CHAPTER 5

DECONTAMINATION

The idea behind decontamination is relatively the same for a fixed site as for a tactical unit. Personnel need to decontaminate to reduce the hazard and spread of a contaminating agent.

Additionally, both the fixed site and tactical unit have the goal of recovering the unit back to an acceptable level of operational effectiveness. The inability of the site to move makes decontamination a more critical capability. Therefore, the fixed site commander will need to establish decontamination operations to obtain and maintain this acceptable level of effectiveness.

DECONTAMINATION PRINCIPLES

There are four decontamination principles (from FM 3-5) that can be applied to fixed sites.

DECONTAMINATE AS SOON AS POSSIBLE

This is emphasized as the most important principle of decontamination, since it is necessary to remove any contamination that forces personnel into a higher MOPP level. This is basically the first step in recovering a site's mission effectiveness by personnel decontaminating themselves, their personal equipment, and critical, mission essential equipment that they operate.

DECONTAMINATE ONLY WHAT IS NECESSARY

For fixed sites, decontamination is more of a manpower resource constraint rather than a time constraint. With this in mind, the commander must decontaminate only mission essential equipment first and equipment in a mission support role such as maintenance and supply functions. The mission of the site will determine the decontamination effort. Equipment and/or areas contaminated should be marked appropriately. A prime example of this principle is the loading and unloading of supplies on a boxcar at a site with railheads. Since the fixed site does not have the manpower nor the right amount of decontamination equipment to decontaminate the entire boxcar, the boxcar's door handle, the outer side, and the lip edge are decontaminated to prevent the spread of contamination into the boxcar, onto personnel, and supplies.

LIMIT SPREAD OF CONTAMINATION

Decontamination is another way of supporting contamination control by limiting the spread of contamination. Through the application of this decontamination principle, we begin to limit the spread of contamination into work areas, rest and relief areas, equipment, and supplies. Next, the commander must consider moving the decontamination effort to contaminated personnel and equipment on the site, for fear of spreading more contamination to other parts of the site, and possibly personnel and equipment entering and leaving the site.

DECONTAMINATE BY PRIORITY

Items such as wheeled vehicles, forklifts, and railcars, which are critical to the site's overall mission, will need to receive decontamination first in order to get effective use out of available decontamination assets. Therefore, the commander should establish a set of priorities. These priorities may be broken down by functional area, if the site performs various missions, such as maintenance (light and heavy), ammunition repair and supply, and general supply.

METHODS

Because fixed facilities can not relocate, contamination will spread through the movement of material and personnel. Decontamination capabilities will be integrated into essential work areas plus rest and relief areas to limit the spread of contamination. Some methods for integrating decontamination into different types of work areas include the following:

- Decontaminate interiors of office or storage buildings with large commercial heaters.
- Decontaminate loading docks, entries and exits, and building exteriors with STP, soap and water, M13 DAP, M280 DKIE, or commercial equipment such as firetrucks.

The decontamination equipment can be architecturally embedded and designed to accommodate the throughput of each work area. For instance, rest and relief shelters need rapid personnel decontamination systems and supply operations need a decontamination system that can handle moderate size pieces of equipment but at a very high volume. Light maintenance needs a system that can decontaminate equipment that is sensitive to harsh decontaminate or water (see Figure 5-l), and heavy maintenance needs a system that can clean large equipment (see Figure 5-2).

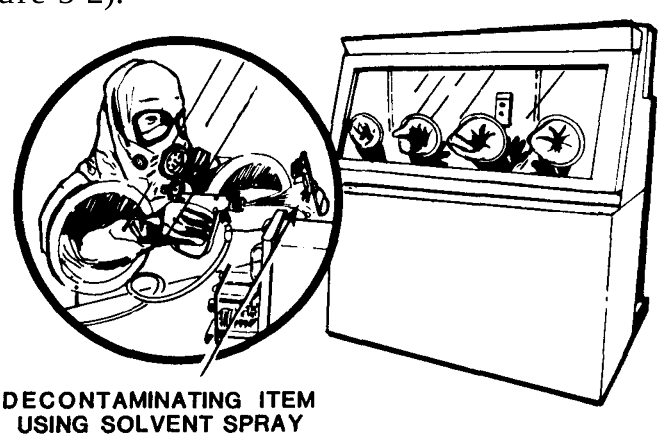


Figure 5-1. Nonaqueous equipment decontamination system (NAEDS).

