Uploaded to the VFC Website

February 2014

This Document has been provided to you courtesy of Veterans-For-Change!

Feel free to pass to any veteran who might be able to use this information!

For thousands more files like this and hundreds of links to useful information, and hundreds of "Frequently Asked Questions, please go to:

Veterans-For-Change

Veterans-For-Change is a A 501(c)(3) Non-Profit Organizaton
Tax ID #27-3820181
CA Incorporation ID #3340400
CA Dept. of Charities ID #: CT-0190794

If Veterans don't help Veterans, who will?

We appreciate all donations to continue to provide information and services to Veterans and their families.

https://www.paypal.com/cgi-bin/webscr?cmd=_s-xclick&hosted_button_id=WGT2M5UTB9A78

Note: VFC is not liable for source information in this document, it is merely provided as a courtesy to our members & subscribers.

II 39. Baygon Spray. This ready-to-use insecticide solution contains 1% o-Isopropoxyphenyl Methylcarbamate, 84% petroleum distillate and 15% inert ingredients. See Item No. 38 above. Although this item must be applied by certified personnel and there is some delay in procurement through official channels, local procurement must be cautious since some formulations with dangeroulsy low flash points are available. See the discussion on flash points in Part III of this Review.

Spec not given, FSCM 32766	/CN (1 gallon)
689393-666	6840-180-6069

II 40. Carbaryl 80%. (Sevin) This finely ground powder forms a suspension in water. It contains 80% 1-naphthyl methyl carbamate and 20% inert ingredients. It is packaged in 15-pound pails or in 10-pound paper bags.

FED O-I-00574	$5.28/PL (15 pounds)
676163-500	6840-932-7297

II 41. Carbaryl-DDT, Micronized Dust. This specially formulated insecticide is prepared for use ONLY in the disinsection of aircraft. It is packaged in three size cartons.

Spec not given	$21.60/Carton (1 gram)
	6840-180-6141
Spec not given	$26.80/Carton (5 grams)
	6840-180-6142
Spec not given	/Carton (13 grams)
	6840-180-6143

II 42. Chlordane. This emulsion concentrate contains 72% chlordane and 28% solvents and emulsifiers. When properly diluted with diesel oil or water, this concentrate makes an excellent residual type spray if correctly applied. An additive, such as Tween 80, might be necessary in preparing the dilute spray.

FED O-I-515	$28.60/PL (5 gallons)
677289-500	6840-270-8262

II 43. Chlordane. Powder form. This finely ground powder contains 5-6% chlordane and 94 - 95% inert ingredients in a ready-to-use dust.

MIL-I-21036	$4.16/PL (25 pounds)
677852-500	6840-543-7825

delete 44. DDT. This solution contains 20% DDT and 80% aromatic petroleum derivative solvents. It was prepared primarily for dispersal by aircraft. Its use has been discontinued. It is listed here for identification pruposes only. It is shown in FSC 6800-IL-CB2 of 1 July 1970 but it should not be ordered or used.

FED O-I-509	$341.62/DR (55 gallons)
678415-500	6840-281-3462

6201

delete

45. DDT. This residual spray solution is flammable. It contains 5% DDT, 70% deodorized kerosene and 25% auxiliary solvents. This information is listed for identification use only.

FED O-I-531 — $3.78/PL (5 gallons)
678978-500 — 6840-253-3892

delete

46. DDT. This nonflammable emulsion concentrate contains 25% DDT and 75% emulsifier and solvent. It was formulated to be diluted with water before use. This listing is for information purposes only. Do not use this item. It is nonstandard.

FED O-I-558A — $66.00/DR (55 gallons)
679260-550 — 6840-598-7314

II
K4445 II E
1037A

47. DDT. This non-flammable emulsion concentrate contains 25% DDT (25 gms DDT/100 ml solution). It is used as a residual spray after dilution with water. (Do not order 6840-543-4038.)

FED O-I-558 — $6.36/PL (5 gallons)
679541-500 — 6840-246-6432

II

48. DDT. This finely ground powder contains 75% DDT and 25% biologically inert ingredients. The item is formulated to produce a good suspension in water but frequent agitation is required to maintain the suspension during spraying. For use as a residual spray in the control of mosquitoes, ants, fleas and ticks.

