method on the adjacent wall is a water wash, it would be impractical not to use the same procedure on windows. Further, since the chosen method for walls will result in adequate decontamination, the method will also be effective on windows, since its efficiency on windows will be even greater. In effect, this means simply increasing the wall area by the window area. Therefore, except for removal and replacement, the costs and rates of the operations on windows are equal to those on walls.

If the wall method cannot be used on windows, the process for selecting the method is the same as for other surfaces, except that the selection is tentative, subject to the final step in the selection process. The costs and rates of these operations when applied to windows are estimated as equal to the cost of performing the operation on the wall plus a cost and rate adjustment associated with moving and setting up equipment and materials.

The final step in the selection process is applied when the wall method cannot be used on windows; it concerns window removal and replacement. If the cost of removal and replacement is less than the sum of the costs of methods tentatively selected for decontaminating the inside and outside window surfaces, then the removal and replacement method is selected. Information on this method is summarized in Table 2.15.

2.4.3.3 Interior Floors, Walls and Glass Surfaces

Floor surfaces include linoleum, wood, carpeted, and concrete floors. Linoleum is considered representative of asphalt tile, vinyl, and other resilient floor coverings. Interior walls include painted wood or plaster walls and concrete walls. Most of the operations for these surfaces are similar or identical. The major differences are for the removal and replacement of the interior wall or the floor covering. In addition, decontamination efficiencies are not the same across surfaces. For example, vacuum removal of particles is much more effective on linoleum floors than on carpeted floors. Finally, the process for selecting a method to be used on interior glass surfaces follows the same multi-step procedure described above for exterior glass surfaces.

While most of the operations for treating interior surfaces have already been described, a few operations require explanation. Sanding of wood floors refers to a thorough refinishing of the floor. For carpeted floors, scrubbing and washing is not appropriate; but the operations of steam cleaning and carpet shampooing are. The costs and rates of the operations applied to interior floors and walls are summarized in Tables 2.16 through 2.21.

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Table 2.15. Summary of Data for Removal and Replacement of Windows

Procedure	Rate (m^2/hr)	Cost (1982 $/$m^2$)			
		Total	Labor	Equipment	Materials
Removal	1.73	13.86	11.21	2.65	--
Replacement	1.38	215.94	35.29	--	180.65
Total	1.38	229.80	46.50	2.65	180.65

2.4.3.4 Building Contents

Building contents are considered in four broad categories: hard-surface furnishings, soft-surface furnishings, electronic equipment, and paper products. Each of these categories consists of a variety of items. Hard-surface furnishings in a home include such items as stoves, refrigerators, cabinets, tables, and bathroom fixtures. For convenience, the inventory of hard-surface items found in the representative 191.5 sq meter home is defined as one unit of hard-surface furnishings. Similarly, we define one unit of the other three contents categories as the inventory of representative items from that category found in this representative housing unit.

The number of units of a building contents category in a representative 1006 sq meter commercial structure or in a representative 2082 sq meter industrial structure is based on the inventory of this category in the residential unit. This number depends on the relative effort required to decontaminate that category of items over an equal amount of commercial or

Table 2.16. Summary of Representative Cost and Productivity Data for Decontamination Operations on Linoleum Floors

Operation	Rate (m^2/hr)	Cost (1982 $/$m^2$)			
		Total	Labor	Equipment	Material
Vacuum	69	0.18	0.16	0.02	--
Scrub and wash	10	1.75	1.15	0.60	--
Strippable coating	40	2.92	1.09	0.06	1.77
Foam	40	0.869	0.715	0.071	0.083
Fixative	40	0.834	0.555	0.049	0.23
Remove and replace	5.48	14.47	8.11	--	6.36

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Table 2.17. Summary of Representative Cost and Productivity Data for Decontamination Operations on Wood Floors

Operation	Rate (m^2/hr)	Cost (1982 $/$m^2$)			
		Total	Labor	Equipment	Material
Vacuum	69	0.18	0.16	0.02	--
Scrub and wash	10	1.75	1.15	0.60	--
Strippable coating	40	2.92	1.09	0.06	1.77
Foam	40	0.869	0.715	0.071	0.083
Sand	1.32	23.74	18.45		5.29
Fixative	40	0.834	0.555	0.049	0.23
Remove and replace	1.73	57.19	29.70	--	27.49

Table 2.18. Summary of Representative Cost and Productivity Data for Decontamination Operations on Carpeted Floors

Operation	Rate (m^2/hr)	Cost (1982 $/$m^2$)			
		Total	Labor	Equipment	Material
Vacuum	69	0.18	0.16	0.02	--
Foam	40	0.869	0.715	0.071	0.083
Fixative	40	0.834	0.555	0.049	0.23
Remove and replace	3.7	22.21	8.21	--	14.00
Steam clean	33	0.74	0.59	0.15	--
Shampoo	40	1.25	0.80	0.45	--

Table 2.19. Summary of Representative Cost and Productivity Data for Decontamination Operations on Concrete Floors

Operation	Rate (m^2/hr)	Cost (1982 $/$m^2$)			
		Total	Labor	Equipment	Material
Vacuum	69	0.18	0.16	0.02	--
Scrub and wash	10	1.75	1.15	0.60	--
Strippable coating	40	2.92	1.09	0.06	1.77
Foam	40	0.869	0.715	0.071	0.083
Scarify	8.1	11.44	10.43	1.01	--
Resurface	6	13.34	10.90	1.14	1.30
Medium-pressure water	8	2.43	2.18	0.25	--
Hydroblast	11	8.50	3.39	5.11	--
Scarify and resurface	6	24.78	21.33	2.15	1.30
Fixative	40	0.834	0.555	0.049	0.23

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Table 2.20. Summary of Representative Cost and Productivity Data for Decontamination Operations on Painted Wood/Plaster Interior Walls

Operation	Rate (m^2/hr)	Cost (1982 $/$m^2$)			
		Total	Labor	Equipment	Material
Vacuum	69	0.18	0.16	0.02	--
Scrub and wash	10	1.75	1.15	0.60	--
Strippable coating	40	2.92	1.09	0.06	1.77
Foam	40	0.869	0.715	0.071	0.083
Fixative	40	0.834	0.555	0.049	0.23
Remove and replace	5.28	23.84	21.15	--	2.69

industrial floor space. For example, consider equal areas of floor space in a residential unit and a commercial unit. If decontaminating the hard-surface furnishings in the commercial space takes 2.5 times the effort required in the residential space, then we will say that the commercial space contains 2.5 times as many units of hard-surface furnishings as the residential space.

Hard-surface furnishings include such things as desks and book cases in commercial offices and machinery in industrial buildings. Soft-surface furnishings include draperies, fabric-covered chairs, sofas, fabric-covered office partitions, and so forth. However, carpets are not included in this category, since they are already treated separately as a floor covering.

Electronic equipment consists of televisions, computers, communications equipment, radios, and so forth, while paper products refer to printed, typed, and written documents. Not included in paper products are such items as pack-

Table 2.21. Summary of Representative Cost and Productivity Data for Decontamination Operations on Interior Concrete Walls

Operation	Rate (m^2/hr)	Cost (1982 $/$m^2$)			
		Total	Labor	Equipment	Material
Vacuum	69	0.18	0.16	0.02	--
Scrub and wash	10	1.75	1.15	0.60	--
Strippable coating	40	2.92	1.09	0.06	1.77
Foam	40	0.869	0.715	0.071	0.083
Fixative	40	0.834	0.555	0.049	0.23
Scarify	4	22.68	20.85	1.83	--
Medium-pressure water	8	2.43	2.18	0.25	--
Hydroblast	11	8.50	3.39	5.11	--
Remove and replace	3.95	180.59	130.23	15.60	34.77

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aging materials or paper towels; the relevant characteristic of the paper products that are included here is that they derive their value from what is written or printed on the paper and not from the paper itself.