Decontamination equipment can also be mobile for the decontamination of equipment, roads, and buildings. It will be used for limited (partial) decontamination to prevent the spread of contamination to equipment, roads, or buildings that are considered vital for continued operations. Figure 5-3 is an example of mobile decontamination. In Figure 5-3, the M13 portable decontaminating apparatus is used to apply the decontaminant (DS2), and the M17 lightweight decontaminating system is used for the prewash and rinse.

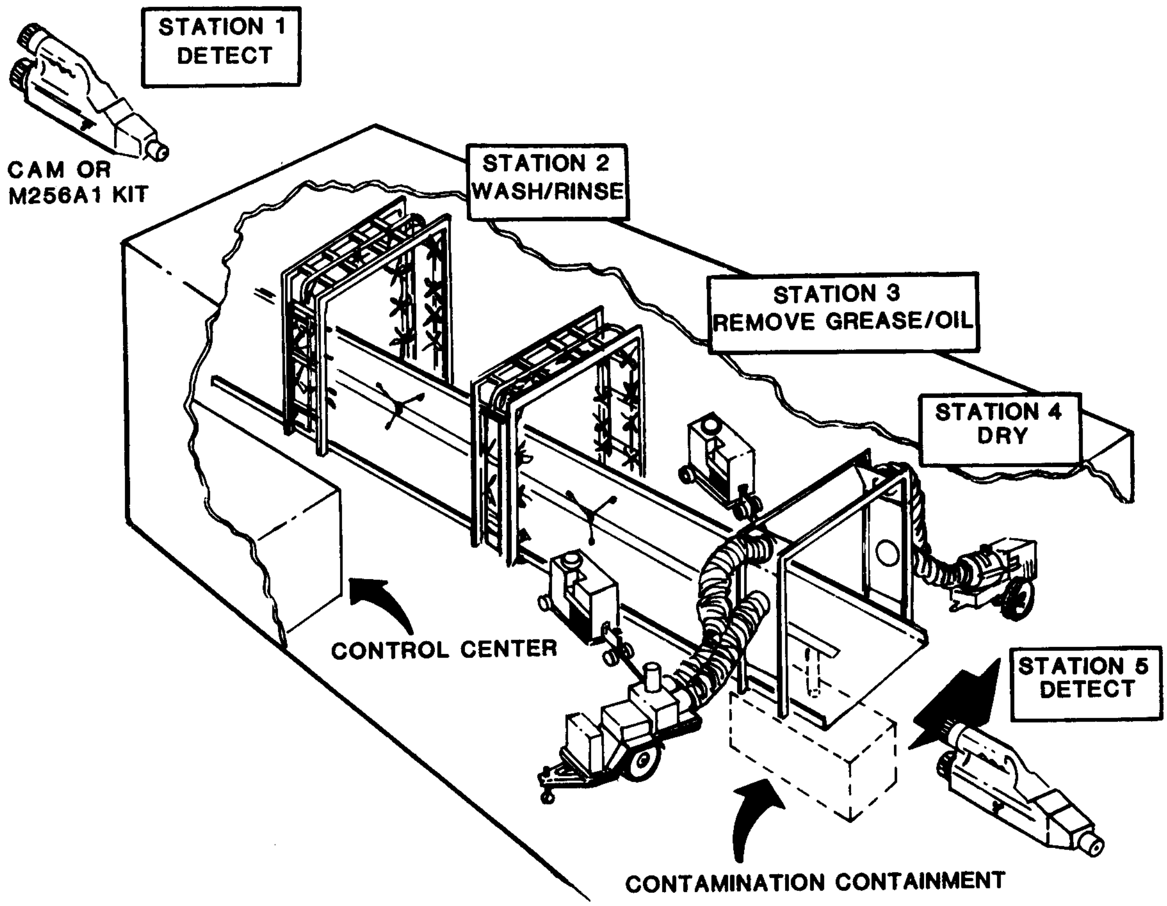


Figure 5-2. Decontamination bulk cleaning station.