FED O-I-568 — $5.23/PL (20 pounds)
680105-500 — 6840-264-6692

delete

49. DDT. This powder contains 10% DDT and 90% pyrophyllite or talc. Its use has been discontinued. This listing is for information only. Do not use.

FED O-I-578 — $0.08/CN (2 ounces)
680667-333 — 6840-274-5415

delete

50. DDT-Lindane. This nonflammable solution contains 10% DDT, 2% lindane, 83% tetrachloroethylene and 5% motor oil. It should be diluted with diesel oil before use. It is commonly known as indoor fog oil but it must NOT be used to treat food storage spaces or subsistance warehouses. It is to be discontinued from use. This listing is for identification purposes only.

FED O-I-561 — $11.40/PL (5 gallons)
681230-500 — 6840-285-4307

I

51. DDT-Pyrethrum Aerosol. This 12-ounce pressurized can contains a special formula which is to be used for the disinsection of airplanes only. This formula meets the U. S. Public Health Service Spec No. 1152 (DDT 3%,

6202

pyrethrum extract 5%, cyclohexanone 5%, lubricating oil, SAE 30 2% and propellent 85%). Although the use of this item is still authorized, a replacement is planned.

MIL-I-51238 — $0.84/CN (12 ounces)
681793-500 — 6840-766-9631

52. Diazinon. This flammable solution contains 0.5% diazinon, 99.2% deodorized kerosene and 0.2% aromatic petroleum derivative solvent and 0.1% inert ingredients. It is a ready-to-use residual spray material for use in controlling cockroaches resistant to chlorinated hydrocarbon insecticides. II

MIL-I-21177 — $0.93/CN (1 gallon)
682919-500 — 6840-844-7355

53. Diazinon. This non-flammable emulsion concentrate contains 47.5% diazinon, 52.5% solvent and emulsifier. When diluted as specified with water it is suitable for residual spray for the control of insects resistant to chlorinated hydrocarbon insecticides. II

FED O-I-520 — $20.10/PL (1 gallon)
683482-500 — 6840-782-3925

54. Diazinon. This finely ground powder contains 2% diazinon and 98% inert ingredients. It is a ready-to-use dust preparation. It is not to be mixed with water. II

MIL-I-22772 — $4.90/PL (25 pounds)
684045-500 — 6840-753-5038

55. Dichlorvos. This specially formulated pelletized form insecticide contains 20% dichlorvos (DDVP). (Vapona). These pellets are for use in Dichlorvos Dispenser (MIL-D-28573YD) on the treatment of stored products. Special training programs will train the operators of this equipment. II

Spec not given — /PL (30 pounds)
6840-181-7311

56. Dichlorvos. Insecticide strip. A space insecticide is released from impregnated resin strips. (Vapona) This listing originally defined special 2-inch strips which were designed for use in shipping containers which contain retrograde cargo. It is reported that the same Federal Stock Number will procure 10-inch strips. Although these strips will provide control of certain flying insects, their use is not recommended for every location. Follow directions carefully. I

MFG FED Code 86961 — $11.50/CS (144 2-in. strips)
690238-500

$0.90/EA (90 10-in. strips per case)
6840-142-9438

II

57. Dieldrin. This emulsion concentrate contains 15% Dieldrin, 82.4% emulsifier and aromatic hydrocarbons and 2.6% related compounds. It must be diluted with water before it is used as a residual treatment for termite control.

FED O-I-522 — $16.90/PL (5 gallons)
684608-500 — 6840-264-9043

II

58. Dursban. This emulsion concentrate contains 40.8% O,O-diethyl 0-3,5,6-trichloro-2-pyridyl phosphorothioate (Dursban), 24.5% aromatic petroleum derivative solvent and 34.7% inert ingredients. It mixes easily with water or oil such as kerosene of No. 2 diesel fuel oil.