The operations for building contents are similar to the operations that are performed on other surfaces. Only operations pertaining to paper products deserve additional comment here. For paper products there are three levels of vacuuming, depending upon the severity of contamination. The first level, vacuum paper in place, refers to vacuuming books and papers without disturbing them or disturbing them very little. Vacuuming exposed paper is the next level and requires picking up each paper article and vacuuming all of its exposed surfaces. At the third level, each individual sheet or page is vacuumed separately. If this third level of vacuuming is inadequate, the individual sheets or pages of paper are machine copied, and the originals are disposed of.

The data relating to the operations applied to the building contents categories are summarized in Tables 2.22 through 2.25.

2.4.4 Automobiles

Automobiles are treated in a manner similar to other surface categories and are comprised of four surfaces categories: exteriors, interiors, tires, and engine and drive train. The costs are expressed in terms of dollars per vehicle, and the rate is expressed in terms of vehicles per hour.

The first set of operations consists of removing the vehicles to a site where they can be cleaned. The cost of these operations is included under automobile exteriors. While no efficiency is assigned, vehicle transport is assumed to be necessary prior to decontamination. The alternatives for transporting cars are to drive the car to a decontamination site, to tow the car to the site, and to haul the car to the site via a vehicle transport truck. Towing is the most costly, and driving the car is the least costly.

The operations for cleaning the car's exterior are ordinary spray wash, detailed cleaning and scrubbing, and sanding and repainting. The costs of these operations cover a wide range, and the least costly has a relatively high decontamination efficiency. The costs and rates of these operations are presented in Table 2.26.

The options for decontaminating automobile interiors are ordinary vacuuming; detailed vacuuming and cleaning; removing the interior, cleaning, and replacing; and re-upholstering. The costs and rates for these operations are shown in Table 2.27.

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Table 2.22. Summary of Representative Cost and Productivity Data for Decontamination Operations on Hard-Surface Furnishings

Operation	Rate (u/hr)	Cost (1982 $/unit) Total	Labor	Equipment	Material
Vacuum	0.218	244.4	204.4	27.5	12.3
Dust	0.110	506.2	405.1	76.0	25.1
Wipe	0.110	569.8	456.0	85.6	28.2
Strippable coating	0.055	3,598.7	1,417.8	267.6	901.1
Remove and replace	0.008	9,387	4,824	457	4,106

The operations for decontaminating tires are ordinary spray wash, detailed scrub and wash, sandblast, and remove and replace with new tires. The costs and rates for these operations are given in Table 2.28.

The operations for cleaning automobile engines and drive trains are steam cleaning and cleaning with an organic solvent. Table 2.29 summarizes the costs and rates for these operations.

2.5 HAULING COSTS

A number of operations require hauling of soil, removed material, or byproducts to a dump site. The costs of hauling are calculated separately and then added to the cost of the operation. The calculation of hauling costs depends first on the distance to the dump site. Second, since costs are reported on a per unit area basis, hauling costs also depend on the volume of material to be hauled for each sq meter of surface treated. For example, soil scraping generates about 0.15 cu meters of material per sq meter of ground. Table A.6.2.2 in Appendix A shows the volume of material to be hauled per sq meter of area treated.

Table 2.23. Summary of Representative Cost and Productivity Data for Decontamination Operations on Soft-Surface Furnishings

Operation	Rate (u/hr)	Cost (1982 $/unit) Total	Labor	Equipment	Material
Vacuum	0.350	76.0	63.66	8.6	3.8
Steam clean	0.175	193.9	127.3	56.9	9.7
Foam	0.055	154.6	127.3	19.5	7.8
Replace fabric	0.016	2,789.9	1,395.0	418.2	976.7
Remove and replace	0.159	3,143.0	120.0	156.5	2,853.0

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Table 2.24. Summary of Representative Cost and Productivity Data for Decontamination Operations on Electronic Equipment

Operation	Rate (u/hr)	Cost (1982 $/unit) Total	Labor	Equipment	Material
Vacuum	0.219	76.9	68.5	4.57	3.84
Spray Solvent	0.073	231.4	205.5	13.70	12.19
Remove and replace	0.159	868.9	94.3	12.60	762.00

Table 2.25. Summary of Representative Cost and Productivity Data for Decontamination Operations on Paper Products

Operation	Rate (u/hr)	Cost (1982 $/unit) Total	Labor	Equipment	Material
Vacuum paper in place	0.438	60.8	50.9	6.9	3.04
Vacuum exposed paper	0.145	183.6	153.7	20.7	9.24
Vacuum individual pages	0.109	244.2	204.4	27.5	12.29
Machine copy pages	0.146	1,177.2	114.2	403.0	660.00

Table 2.26. Summary of Representative Cost and Productivity Data for Automobile Exterior Decontamination Operations

Operation	Rate (autos/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Material
Drive car	2	15.00	13.50	0.75	0.75
Tow car	1	50.00	20.00	25.00	5.00
Truck car	4	40.00	16.00	20.00	4.00
Ordinary wash	4	5.00	4.00	0.50	0.50
Detailed wash	0.25	75.00	58.50	7.50	9.00
Repaint	0.083	900.00	558.00	72.00	270.00

Table 2.27. Summary of Representative Cost and Productivity Data for Automobile Interior Decontamination Operations

Operation	Rate (autos/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Material
Ordinary vacuum	3	6.00	4.10	0.60	0.30
Detailed vacuum & clean	1	45.00	31.50	4.50	9.00
Remove, clean, & replace	0.125	300.00	240.00	30.00	30.00
Re-upholster	0.14	600.00	210.00	180.00	210.00

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Table 2.28. Summary of Representative Cost and Productivity Data for Automobile Tires Decontamination Operations

Operation	Rate (autos/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Material
Ordinary spray wash	10	1.85	1.75	0.10	--
Detailed wash and scrub	3	5.83	3.83	2.00	--
Sandblast	8	12.71	5.54	7.17	--
Remove and replace	1	225.00	22.50	24.75	177.75

Table 2.30 shows the total cost to haul a cu meter of material and the rate in cu meters per hour per dump truck for selected round-trip distances.

2.6 WASTE BURIAL COSTS

All of the operations that involve hauling costs also will involve radiological waste disposal costs. The materials to be disposed of may include walls, floors, roofs, pavement, soil, sludge, strippable coating, glass and various building contents. It is assumed that these materials fall into Class A low-level nuclear waste as defined in 10 CFR 61. Materials in this category require simple burial in a pit. The pit does not have to be lined or covered with a waterproof material, but burial in an impervious clay soil or above rock strata would be necessary if radionuclide migration through the soil poses a risk.

The costs developed here assume that a pit would be constructed on or near the accident site using earth excavation equipment. First, the pit would be excavated and the removed soil transported to a nearby location. Next, the pit would be filled with radwaste and compacted. Finally, the pit would be covered using clean soil that was originally removed from the pit.

Table 2.29. Summary of Representative Cost and Productivity Data for Decontamination Operations on Automobile Engines and Drive Trains

Operation	Rate (autos/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Material
Steam clean	1	26.00	18.72	2.60	4.68
Clean with solvent	1	37.00	35.15	0.35	1.40

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Table 2.30. Summary of Representative Cost and Productivity Data for Hauling

Round-Trip Distance (miles)	Rate (m^3/hr/truck)	Cost (1982 $/$m^3$)
1	38.2	1.72
2	30.6	2.14
3	25.5	2.57
4	21.8	3.00
5	19.1	3.43
10	15.8	4.15
20	13.9	4.72
30	11.8	5.58
50	9.9	6.65
100	5.5	12.00

The total cost of waste burial in 1982 dollars comes to $4.86 per cu meter of radwaste buried, of which 35 percent of this cost is for labor and the remaining 65 percent is for equipment.

2.7 SURVEYING AND MONITORING COSTS

Surveying and monitoring activities begin almost immediately after the accidental release of radioactive products and continue until several years after decontamination has been completed. Radiological *survey* operations are designed to measure the composition and extent of radiological contamination over a large area, while radiological *monitoring* operations gauge the effectiveness of decontamination activities.