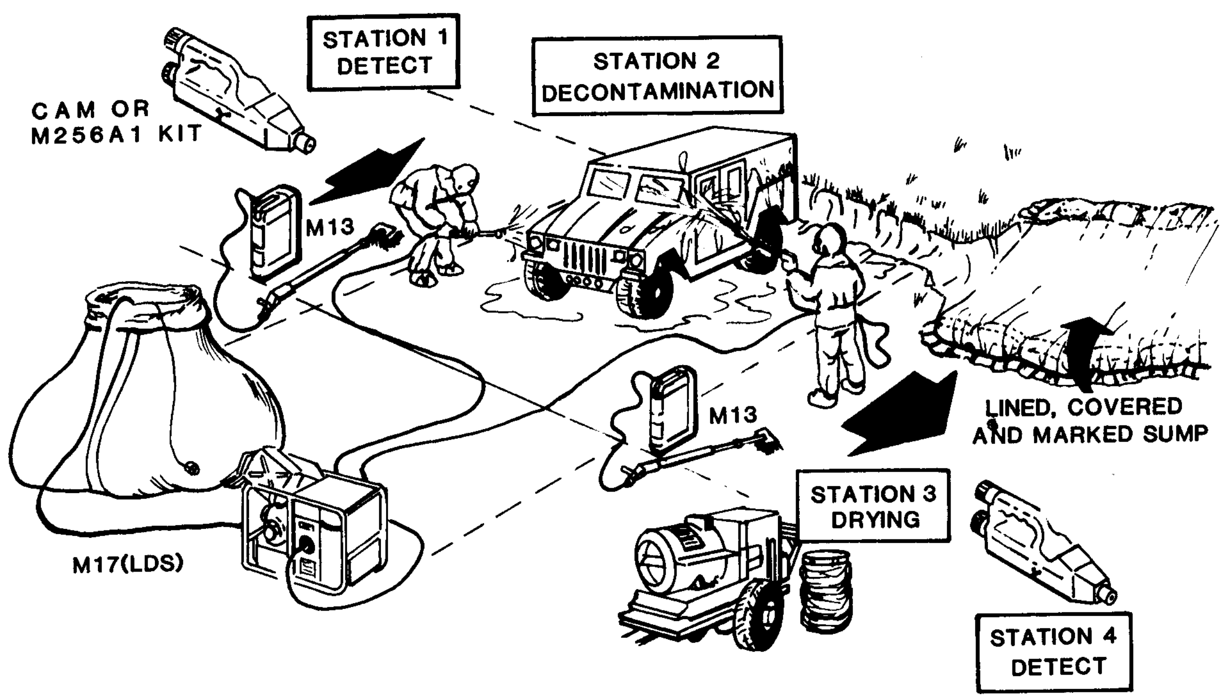


Figure 5-3. Mobile fixed site decontamination.

There is a four station set-up using currently fielded equipment requiring control of contaminated runoff. (The CAM is not currently fielded to all units and is not considered to be a near term item for fixed sites.)

The commander must apply the two levels of decontamination discussed in FM 3-5, partial. and complete. Partial decontamination will reduce the transfer hazard by decontaminating select surfaces of equipment, roads, and buildings. Complete decontamination will eliminate contamination from equipment so that maintenance can be performed at the site in a toxic-free environment or for equipment leaving the site to a toxic-free environment. Figure 5-4 shows a list of suggested decontaminants and their usage, which would be useful in determining the possible level of decontamination.

DECONTAMINANTS	USAGE
STB	Mission-essential buildings, roofs, roads, terrain.
Weathering	Non-mission-essential buildings, roofs, roads, terrain, vehicles.
Accelerated Weathering	Buildings exterior and interior vehicles.
Soap/Detergent and Water	Roads, buildings, windows, vehicles.
M280 DKIE	Entry/exit areas, small tools and equipment, windows.
DS2	Vehicles, machinery.
M258A1	Personal skin decontamination.

Figure 5-4. Fixed site decontaminants.