Spec not given
6840-402-5411

II

59. Lindane. This emulsion concentrate contains 12 grams of lindane per 100 ml (approximately 1 pound of lindane/gallon). 12% concentrate. It is non-flammable. It must be diluted with water when used as a residual spray to control mosquitoes, flies, sand fleas, roaches, ants, mites, ticks and fleas.

FED O-I-533 — $9.50/DR (5 gallons)
685171-500 — 6840-242-4213

I
K4450 II E
1869A

60. Lindane. This finely ground powder contains 1% lindane and 99% inert ingredients. It is ready-to-use as a dust. It is not dispersible in water. It is especially prepared for application to the skin and the inside of clothing where DDT-resistant lice may be present. It is used in the control of body crab and head lice, fleas, bedbugs and other crawling insects. It is packaged in two sizes for convenience.

MIL-I-11490 — $0.08/CN (2-ounce can)
685734-333 — 6840-242-4217

II
K4455 II E
1035A

(Two ounces of dust in a 3-ounce plastic bottle is planned, but you will probably receive a 2-ounce metal can with a dust-type top. Follow directions.)

685734-666 — $3.36/PL (25 pounds)
6840-242-4219

(This item is packaged for use in mass delousing programs when the Mass Delousing Outfit - FSN 3740-889-2315 or the manually operated Duster - FSN 3740-132-5936 may be required.)

II

61. Malathion. This emulsion concentrate is flammable. It contains 57% malathion, 30% aromatic petroleum solvent and 15% inert ingredients and emulsifier. It is packaged in three sizes; the one-gallon and five-gallon packages contain Grade A malathion (less odor) but the 55-gallon drum contains Grade B malathion. The contents of the 1- and 5-gallon containers

6204

will emulsify very well with water to produce a residual spray for the control of ants, bedbugs, cockroaches, fleas, soft-body insects, mites, scales. In order to produce a satisfactory emulsion with many forms of diesel oil or kerosene, a sludge inhibitor - Thiosperse - is recommended and should be procured locally and used according to directions.

K4460 II E 2749A	FED O-I-565 686297-249 (Grade A)	$7.75/GL (1-gallon pail) 6840-655-9222
	686297-498 (Grade A)	$24.00/PL (5 gallons) 6840-685-5438
K4465 II E 2749B	686297-747 (Grade B)	$267.00/DR (55 gallons) 6840-685-5437

62. Malathion. Solution concentrate. This technical non-flammable liquid contains 95% malathion (Grade B) and 5% inert ingredients. It is not emulsifiable. It is formulated especially for dispersal by aircraft as low volume concentrate or diluted with suitable oil. The addition of Thiosperse may be required to prevent sludge formation with certain diesel oils or kerosenes.

II
K4470 II E
2749C

MIL-M-51064B 686860-500	$407.00/DR (55 gallons) 6840-926-1481

63. Malathion. This ready-to-use powder contains 1% malathion and 99% inert ingredients. It is not water dispersible. It is intended for use in areas where body lice are known to be resistant to DDT and lindane and louse-borne disease is prevalent. Before use this item requires the approval of the Surgeon General.* It is listed for information purposes only. Do not procure.

III

FED O-I-554 687423-500	$5.01/PL (25 pounds) 6840-823-7945

*See Department of the Army Circular 420-3 of 3 August 1964.

64. Methyl Bromide. This odorized non-flammable fumigant is a liquid under pressure. It is available in two sizes - 1-pound can and 150-pound cylinder. Its use by properly trained personnel is intended as a general fumigant for control of insects in household effects, certain products stored in bulk or packages and soil. (98% concentrate)

II

FED O-I-556 (Type I) 687986-333	$0.54/CN (1-pound can) 6840-823-7946
687986-666	$110.00/CY (150 pounds) 6840-680-0142

6205

65. Naled. (Dibrom) This solution concentrate contains 85% naled and 15% inert
II ingredients. It is not emulsifiable. Certain diesel fuel oils and kerosenes may produce an undesirable sludge when used to dilute this compound. To prevent this sludge, Ortho Additive D is required and should be procured locally.