There are several types of surveying and monitoring activities that would likely be undertaken in the event of a major accidental release. These are described briefly in this section.

An aerial survey would be conducted soon after the event to provide an assessment of the dispersion of radioactive products into the environment. Following this initial survey, two additional aerial surveys would be conducted during the first year after the event. Then, beginning in the following year, aerial surveys would be performed every other year through the tenth year following the accident.

After the initial aerial survey, additional information on the extent and nature of the deposition is achieved with two-person teams taking air and

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soil samples at specified points. These teams would, at the same time, carry out supplemental water and plant sampling.

Several activities would take place immediately after decontamination. Mobile gamma scanning is used to detect and record radiation on exterior surfaces, excluding roofs and wooded areas. Manual surveys are conducted on the inside and outside surfaces of buildings and in wooded areas.

In the years that follow, thermoluminescent detectors (TLDs) and permanent air samplers are used to monitor the area for any increase in activity levels caused, say, by resuspension of contaminants.

Summary information of surveying and monitoring activities is presented in Table 2.31.

2.8 DECONTAMINATION EFFICIENCIES FOR VARIOUS SURFACES

This section gives estimates of removal efficiencies for decontamination operations. Actual efficiencies are highly variable, being subject to numerous factors. For this reason the efficiency estimates in this report should be regarded as relative measures of the expected effectiveness of the operations. When one operation follows another, the efficiency of the second operation will usually fall. This is simply because the first operation will tend to remove those particles that are the easiest to remove. The derivation of efficiencies is explained in more detail in Appendix B.

There are few sources that give information about the efficiency of large surface area decontamination techniques. The best available data come from field tests performed in the 1960's with respect to nuclear weapons products, whose characteristics, unfortunately, differ significantly from those associated with nuclear reactor accidents. In addition, specific data describing the actual decontamination operations used in these tests are not reported. For example, information such as how much water was used for a high pressure water wash was not revealed. Similarly, the concentration of leaching solutions was not provided.

A further difficulty lies in determining the removal efficiency of an operation when that operation follows another operation. A low-pressure water flushing of streets will almost always remove more contaminants if it is not first preceded by some other treatment. In developing decontamination efficiencies for second, third, and fourth treatment applications, three factors were considered: 1) the relative efficiencies reported for the single

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Surface	Operation	Rate m^2/hr	Total $/$m^2$	Labor $/$m^2$	Equip. $/$m^2$	Sample Analysis	Administration
All exterior horizontal surfaces	Aerial survey	3.24×10^{8}	1.61×10^{-6}	9.26×10^{-7}	1.44×10^{-6}	--	4.26×10^{-7}
All exterior surfaces	Mobile air and soil sampling	7.55×10^{7}	3.23×10^{-6}	6.62×10^{-7}	8.19×10^{-8}	2.19×10^{-6}	3.05×10^{-7}
Ground surfaces	Supplemental water and plant sampling	7.55×10^{7}	3.26×10^{-6}	--	--	3.26×10^{-6}	--
Bldg. walls, ext. horiz. surfaces, except roofs	Mobile gamma scanning	2.58×10^{5}	7.28×10^{-4}	2.91×10^{-4}	3.03×10^{-4}	--	1.34×10^{-4}
Bldg. surfaces	Manual survey	154	.4602	.1622	.0130	.2104	.0746
Exterior surfaces	Manual survey	308	.2301	.0811	.0065	.1052	.0373
Wooded areas	Manual survey	154	.4602	.1622	.0130	.2104	.0746
Exterior surfaces	Placement of TLDs	1.81×10^{7}	3.29×10^{-6}	1.37×10^{-6}	1.29×10^{-6}	--	6.34×10^{-7}
Exterior surfaces	Replacement of TLDs	3.03×10^{7}	2.08×10^{-6}	8.25×10^{-7}	1.98×10^{-7}	6.76×10^{-7}	3.80×10^{-7}
Exterior surfaces	Set up permanent air samplers	2.91×10^{7}	2.73×10^{-5}	8.58×10^{-7}	2.60×10^{-5}	--	3.95×10^{-7}
Exterior surfaces	O&M of permanent air samplers[a]	5.44×10^{7}	1.32×10^{-6}	4.99×10^{-7}	1.26×10^{-7}	4.72×10^{-7}	2.29×10^{-7}
Exterior surfaces	Initial removal of air samplers	5.44×10^{7}	8.16×10^{-7}	4.60×10^{-7}	1.45×10^{-7}	--	2.11×10^{-7}
Exterior surfaces	Extended removal of air samplers	9.96×10^{9}	4.45×10^{-9}	2.51×10^{-9}	7.90×10^{-10}	--	2.11×10^{-9}
Agricultural fields and orchards	Soil and crop sampling	1.16×10^{6}	7.30×10^{-4}	2.15×10^{-5}	6.78×10^{-6}	6.92×10^{-4}	9.99×10^{-6}

(a) Values are for initial operation and maintenance only. Extended operation and maintenance costs must be computed via formula in Section A.6.1.8.2.

Table 2.31 Summary of Surveying and Monitoring Activities

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operations; 2) the diminishing effectiveness of subsequent operations on the same surface; and 3) any likely interaction between different operations.

The most important point of this discussion is that the reader should be aware that the decontamination efficiencies are very crude estimates. Their validity and potential usefulness lie in their mutual consistency. For this reason they are properly viewed as relative measures of decontamination efficiencies. The generally poor quality of these efficiency numbers do not, however, undermine the approach taken in this report. First, there is the anticipation that more reliable values will be available in the near future as the result of recently completed and scheduled field experiments involving reactor products. Second, it is anticipated that results will be available from the Soviets with respect to their cleanup efforts from the Chernobyl accident.

If DECON is being used in making the site restoration decisions, then the revised efficiency values can be entered into the Reference Database, a quick and simple task with the user-friendly software provided with DECON. DECON can then be used to quickly reevaluate the restoration options.

2.8.1 Cost and Efficiencies of Decontamination Methods

In the terminology used here, a sequence of one or more *operations* comprises a *method*. The cost of a method is equal to the sum of the costs of the constituent operations, but, as indicated above, the net efficiency of the method is a more complex function of the separate operations. (These net efficiencies are explained in more detail in Appendix B.) In selecting from the methods available for use on a surface, the cost and the efficiency of the methods are the two characteristics of central importance. The efficiency of the method must be great enough to satisfy the cleanup criteria, and the least cost among these will be the method of first choice. (Of course, the first choice method might be rejected on other grounds; for example, the equipment needed to apply it might not be available.) The efficiency-cost relationships are presented graphically in Figures 2.1 through 2.30 for each of the surface categories. The graphic representation is facilitated by transforming efficiencies to decontamination factors. The relationship is

$$DF = \frac{100}{100-E}$$

where **DF** is the decontamination factor and **E** is the efficiency expressed as a percentage.

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As an example consider Figure 2.1, which shows the decontamination factors and costs for several meth of decontaminating agricultural fields. (The methods indicated in Figures 2.1 through 2.8 use the code letters defined in Table 1.1). Because the costs and decontamination factors cover such a broad range with relatively small differences for smaller values, a logarithmic scale is used in presenting the scattergram.

In general, one would like to obtain a high decontamination factor at low cost. This means that preferred choices are represented by those points which are toward the bottom and the right of the graph. Consider in Figure 2.1 the method **L**--leaching (located at the lower-middle portion of the graph near the left axis). It has both a lower decontamination factor and a higher cost than method **WW**--two applications of water. In other words, it is *dominated* by method **WW**. **WW** will always be preferred over **L** in the absence of considerations other than cost and efficiency. The set of points defining the dominant methods will form an *envelope*, and only methods lying on the envelope itself will be selected on the basis of cost and efficiency alone.

In practice, some of the dominant methods will be excluded because their application creates additional problems and costs. For example, using water to decontaminate roofs could cause a contaminated water problem, requiring the water to be collected and treated. The additional costs to comply with these requirements could result in dominated methods actually being less costly and therefore preferred.