Sometimes an apparatus not normally used for decontamination can be used in support of decontamination operations. For example, fire trucks and commercial high-pressure cleaners can be integrated into the decontamination effort. The cost, training, and logistics burden can be minimized for those sites having this equipment organic to them. These two pieces of equipment can replace the decontamination apparatus in the prewash and rinse station in an equipment decontamination line in Figure 5-3. This can be thought of as tailoring a piece of equipment for decontamination for a particular fixed site. A decontamination system can be developed from one or both of these pieces of equipment with the addition of a decontamination applicant (M13) and a heater for drying. This then becomes a single flexible system designed to meet the needs of partial and complete decontamination. Use of this system can fulfill the decontamination requirements of the primary wash, decontaminant application, and rinse steps of complete equipment decontamination. Also, the partial decontamination requirements will be met through selective use of some equipment from the system. For instance, the high water pressure capability can be used to remove large amounts of accumulated soil. with contaminants. The optimum water pressures and flow rates have been determined to be within 800 to 1,500 pounds per square inch (psi) and 3 to 6 gallons per minute (GPM). Currently, three 65-GPM pumps and a water tank are required to supply water to the operation (two 65-GPM pumps for the primary wash station and one 65-GPM pump for the rinse station). Conduct a site analysis to determine what organic assets could be used in a decontamination role, such as steam cleaners, washracks, fire hydrants, buildings containing showers for personnel decontamination, and organic bodies of water (for example, a lake, creek, or stream).

In decontamination operations, control of contaminated runoff will be important in limiting the spread of contamination. This may be questionable for sites that become contaminated from an NBC attack. Even so, limit the extent of contamination as much as possible. Figure 5-3 shows construction of a simple contamination runoff system in which the contaminated runoff can be covered and marked. For a centralized decontamination area that is permanent in nature, such as washracks and the example in Figure 5-2, a more sophisticated contamination runoff system is required (see Figure 5-5).