MIL-I-51260 — $334.00/DR (15 gallons)
689112-500 — 6840-926-9163

66. Pyrethrin-Piperonyl Butoxide. This 12-ounce aerosol is an excellent all
I purpose insecticide spray. The formula contains 0.6% pyrethrum extract,
K4485 II E 1.4% piperonyl butoxide or sulfoxide, 85% propellent, 10% deodorized
1868A kerosene and 3% aromatic petroleum solvent. It is intended for use in control of mosquitoes, DDT-resistant flies, other flying insects and small insects indoors.

FED O-I-507 — $0.57/EA (12-ounce can)
689675-500 — 6840-823-7849

Do not use 6840-254-8770
Non-standard

67. Pyrethrum Space Spray. This flammable liquid is a general purpose space
I spray and is ready-to-use. It contains 2.0% pyrethrum extract, 1.6% piperonyl butoxide or equivalents synergist and 96.4% deodorized kerosene maximum. It is an excellent spray for the control of flying insects indoors.

MIL-I-51319/MU — $1.65/CN (1 gallon)
689956-500 — 6840-400-2140

68. Soil Fumigant - SMDC (VAPAM) This solution contains 32.7% Sodium
II N-Methyl- dithiocarbamate (anhydrous) and 67.3% inert ingredients. It is intended for use as a soil fumigant in the treatment of retrograde cargo. It is readily diluted with water.

MIL-S-51342/MU — /PL (5 gallons)

RODENTICIDES

70. Rodenticide Bait. This ready-to-use, anticoagulant bait contains 4.8% liquid
I petrolatum, 4.8% sugar, 0.05% dye, 0.025% lethal ingredient and the
K4765 II E remainder is breakfast rolled oats cereal.
3554A

FED O-R-00500 — $1.10/CN (5 pounds)
690801-500 — 6840-753-4973

6206

71. Rodenticide Bait Block. This rodent bait block is specially formulated for
I control of rodents in shipping containers, such as those which contain retrograde cargo. The block contains 55-57% inert ingredients composed of a cereal formulation mold inhibitor and an insecticide, 38-40% technical grade paraffin wax with a minimum melting point of 165 degrees F., 5% diphacin, composed of .005% diphacin in 4.995% starch. The 8-ounce block has a center hole of 3/4 to 1 inch in diameter with attached heavy duty red binding tape, 8 feet x 3/4 inch minimum width, and warning card.

MFG Code 27633, P/N 788	$10.10/Carton of 40 blocks - 20 pounds.
691364-500	6840-089-4664

72. Rodenticide, anticoagulant, concentrate. This rodenticide concentrate
II contains diphacinone, fumarin, pivalyl or PMP. This concentrate must be diluted with water or made into a dry cereal bait before it is used. It is to be diluted to produce 1 part of this concentrate with 9 parts of bait diluent.

FED O-R-00497	$0.56/LB (1-pound can)
691927-500	6840-753-4972

73. Calcium Cyanide. This compound is formulated as a powder or a dust which
II contains 42% calcium cyanide and 58% inert ingredients. In order to disperse this fumigant into rodent burrows, use the Duster, FSN 3740-267-4802, which is made for this purpose.

FED O-R-501	$1.05/CN (1-pound can)
693053-500	6840-246-6436

74. Calcium Cyanide. This item is the same as Item No. 73 except for packaging.
II This 5-pound container is now a non-standard item and for safety and economy should not be used. It is listed here for information purposes only.

FED O-R-501	$3.30/CN (5 pounds)
693616-500	6840-264-6684

75. Rodenticide, Zinc Phosphide. This rodenticide is a fine powder which
II contains 80% technical zinc phosphide and 20% antimony potassium
K4770 II E tartrate.
1064A

FED O-R-511	$0.37/BT (1 ounce)
694179-500	6840-285-7091

Miscellaneous Pesticide Information

INSECTICIDES

76. Naphthalene, "Moth Balls." This familiar product still has many uses in Pest
I Control.

FED R-N-91	$0.88/BX (1 pound)
287130-249	6810-597-6111

6207

77. Naphthalene, "Moth Flakes." This familiar product still has many uses in pest control.

I K4475 II E 2126A

FED R-N-91 — $0.41/LB (1-pound box)
287130-489 — 6810-286-6018

78. Paradichlorobenzene. PDB. This crystalline form of PDB has many uses including moth prevention, deodorant and fungicide. A little PDB in the right place will prevent odors, mildew, and moth damage. It is packaged in two sizes of containers.