If relative prices of the input factors change, then some dominated methods could become dominant. For example, if over a period of time labor costs increase faster than equipment costs, then there will be a tendency for equipment-intensive methods to become dominant over labor-intensive methods.

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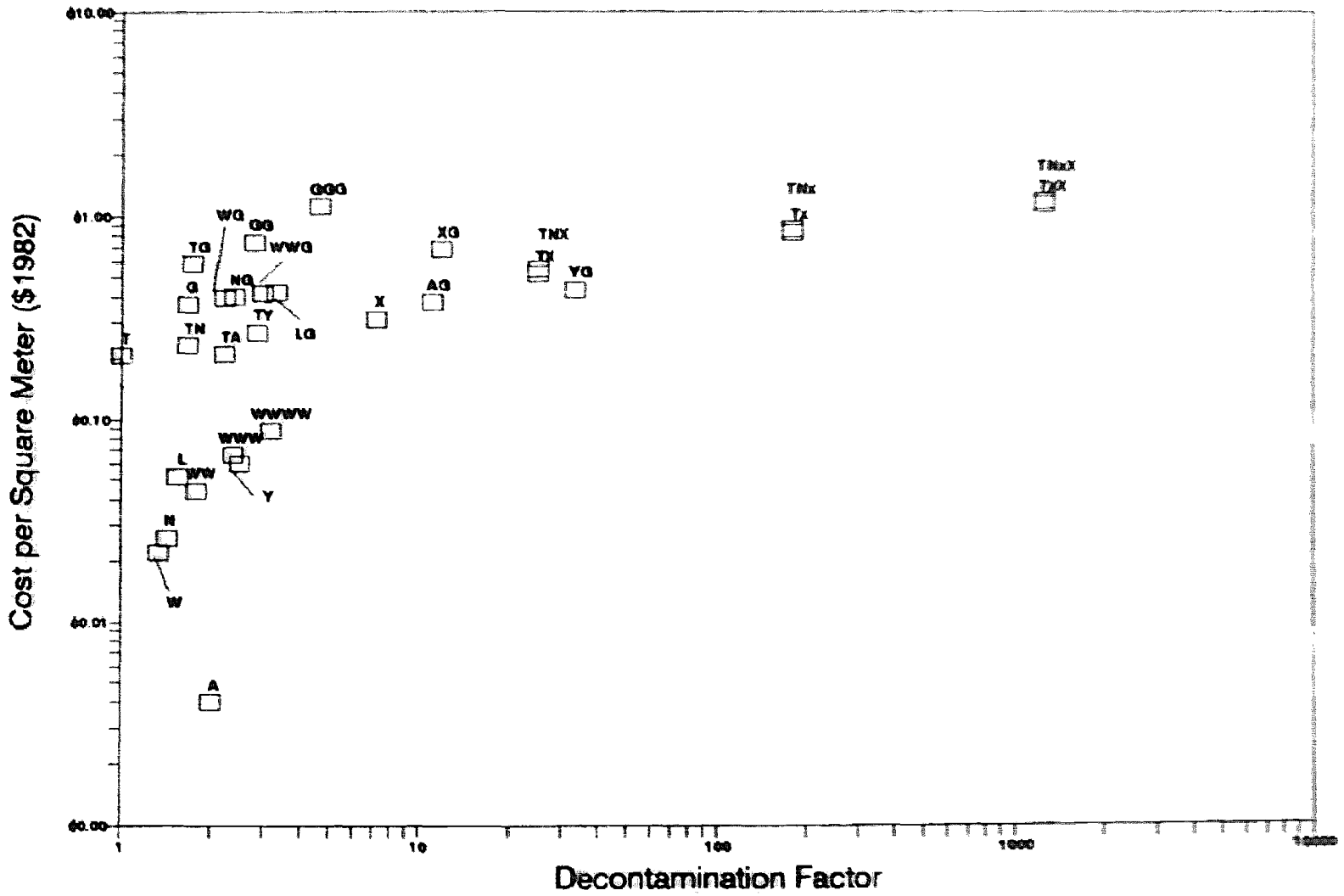

Figure 2.1. Costs and Efficiencies of Decontamination Methods: Agricultural Fields

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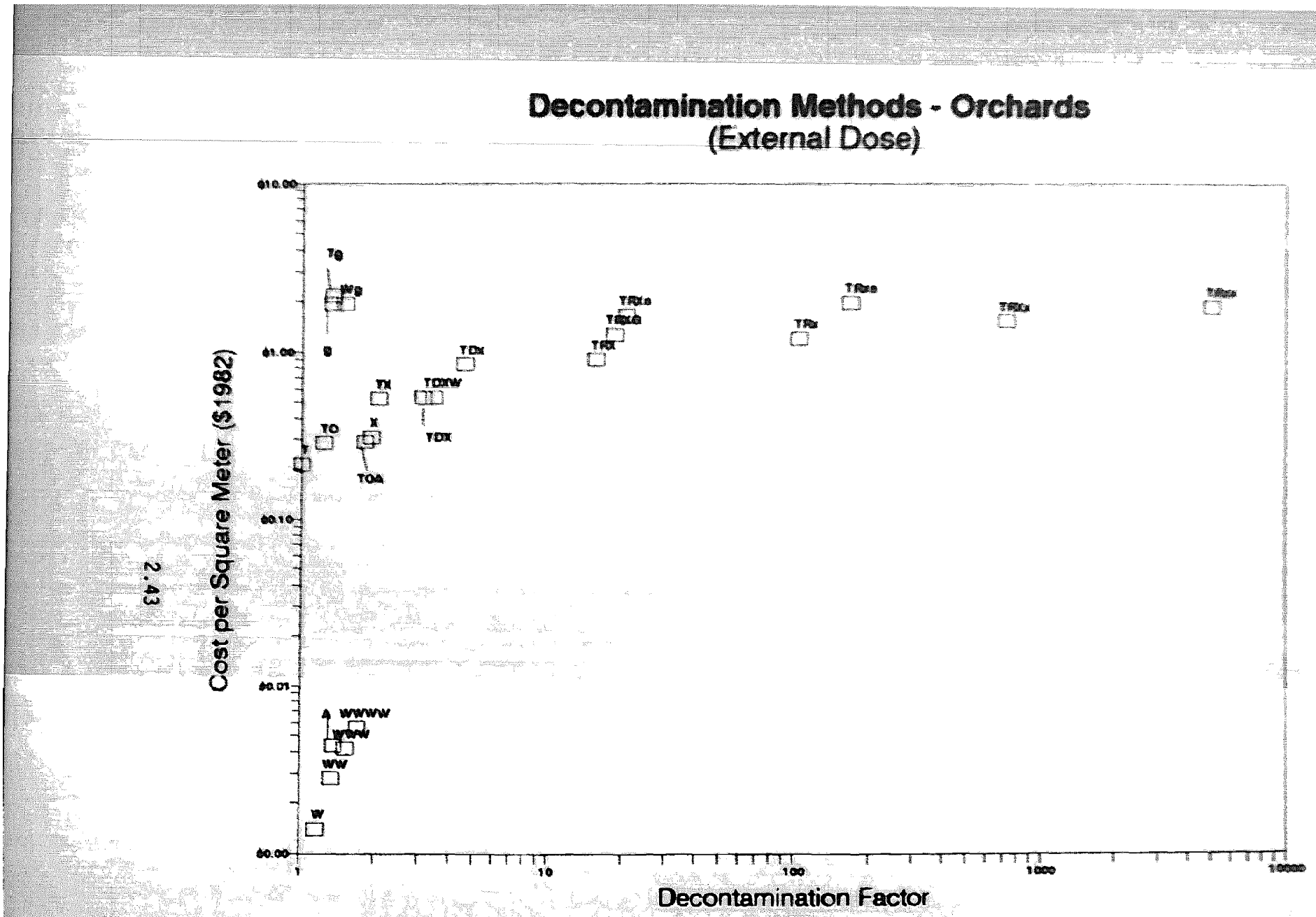

