S. Howell. A Personal Alarm System for Prison Officers. Proceedings - 1976 Carnahan Conference on Crime Countermeasures.

119. R. W. Lewis, T. W. Lazniak, A Report on the Boeing Fleet Location and Information on Reporting System (FLAIR). Proceedings - 1976 Carnahan Conference on Crime Countermeasure.

120. G. D. Wilson. Selection Factors for Police Automatic Vehicle Location Systems. Proceedings - 1977 Carnahan Conference on Crime Countermeasures.

121. R. C. Larson, et.al. Evaluation AVM System. National Institute of Law Enforcement and Criminal Justice. June 1977.

122. Automatic Vehicle Location Techniques for Law Enforcement Use. National Institute of Law Enforcement and Criminal Justice. LESP-RPT-0205.00. September 1974.

123. L. P. Tuttle, W. R. Vogeler. Application of Loran C to Vehicle Tracking. Telecom, Inc.

124. Location of Vehicles Using AM Station Broadcasting Signals, A NASA Tech Brief, B-74-10300.

125. Hoffman Electronics, Personal Interview. December 1977.

126. R. D. Doering. Feasibility Study: Automatic Vehicle Locator System - Orlando Police Department. Proceedings - 1974 Carnahan and International Crime Countermeasures Conference.

127. Overhead Crane Handling Systems for Nuclear Power Plants. U.S. Nuclear Regulatory Commission. Regulatory Guide 1.104. February 1976 (For Comment).

128. D. Winters. Photo Surveillance. Proceedings - 1969 Carnahan Conference on Electronic Crime Countermeasures.

129. E. D. Spear. LODIF-anIR Surveillance Camera. Proceedings - 1970 Carnahan Conference on Electronic Crime Countermeasures.

130. Fixed Surveillance Cameras - Selection and Application Guide. A User Guideline Prepared by the Law Enforcement Assistance Administration. NILECJ-Guide-0301.00. December 1974.

131. R. K. Harmon. Guidar: An Intrusion Detection System for Perimeter Protection. Proceedings - 1976 Carnahan Conference on Crime Countermeasures.

132. "Search Information - Unpublished." Provided by Department of Treasury, U.S. Customs Serivce. July 1977.

133. Detailed Automobile Search Checklist. Department of Treasury, Bureau of Alcohol, Tobacco and Firearms. ATF Training 5145-07 (B-72).

134. C. R. Newhauser. Bomb Scene Procedures - The Protective Response. The National Bomb Data Center.

135. Mechanics of the Car Search. International Association of Chief of Police. Training Key Number 31.

136. R. J. Blaine, Personal Interview. U.S. Federal Correctional Institution, Lexington, Kentucky. December 1977.

137. Scope of Legal Authority of Private Security Personnel. Private Security Advisory Council - LEAA, U.S. Department of Justice. August 1976.

138. J. J. Sullivan, "Legal Authority of Security Personnel," Security Management, Volume 10, No. 2. February 1973.

139. Proser, Smith. Torts. Foundation Press, 1967.

140. ANSI. Industrial Security for Nuclear Power Plants. ANSI Standard N18.17, March 1973.

141. Artillery Ammunition - Guns, Howitzers, Mortars and Recoilless Rifles. Department of Army TM 0-1300-203 (1967).

142. Blasters Handbook. DuPont, 15th.

143. Cook, M.A., The Science of High Explosives, Reinhold Publishing Corporation, New York (1958).

144. Dick, R. A., The Impact of Blasting Agents and Slurries on Explosives Technology, United State Department of Interior, Bureau of Mines, Information Circular 8560 (1972).

145. ERDA. Nuclear Fuel Cycle. ERDA 33, March 1974.

146. The Nuclear Industry 1974. WASH-1174-74.

147. Explosives Series - Properties of Explosives of Military Interest, Engineering Design Handbook, AMC Pamphlet AMCP 706-177, 1967.

148. GAO. An Unclassified Digest of a Classified Report Entitled "Commercial Nuclear Fuel Facilities Need Better Security". EMD-77-40'a. May, 1977.

149. GAO. Security at Nuclear Power Plants at Best, Inadequate, EMD-77-32, General Accounting Office.

150. Glancy, J. E., Safeguards Implementation Practices for a Model Mixed Oxide Recycle Fuel Fabrication Facility. BNL-21049. Science Applications, Inc. May 1976.

151. Glancy, J. E., Design Information Questionnaire for A Model Mixed Oxide Fuel Fabrication Facility. BNL-21048. Science Applications, Inc. May 1976.

152. Lawrence Livermore Laboratories. Data and Analysis Used In Security Forces Comparison Study. UCRL-51954 Supplement. November, 1975 (Classified).

153. Military Explosvies. Department of Army Technical Manual TM 9-1300-214, 1967.

154. NRC. Draft Environmental Statement on Transportaion of Radioactive Material by Air, & Other Modes. NUREG, 0034, March 1976.

155. NRC. Interim Acceptance Criteria for a Physical Security Plan for Nuclear Power Plants (Draft), NUREG 0220. March, 1977.

156. NRC. Security Agency Study - Report to Congress on the Need for, and the Feasibility of Establishing a Security Within the Office of Nuclear Material Safety and Safeguards. NUREG-0015, August 1976.

157. Safety in Construction Manual - Explosives, Employers Mutual, Wausau, Wisconsin (1948).

158. U.S. Atomic Energy Commission. Materials Protection Contingency Measures for Uranium and Plutonium Fuel Manufacturing Plants. Regulatroy Guide, June 1974.

159. U.S. Atomic Energy Commission. Perimeter Intrusion Alarm Systems. Regulatory Guide 5-44, Revision 1, June 1976.

160. U.S. Atomic Energy Commission, Plant Security Force Duties. Regulatory Guide 5.43, January 1975.

161. U.S. Atomic Energy Commission. Shipping and Receiving Control of Special Nuclear Material. Regulatory Guide, (for comment) June 1976.

162. U.S. Atomic Energy Commission. Training, Equipping, and Qualifying of Guards and Watchmen, Regulatory Guide 5.20, January 1974.

163. U.S. Atomic Energy Commission. Visual Surveillance of Individuals in Material Access Areas. Regulatory Guide 5.14, November 1973.

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16. ABSTRACT (200 words or less)

This document has been prepared as an aid in planning a vehicle access and control system at nuclear fixed site facilities. In this document, various threats have been postulated and countermeasures proposed. Although many of the threats and countermeasures may exceed those presented in Title 10, Code of Federal Regulations,(CFR), Part 73, this was done to present an in-depth study of planning options that might apply to each nuclear fixed site facility. Therefore, the reader should keep in mind the following: (1) options presented need not be considered as requirements which have to be met to comply with Title 10, Code of Federal Regulations (CFR Part 73.2) and (2) overall, the options may appear to vary between inadequate and very excessive. However, when considered as part of a particular facility's physical security system, any one option may prove to be of the most value in helping to reduce the threat to that facility.

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