I K4480 II E 3552A

FED O-P-99
150884-333 — $0.33/CN (1-pound can) 6810-174-1824

$15.70/DR (100-pound fiber drum)
150884-666 — 6810-174-1825

79. Carboxide. Carboxide is a fumigating compound which contains 89.5 - 90.5% carbon dioxide and 9.5 - 10.5% ethylene oxide. Be sure of this formula before you use this item. Special training is necessary for the proper use of this fumigant. It is issued in a cylinder (FSN 8120-151-9751) which contains 60 pounds of carboxide.

II

MIL-F-2918
604099-500 — /CY (60 pounds) 6830-282-9724

HERBICIDE

80. Pentachlorophenol. This ready-to-use solution contains 5% pentachlorophenol in a light oil with a water repellent compound added. It is stocked primarily as a wood preservative to protect against attack from termites and wood destroying beetles (lyctus). However, pentachlorophenol halts the growth of algae when it is sprayed over small, temporary water impoundments (borrow pits and stone quarries). It also retards the growth of water hyacinths at a dosage of only 5 ppm (1 ppm equals 0.8345 pounds per 1,000 gallons of water). Complete eradication might require as much as 80 ppm. When used in these situations, effective control of many species of mosquito larvae results.

II

FED TT-W-572 Type II — $29.50/DR (55 gallons) 8030-634-7970

Face Paint, Camouflage, FSN 8510-161-6202 (one end of the stick green - one end of the stick sand color) is a stick-form of face paint which contains the insect repellent dimethyl phthalate. This repellent is effective against mosquitoes and other biting flies. Various colors are available at $0.16 each stick. Future developments will produce an improved face paint which will contain the repellent DEET (dimethyl toluamide). This present face paint is listed in TAM K4645 II 3558A.

6208

Ointment, Gamma Benzene Hexachloride, FSN 6505-299-8279, is a good vanishing cream which contains 1% BHC (lindane) which is effective when used on the skin to control the itch mite which causes the disease known as scabies. It is used as a cure for pediculosis; the treatment may be effective in the control of body lice, crab lice and their eggs. The 60-gram tube lists at $0.26 each.

Substitute Items. Substitution of certain items may be authorized by competent military entomologists when the item which was requested has been superseded. This is done to avoid delay and to assist in the continued efficiency of the pest control program. However, NON-STANDARD pesticides and pest control equipment require approval of the Command Entomologist before procurement can be initiated. If you are having problems in effective, safe and efficient control operations, contact your Command Entomologist. DOD Instruction 4150.7 requires that only standard issue pesticides of known composition and origin will normally be used in pest control operations at military installations. Locally procured, proprietary pesticides and pest control equipment will not be used unless approved by the Military Departments. Major military commands (Army Commands, Naval Districts, major Air Force Commands) provide technical services to review requirements and approve procurement of necessary non-standard items when small volume does not justify standardization and when standard supply items will not provide adequate control. Short shelf life and special purpose materials may also justify local procurement.

GSA Items. The General Services Administration catalogs list many pesticides which would appear to be identical to those in the military supply system. This is usually not the case. The packaging may not be designed for prolonged storage; the size or type of package may not be suited for military use, and, in some instances, batches of material, rejected for military use, have found their way into the GSA supply system. Furthermore, the Defense Supply System is not equipped to handle requisitions or MILSTRIP cards for GSA items. When requests for GSA items accidentally get into military channels, confusion and procurement delays may result. If, because of a temporary shortage, or other unique reason, the user is unable to obtain a military standard stock item, he should check the acceptability of a GSA item with the Command Entomologist. If a GSA item is deemed necessary, the request for the material must be directed to the GSA Depot and not to a military supply point.