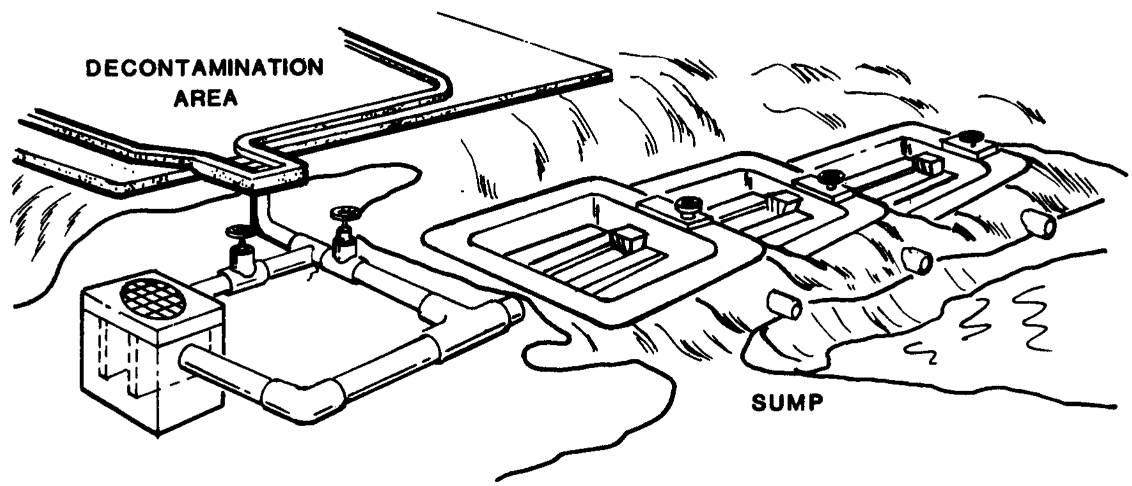


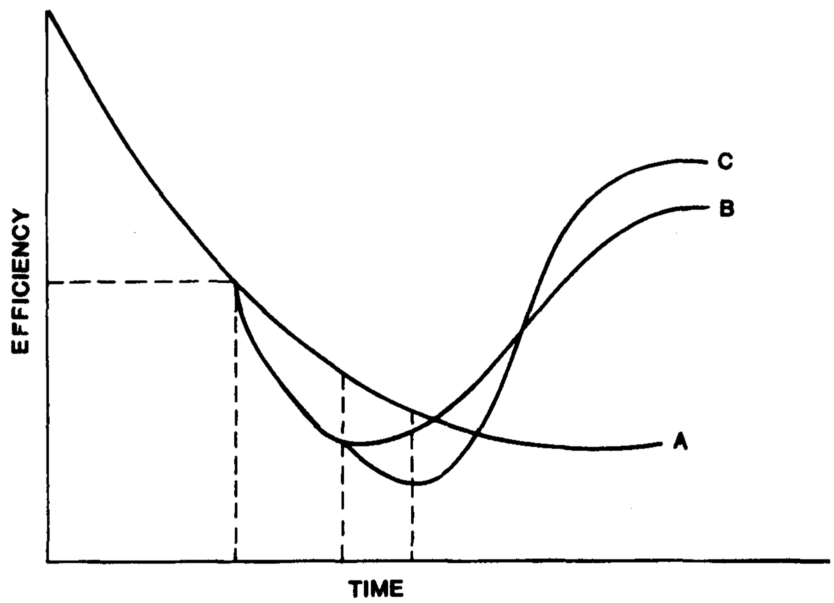
Figure 5-5. Control of contaminated runoff.

Radiological contamination is not affected by the weather or the other variables that affect chemical contamination; see FM 3-3 for radiation decay rates. Flushing, covering, and clearing are effective ways of removing and reducing radiological contamination. However, radiological contamination cannot be neutralized like CB contamination; it also should not be burned since that may spread the contamination. See FM 3-5 for further details on decontamination of NBC contaminants.

Commanders must first consider equipment and personnel assets available and required to implement decontamination measures at fixed sites. The commander will ensure that an individual decontamination capability and an operator and crew equipment decontamination capability exist, as a minimum. Personnel will need to be diagnostically evaluated to determine training shortfalls for operation and maintenance support of equipment, both the military and civilian workforces.

PLANNING

A fixed site must employ decontamination measures at some time after an NBC attack is initiated. A method to consider, when deciding to decontaminate and at what extent, is taking something that is measurable, such as efficiency of output, and graphically depicting its progress over a period of time. It is easy to assume that, without decontamination, the site's efficiency will decrease over the period of time that personnel must operate in MOPP4. Therefore, an efficiency trade-off will have to be made to recover a certain degree of effectiveness. That is, a site stops operations for a certain amount of time to do decontamination to recover operations to a desired level. Thus, the decontamination effort applied should be proportional to the recovery in efficiency. See the following graph in Figure 5-6.



A -- DEGRADATION IN OPERATIONS WHILE PERFORMING NO DECONTAMINATION.

B -- DELAY IN OPERATIONS IN ORDER TO PERFORM DECONTAMINATION TO ACHIEVE A CERTAIN LEVEL OF EFFECTIVENESS.

C -- FURTHER DELAY IN OPERATIONS IN ORDER TO RECEIVE AN INCREASED BENEFIT FROM DECONTAMINATION.

Figure 5-6. Decontamination methodology efficiency trade-off.

As you see in the example, curve A represents degradation of efficiency to a certain amount without decontamination. Curve B represents operations being stopped to decontaminate for a certain length of time and producing an increase in efficiency to a certain level. Notice that curve B shows a greater degradation of efficiency than curve A for this trade-off. Curve represents further degradation of efficiency with an increasing amount of time used to decontaminate producing a greater increase in efficiency.

A commander might ask the following questions when analyzing the decontamination dilemma:

- How soon after the attack can the essential function be regained if no operational recovery measures are attempted?
- How soon after the attack can the essential functions be regained if only those operational recovery measures immediately available to the installation are employed?
- What countermeasures are required to permit the essential functions to be regained at a specified time after attack?

In considering the first question, commanders must realize that without doing any recovery measures they run the risk of lost productivity due to degradation caused by MOPP and increase the chance of contamination spreading. The graph in Figure 5-6 and the methodology behind it provides you with the solution to this first question. The second question gives the commander a good indication whether he has a substantial decontamination capability or not. That is, can effective decontamination be performed so as to limit the spread of contamination and reduce the level of hazard created by contaminating agents? The answer to the third question can be derived from preceding chapters and the methods section of this chapter.

To assist commanders in decontamination operations, a decontamination decision matrix is provided at Figure 5-7. The decision matrix is designed to be entered each time a decontamination operation needs to take place. Notice that matrix differentiates between an on-target and off-target attack. It takes into account that manpower and equipment constraints will exist, giving the commander the dilemma of whether to trade the site's efficiency for decontamination operations. See Figure 5-7 to enter the decision matrix.