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Figure 2.2. Costs and Efficiencies of Decontamination Methods: Orchards

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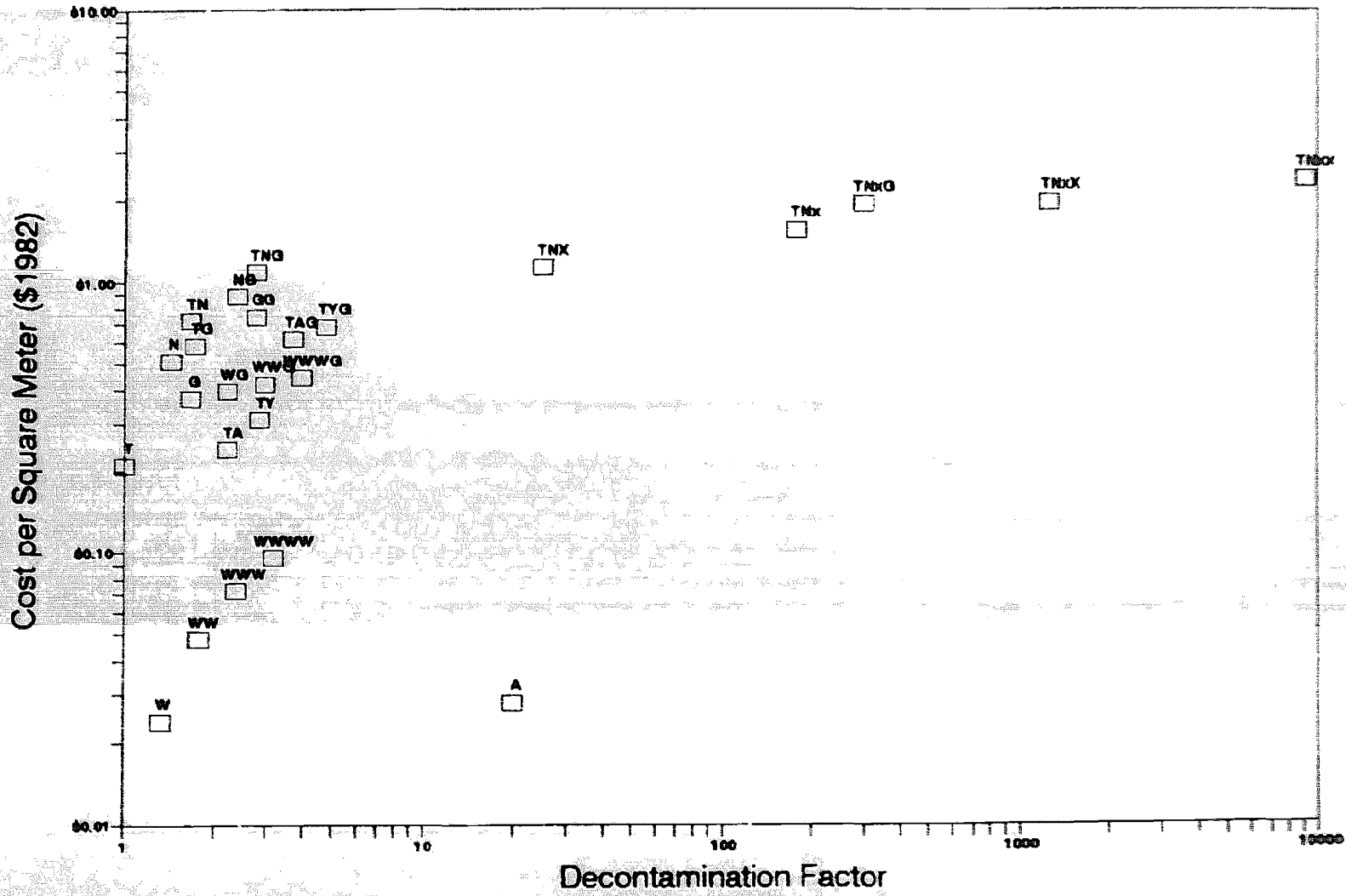

Figure 2.3. Costs and Efficiencies of Decontamination Methods: Vacant Land

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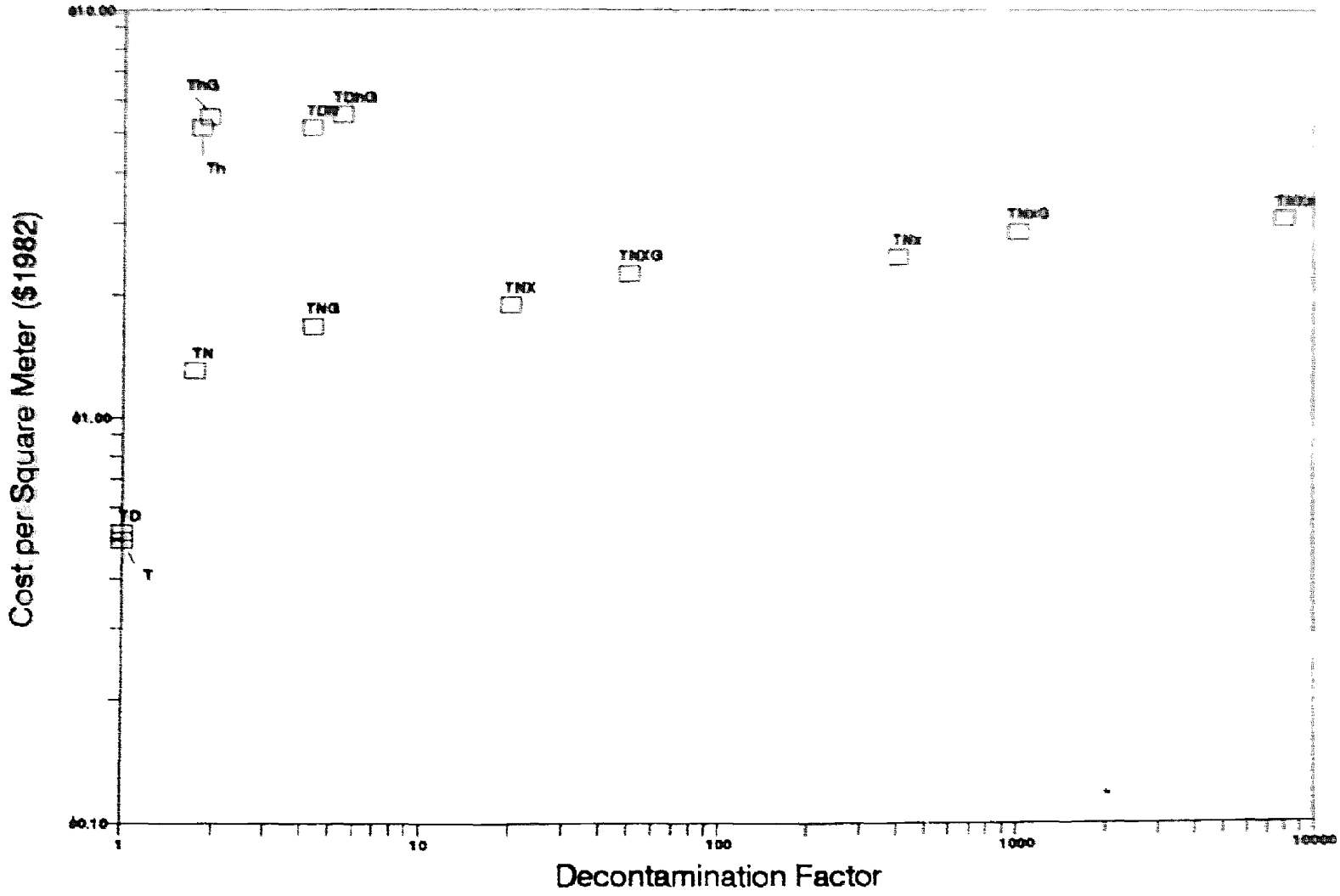