Disposition of surplus, obsolete or discontinued pesticides. In part III of this review the general attitude of many agencies and individuals is compiled. The Naval Supply Systems Command stated in reference (f), paragraph 4b, this Part I, "OSD, based on the above requested information will provide disposition instructions for these DDT formulations." Additional directives will be published when disposition information is required. Several disposal actions have produced undesirable results. The best procedure will require storage of the identified pesticides in accordance with the suggested methods in Part III of this review.

Transition numbers for your convenience.

Class 6840- Federal Stock Number	This Review Number	Federal Stock Catalog Index Number
027-6467	4	660989-500
063-3981	8	662932-500
082-2541	34	674474-500
089-4664	71	691364-500
142-8965	35	675087-500
142-9438	56	690238-500
145-0016	36	675652-333
180-6069	39	689393-666
180-6141	41	
180-6142	41	
180-6143	41	
181-7311	55	
242-4213	59	685171-500
242-4217	60	685734-333
242-4219	60	685734-666
246-6432	47	679541-500
246-6436	73	693053-500
252-3002	49	680667-666
253-3892	45	678978-500
264-6684	74	693616-500
264-6692	48	680105-500
264-9043	57	684608-500
270-6200	29	671659-500
270-8262	42	677289-500
274-5415	49	680667-333
281-2062	30	672222-500
281-3462	44	678415-500
285-4307	50	681230-500
285-7091	75	694179-500
400-2140	67	689956-500
402-5411	58	
442-5698	37	675652-666
498-4057	38	689393-333

6210

Class 6840 - Federal Stock Number	This Review Number	Federal Stock Catalog Index Number
514-0644	21	668281-500
543-7825	43	677852-500
577-4194	11	663777-498
577-4195	12	663777-747
577-4201	28	671096-666
577-4204	9	663214-500
582-5440	27	671096-333
598-7314	46	679260-500
629-1638	1	660399-500
655-9222	61	686297-249
664-7060	10	663777-249
680-0142	64	687986-666
681-9475	17	666029-500
684-8975	7	662651-500
685-5437	61	686297-747
685-5438	61	686297-498
753-4963	32	673349-333
753-4972	72	691927-500
753-4973	70	690801-500
753-5038	54	684045-500
766-9631	51	681793-500
781-8195	25	670252-500
782-3925	53	683482-500
810-6920	20	667718-500
814-7334	24	669970-500
815-2799	16	665466-500
823-7849	66	689675-500
823-7945	63	687423-500
823-7946	64	687986-333
825-7790	19	667155-500
825-7792	13	664340-500
833-1217	3	660962-500
844-7355	52	682919-500
864-5430	33	673349-666
882-4810	23	669407-500
890-2146	5	661525-500

6211

Class 6840 - Federal Stock Number	This Review Number	Federal Stock Catalog Index Number
905-4304	15	664903-500
926-1481	62	686860-500
926-9093	2	660472-500
926-9094	6	662417-500
926-9095	14	664608-500
926-9163	65	689112-500
929-7951	26	670418-500
932-7297	40	676163-500
935-0984	31	672785-500
965-2071	18	666592-500
990-1464	22	668844-500

6212

FSC Index Number	Our Review Number	Federal Stock Number 6840-
660399-500	1	629-1638
660472-500	2	926-9093
660962-500	3	833-1217
660989-500	4	027-6467
661525-500	5	890-2146
662417-500	6	926-9094
662521-500	7	684-8975
662932-500	8	063-3981
663214-500	9	577-4204
663777-249	10	664-7060
663777-498	11	577-4194
663777-747	12	577-4195
664340-500	13	825-7792
664608-500	14	926-9095
664903-500	15	905-4304
665466-500	16	815-2799
666029-500	17	681-9475
666592-500	18	965-2071
667155-500	19	825-7790
667718-500	20	810-6920
668281-500	21	514-0644
668844-500	22	990-1464
669407-500	23	882-4810
669970-500	24	814-7334
670252-500	25	781-8195
670418-500	26	929-7951
671096-333	27	582-5440
671096-666	28	577-4201
671659-500	29	270-6200
672222-500	30	281-2062
672785-500	31	935-0984
673349-333	32	753-4963
673349-666	33	864-5430
674474-500	34	082-2541
675087-500	35	142-8965
675652-333	36	145-0016
675652-666	37	442-5698
676163-500	40	932-7297
	41	180-6141
	41	180-6142
	41	180-6143
677289-500	42	270-8262