Upon analyzing the decision matrix the commander will realize that the amount of decontamination equipment he needs is based on the type of threat (on-target and off-target) and his mission. Remember, an on-target threat constitutes a vapor and liquid hazard from a persistent agent, and an off-target threat constitutes only a vapor hazard from a persistent agent. The decision matrix is straightforward for decontamination operations when a site is contaminated. However, a consideration is made for sites not considered (off-target threat) when entering the decision matrix. Either decontamination is done or no decontamination will be required at all. FM 3-5 states that no decontamination operations are necessary for nonpersistent agents (vapor hazard), such as agents whose persistency is 10 minutes or less. Therefore, decontamination operations could vary for these off-target threats since they primarily deal with vapor hazards.

ACTIONS

If the commander decides to upgrade current decontamination capabilities, then he must submit support documentation. This includes revisions to the TDA, TOE, or CTA for authorization of personnel and equipment items determined to be essential for fixed site decontamination implementation.

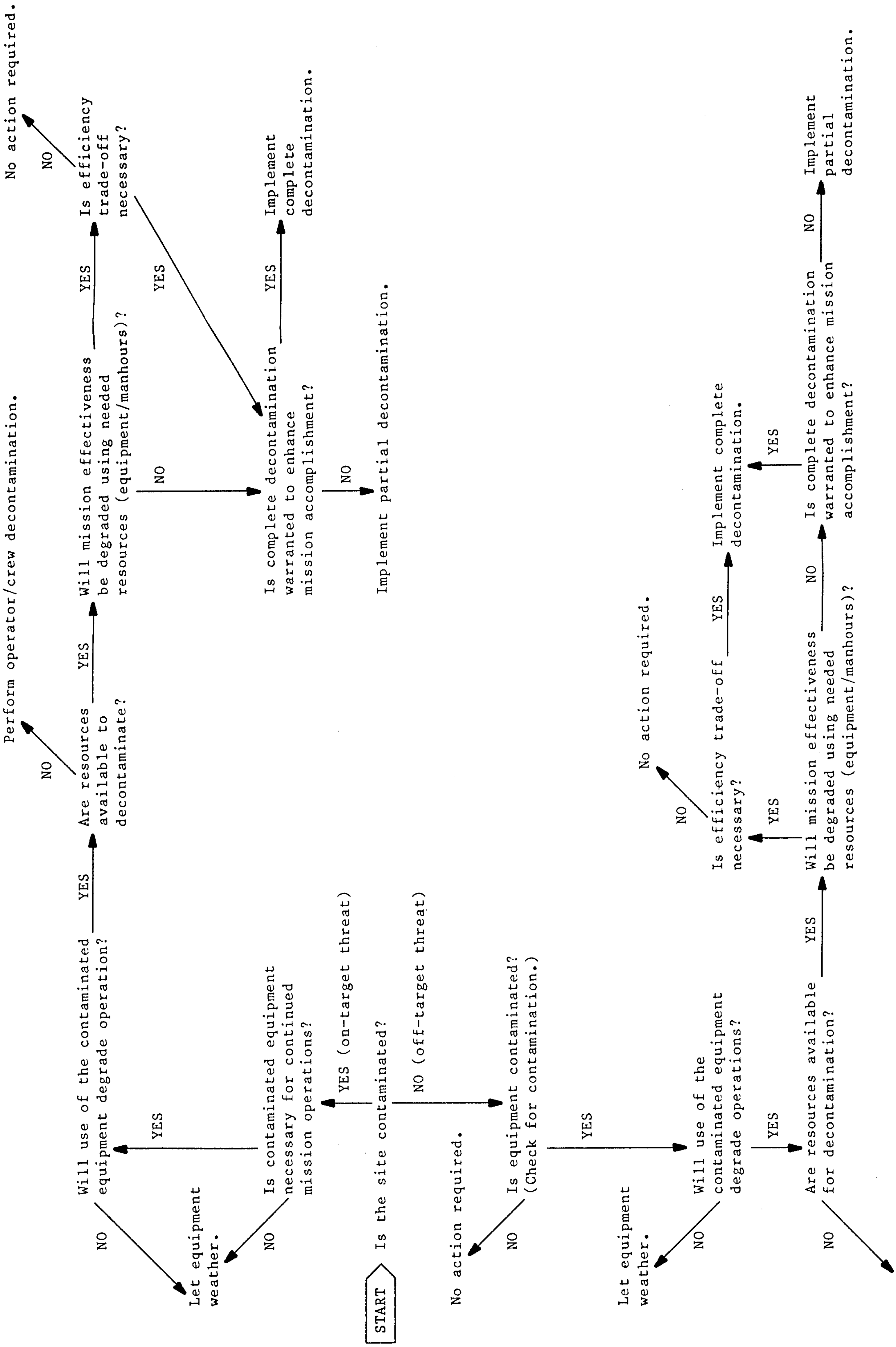


Figure 5-7. Decontamination decision matrix.

A plan divided into three time increments (near term -- 1 to 2 years, mid term -- 3 to 4 years, and far term -- 5 years and beyond) is provided at Table 5-1. The analysis that went into Table 5-1 is as follows: Near term is 15 months, mid term is 37 to 38 months, and far term is greater than 60 months.

Table 5-1. Decontamination.

NEAR TERM	MID TERM	FAR TERM
1. Gate, Primary Vehicle: Wheeled • Commercial equipment for decontamination, nondevelopmental items -- optimum psi, low flow rate for prewash and rinse. • Control runoff with sandbags, plastic liners and fabricated oil/mud separator. • Herman Nelson heater for vehicle interiors.	1. Gate, Primary Vehicle: Wheeled • No change, same as near term.	1. Gate, Primary Vehicle: Wheeled • Type classify commercial equipment for decontamiantion. • Upgrade runoff and sump to final design. • Use CAM detector.
2. Train Gate: Base Entry/Exit Railcars • Decontamination entry and exit with M11 and M13 decontaminating apparatus, portable and M17 lightweight decontamination system.	2. Train Gate: Base Entry/Exit Railcars • Configure for hose down. • Design runoff control system.	2. Train Gate: Base Entry/Exit Railcars • Automated large scale decontamination system.