Figure 2.4. Costs and Efficiencies of Decontamination Methods: Wooded Land

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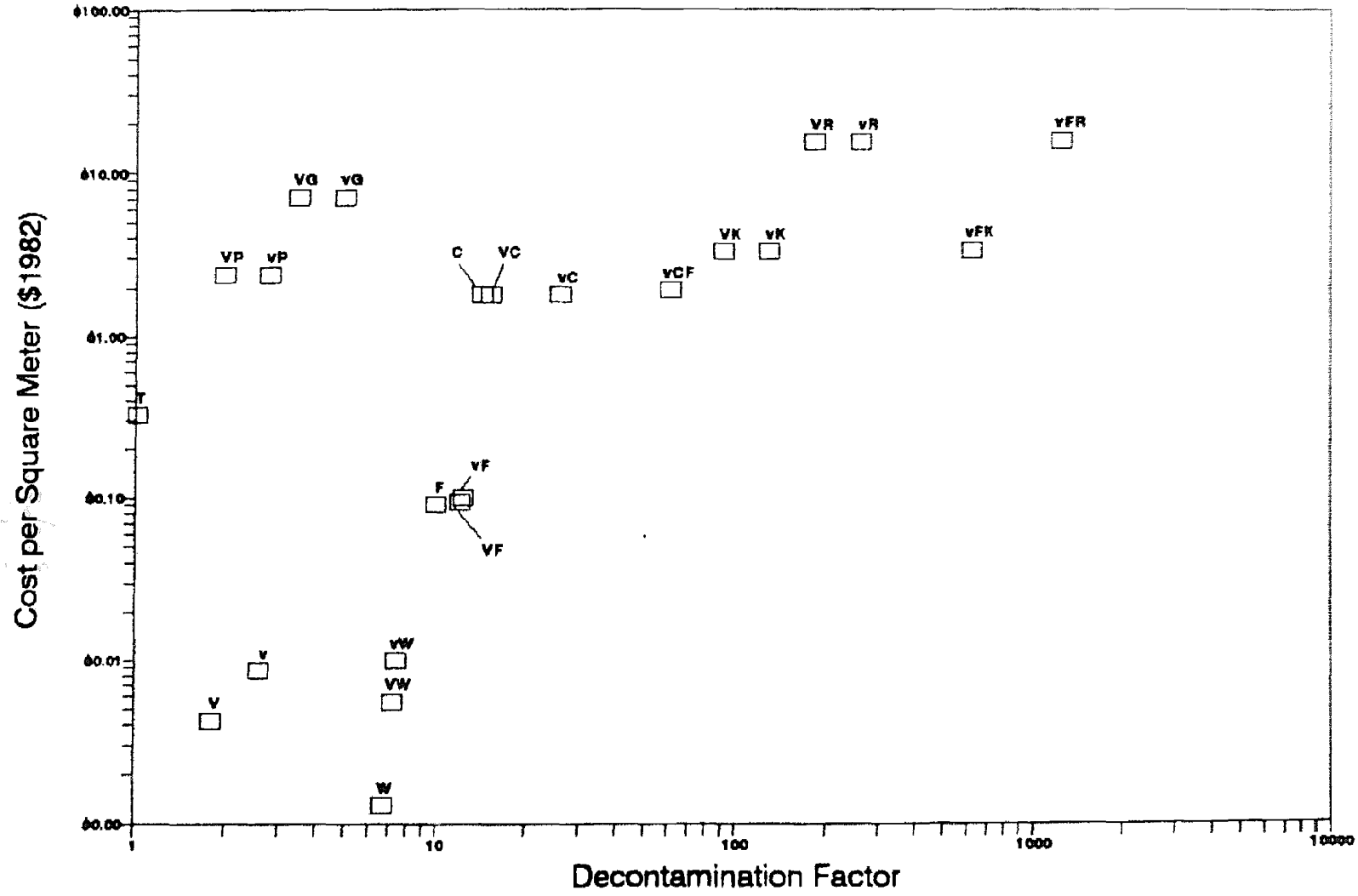

Figure 2.5. Costs and Efficiencies of Decontamination Methods: Asphalt Streets/Parking

OAGI0001550_00087

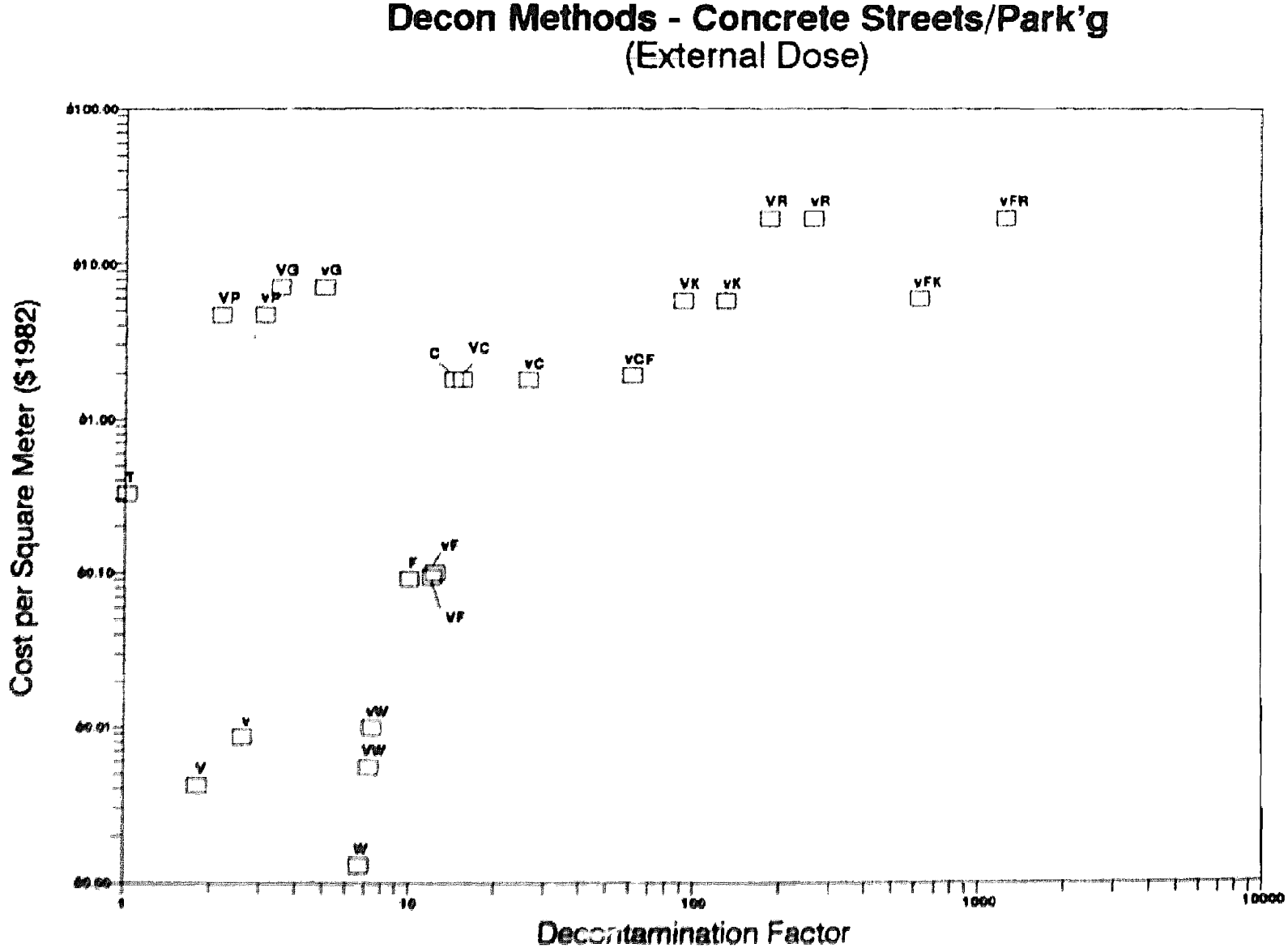

Figure 2.6. Costs and Efficiencies of Decontamination Methods: Concrete Streets/Parking