FSC Index Number	Our Review Number	Federal Stock Number 6840-
677852-500	43	543-7825
678415-500	44	281-3462
679260-500	45	253-3892
679541-500	47	246-6432
680105-500	48	264-6692
680667-333	49	274-5415
680667-666	49	252-3002
681230-500	50	285-4307
681793-500	51	766-9631
682919-500	52	844-7355
683482-500	53	782-3925
684045-500	54	753-5038
	55	181-7311
684608-500	57	264-9043
	58	402-5411
685171-500	59	242-4213
685734-333	60	242-4217
685734-666	60	242-4219
686297-249	61	655-9222
686297-498	61	685-5438
686297-747	61	685-5437
686860-500	62	926-1481
687423-500	63	823-7945
687986-333	64	823-7946
687986-666	64	680-0142
689112-500	65	926-9163
689393-333	38	498-4057
689393-666	39	180-6069
689675-500	66	823-7849
689956-500	67	400-2140
690238-500	56	142-9438

6214

Part II

EQUIPMENT FOR PEST CONTROL AND PESTICIDE DISPERSAL (Primarily FSC 3740-)

References:

(a) FSC 3740/50-IL-N Identification List 1 January 1968
(b) FSC 3740/50-IL-N-CB3 Identification List 1January 1969
(c) FSC 3740/50-IL-N Supplement IL 1 July 1969
(d) FSC 3740/50-IL-N Supplement IL 1 October 1969
(e) C3740/50-IL-MC Identification List 1 January 1970
(f) C3740/50-IL-MC-CB2 Identification List 1 July 1970
(g) C3740/50-ML-MC-CB4 Management Data List 1 July 1970

NOTE: The first 15 items will meet the needs of most pest control operations.

Review No. / TAM No.	Descriptive Information / Specification / FSC Index Number	Price / Federal Stock Number
TAM C4760 II E 1361A	1. Duster, Manually Operated, Rotary Fan, Strap carried. This duster is used to disperse insecticidal dusts over open areas outdoors. The dust hopper has a capacity of 5 to 10 pounds. It has an output range of one to twenty acres. It is complete with one discharge nozzle, two non-flexible extension tubes (14 inches long), and one curved non-flexible tube (10 inches long).	
	FED RR-D-780, Type 2, Size 1 25900 NOTE: Use 3740-494-1768 until exhausted.	$23.30/EA 3740-132-5935
TAM 4680 II E 1401A	2. Duster, Manually Operated, Manually Carried, Tubular. This duster is used for placing insecticidal dusts in hard-to-reach places for the control of ants and roaches. It is used to place insecticidal dusts inside the clothing of personnel for the control of lice. The unit is about 10 inches long and 3 inches in diameter. The steel container has a capacity for one pound of dust or powder. It is packed complete with one flexible extension tube and one discharge nozzle.	
	FED RR-D-780, Type 1, Class B, Size 2 31195 NOTE: Use 3740-494-1767 until exhausted.	$2.20/EA 3740-132-5936
	3. Duster, Manually operated, Manually Carried, Foot Held. This duster is used to dispense Calcium Cyanide (FSN 6840-246-6436) into rodent burrows. This tubular pump is 14 inches long and 4 inches in diameter. The removable	

6215

aluminum container will hold about 5 pounds of calcium cyanide dust. It must be completely emptied after each use before it is stored in a well ventilated space. The pump is complete with a foot holding pedal.

American Cyanimid Co., N.Y., N.Y.	$15.10/EA
Code 70361, Model 50	3740-267-4802
31100	

4. Sprayer, Insecticide, Manually Carried and Operated. This pistol grip type sprayer can produce an intermittent mist or a solid stream. Various adjustments of the nozzles make this sprayer a practical tool. The capacity of the steel container is 1 quart. Idico P/N Model 8-1X

MIL-S-38718	$5.87/EA
90000	3740-141-3285

5. Sprayer, Insecticide, Manually Carried and Operated. This sprayer is a "flit gun" type unit with a plunger type pump. A continuous mist spray is produced. The steel container has a rust-resistant liner. It has a capacity of one quart.