3. Existing Washracks • Review current design and drainage project.	3. Existing Washracks • Design for improved runoff control.	3. Existing Washracks • Install permanent sumps and final design.
4. Organic Vehicle Decontamination Station • Locate and define.	4. Organic Vehicle Decontamination Station • Install temporary runoff control system. • Use commercial equipment for decontamination.	4. Organic Vehicle Decon Station • Upgrade runoff control system. • Type classify commercial equipment.

In Table 5-1, we have a typical Army depot that has entry and exit routes for wheeled vehicles and railcars. For wheeled vehicle entry and exit in the near term, the chosen commercial equipment (nondevelopmental items) meets the optimal psi and flow rate as discussed previously. This becomes a more cost-effective approach in providing decontamination. Construct a temporary contamination control runoff system to keep contaminated runoff from spreading to personnel and equipment. Add an M13 and a Herman Nelson heater for decontaminant application and interior decontamination respectively. In the far term, the commercial equipment used can be type classified after it has been tailored and adopted into the Army logistics system for that site. The runoff system is upgraded and the CAM detector is integrated into decontamination operations as a precheck for contamination and a final check for completeness of decontamination.

In the near term, an expedient approach is taken for railcar entry and exit; perform partial decontamination using current operator and crew decontamination equipment (Mll or M13) for decontaminant application and the lightweight decontamination system (M17 Sanator) for prewash and rinse. In the mid term, configure the decontamination system for hose down to reduce the contamination hazard of the entire railcar rather than selected surfaces. A contamination control runoff is designed due to greater volume of water increasing the chance of contamination spreading. In the far term, the decontamination system is upgraded to perform a complete decontamination of railcars. In near term, the existing washracks on the site are reviewed and will be steadily upgraded with an improved drainage system to control contamination runoff in the mid and far terms.

A centralized decontamination site for vehicles is located and defined in the near term to provide decontamination for vehicles organic to the fixed site. In the mid term, commercial equipment is used for decontamination and a temporary runoff system is installed for the entry and exit of wheeled vehicles. In the far term, commercial equipment can be type classified and the runoff system upgraded as well.