OAGI0001550_00088

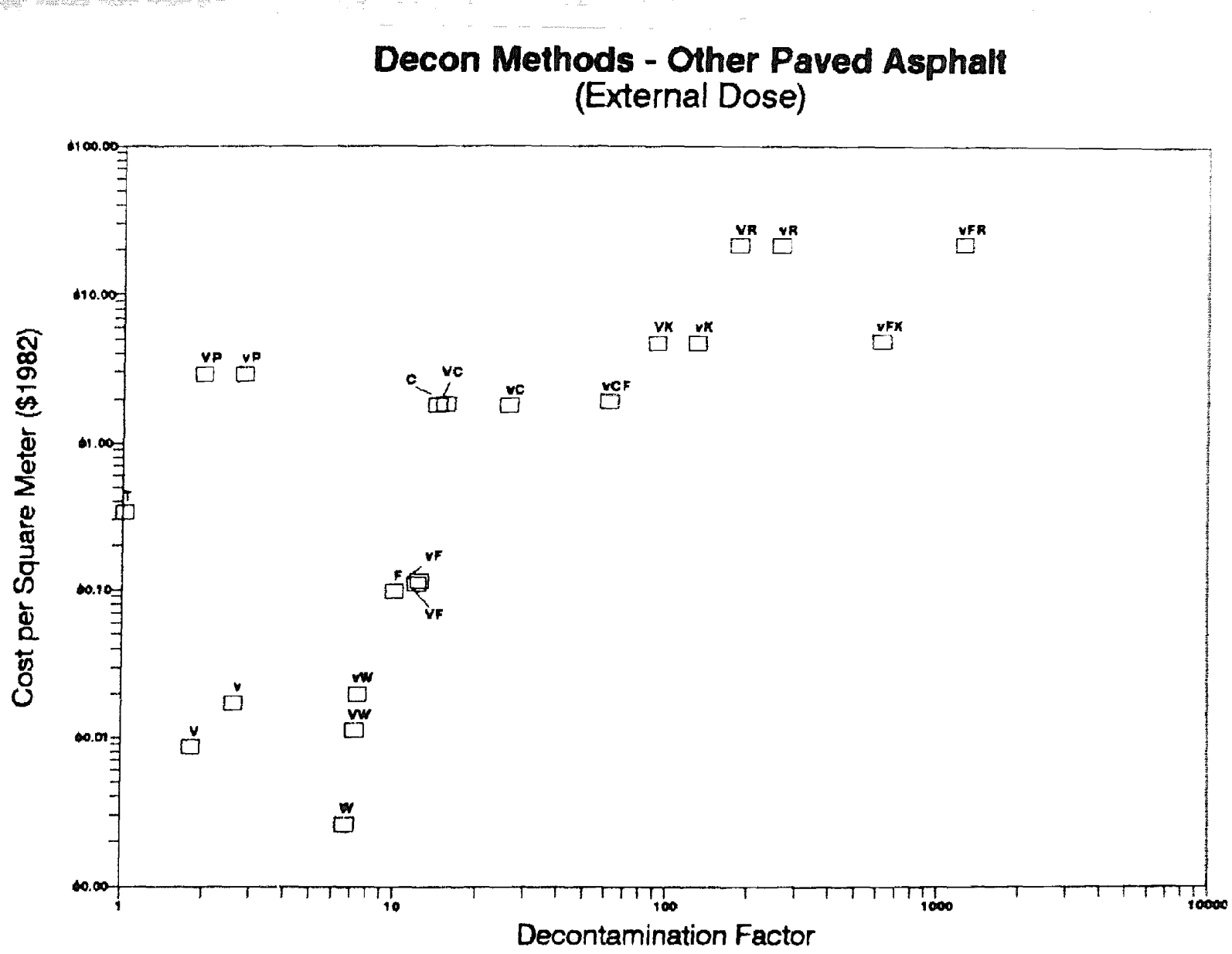

Figure 2.7. Costs and Efficiencies of Decontamination Methods: Other Paved Asphalt

OAGI0001550_00089

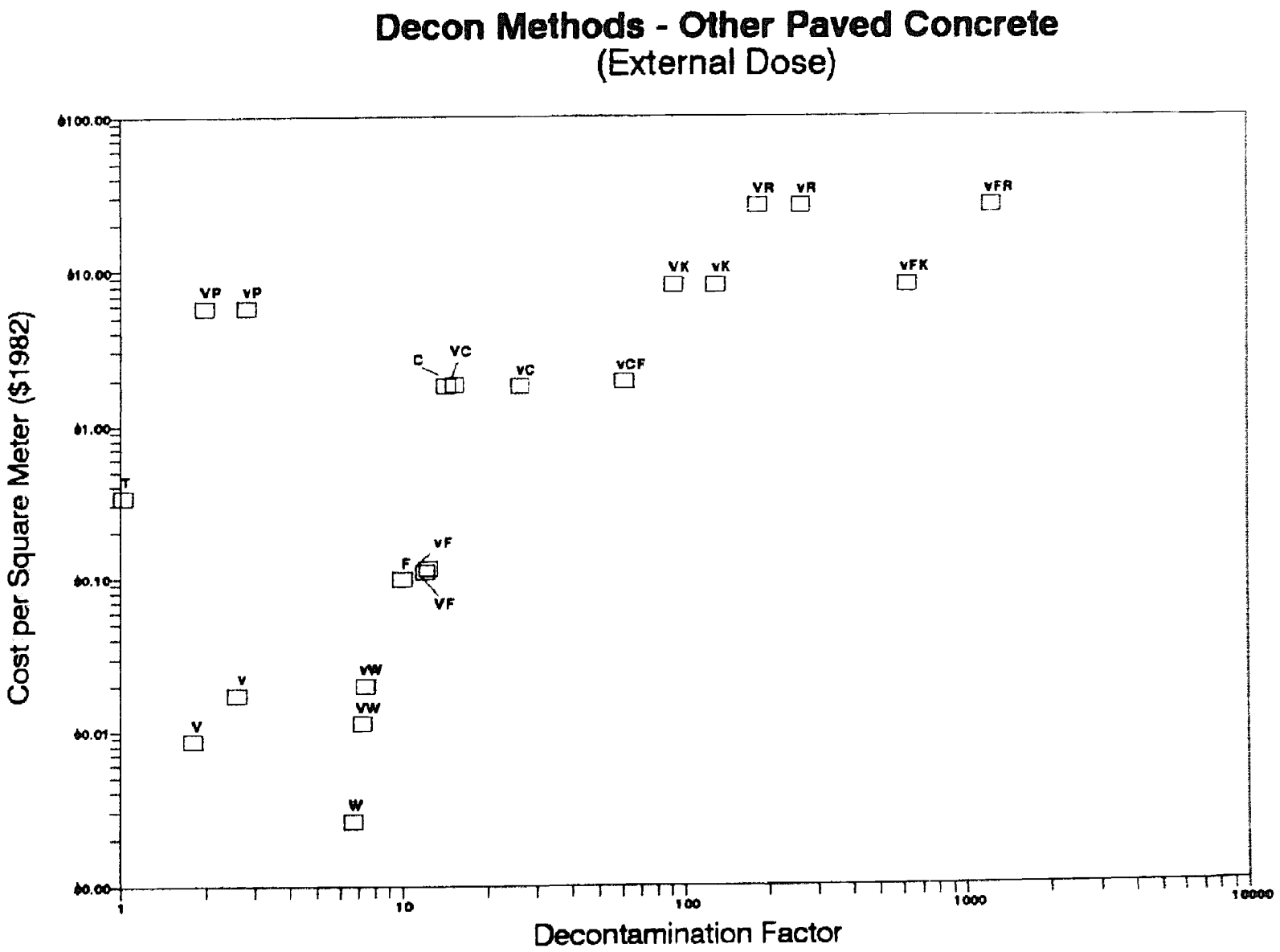

Figure 2.8. Costs and Efficiencies of Decontamination Methods: Other Paved Concrete

OAGI0001550_00090

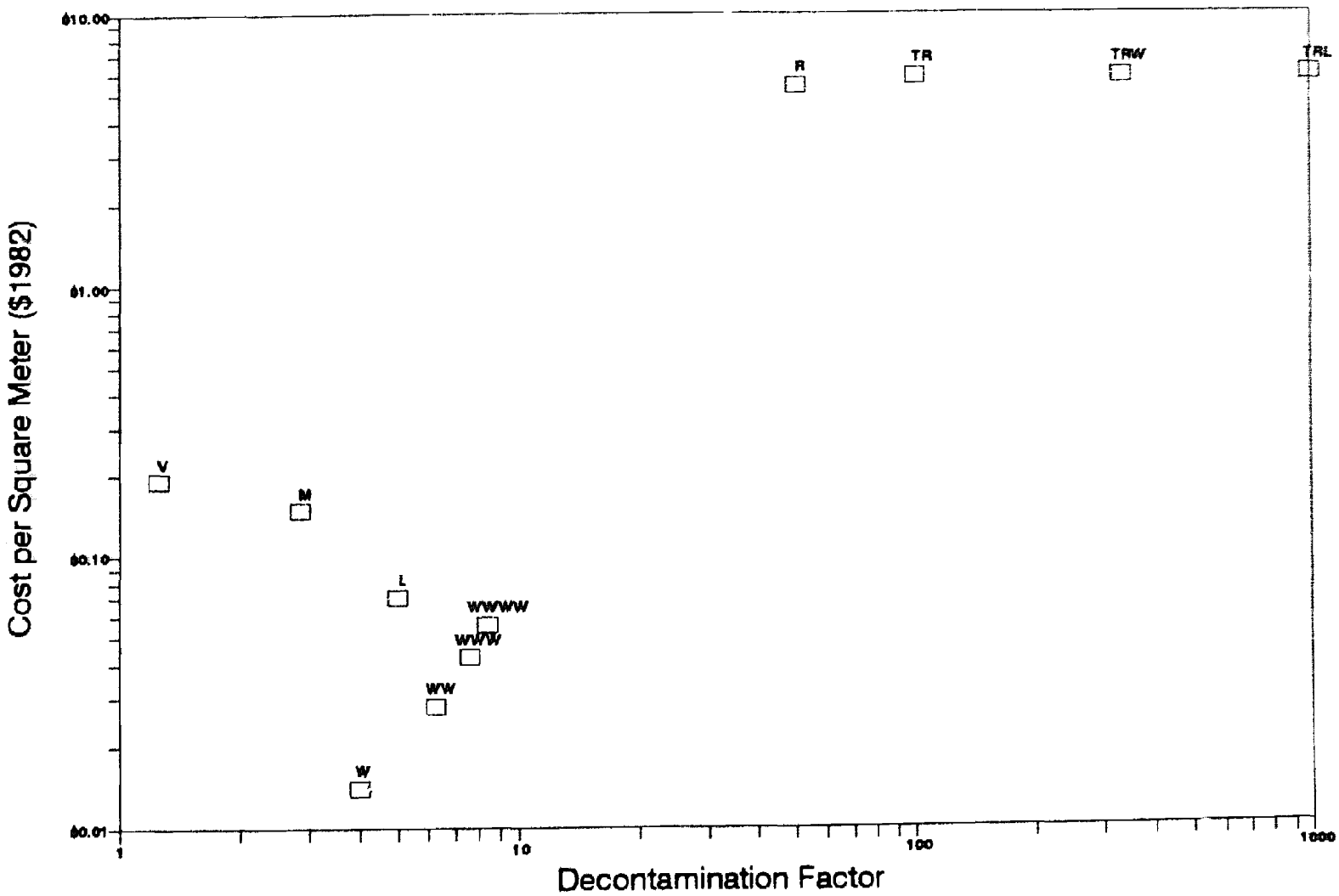

Figure 2.9. Costs and Efficiencies of Decontamination Methods: Lawns

OAGI0001550_00091

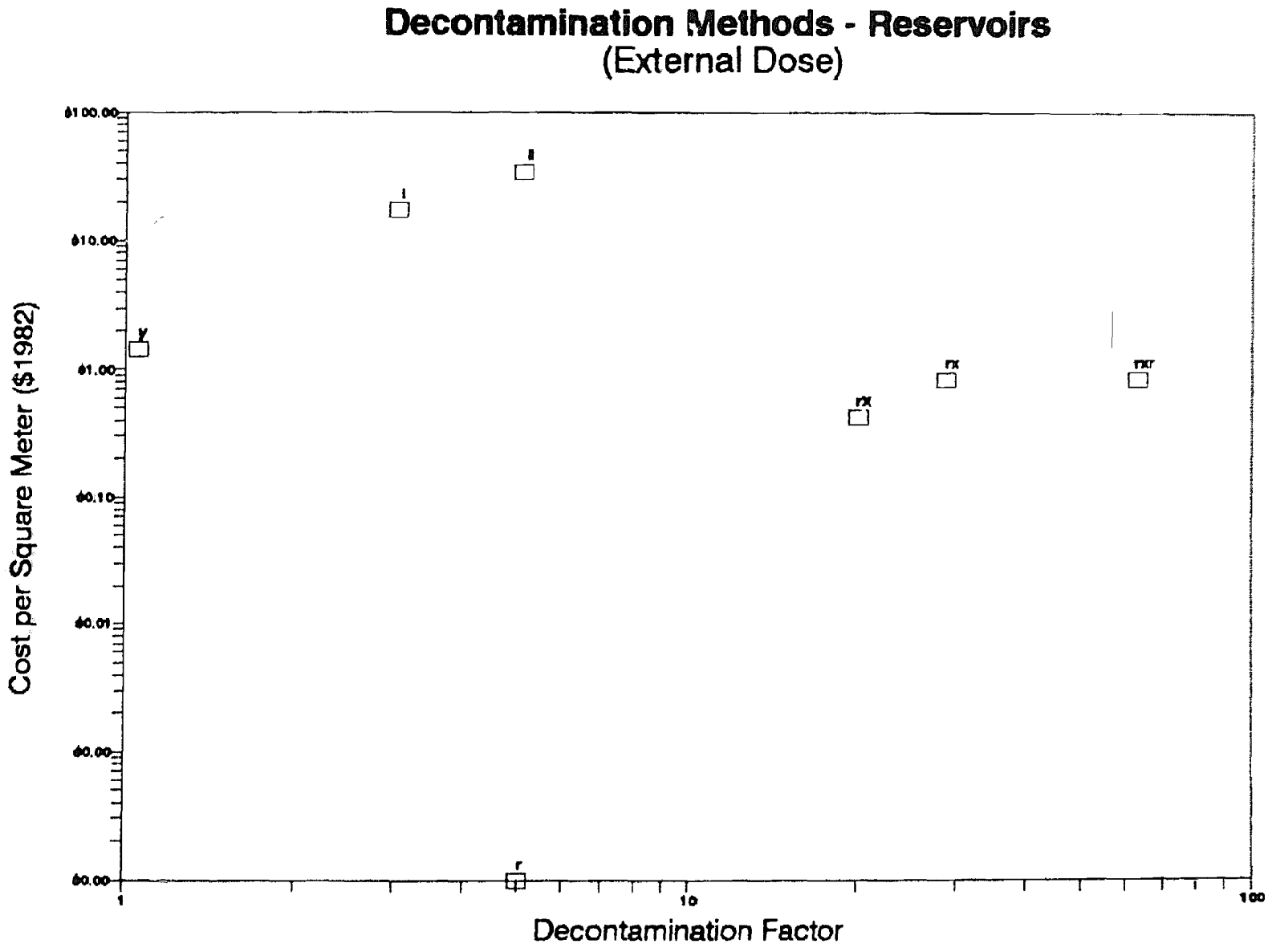

Figure 2.10. Costs and Efficiencies of Decontamination Methods: Reservoirs

OAGI0001550_00092