FED RR-S-626, Type 3, Class 2, Size 1	$2.25/EA
88200	3740-691-1776

NOTE: Use 3740-408-3196 until exhausted.

When 3740-691-1776 is exhausted, use 3740-526-7992.

TAM C6220 II E 4610A

6. Sprayer, Insecticide, Manually Carried, Pressure Type. This compression type sprayer has a capacity of 2 gallons. There is no pressure gauge or agitator. It is complete with a discharge hoze, 2 nozzles, discharge valve and carrying strap. The "On-Off" spray control valve is located on the sprayer wand.

MIL-S-14102	$26.50/EA
88250	3740-641-4719

NOTE: Use 3740-733-1430 until exhausted.

7. Sprayer, Insecticide, Manually Carried, Electrically Operated. This device is equipped with an electric motor, AC, 115V, 60 cycle, single phase with a toggle switch for "On-Off" control. The rust-resistant container has a capacity of 4 quarts. The discharge valve is adjustable to control the volume and form of mist type spray. There is a carrying strap. (Challenger)

MIL-S-22308	$43.90/EA
91100	3740-836-8106

TAM C6215 VII B 06894A

8. Sprayer and Duster, Insecticide, Back-Pack Type, Gasoline Engine Driven. This portable back-pack duster-mister is mounted on the back of the operator. The 1-cylinder, 4 HP air-cooled gasoline engine drives the axial

62/6

vane blower to produce an air stream of about 90 mph. The insecticide container is made of high impact resistant plastic. It has a capacity of 3 gallons of solution of 15 pounds of insecticide dust. When empty, the unit weights less than 30 pounds.

MIL-S-23891	$341.00/EA
112000	3740-904-0818

NOTE: FSN 3740-904-0818 is the proper number to use for procurement of this item. TAM. U.S.M.C. Revision No. 1 NAVMC 1017 of 20 April 1970 lists this unit with FSN 3740-884-4638. Each manufacturer has a different manufacturing number and the Manuals for Operation and Maintenance as well as the Spare Parts are not interchangeable. The manufacturer's number and serial identifier will be used to order spare parts and additional manuals. For example, if your back-pack has a serial number in the range from 68-1001 through 68-1568, it was manufactured by Curtis Dyna-Products and carries FSN 3740-884-4638. In order to overcome certain discrepancies, Curtis Dyna-Products has prepared special repair kits for these units.

9. Sprayer, Insecticide, Non-thermal Aerosol Generator. This skid-mounted unit is driven by a gasoline engine. 18 HP, which drives a turbine to produce about 350 cu. ft. of air per minute to the cluster of discharge nozzles. The maximum discharge rate is 40 gallons per hour. There is no solution supply tank and no agitator. The unit weighs about 700 pounds.

TAM C6230 VII B 0433A

MIL-S-52185	$2097.00/EA
100000	3740-625-9989

NOTE: FSN 3740-625-9989 is the proper number to use for procurement. However, each manufacturer has a different manufacturing number and the Manuals for Operation and Maintenance as well as Spare Parts are not interchangeable. The manufacturer's number and serial identifier will be used to order spare parts and additional manuals. For example, Curtis Dyna-Products Corporation Model CFR-41500 carries FSN 3740-930-9348; Curtis Automotive Devices Model CFR 400000 carries FSN 3740-790-6188; and LECO Model CM-40 carries FSN 3740-955-9341. Each model has its own Operation and Maintenance Manual and Spare Parts List.

10. Sprayer and Duster, Insecticide, Trailer Mounted. The gasoline engine drives a turbine to produce 10,000 cu. ft. per minute at 150 mph at the nozzle. There is a solution tank for 50 gallons of liquid insecticide and a dust container with a capacity of 100 pounds. The device can discharge mists or

dusts separately or simultaneously. The two-wheel trailer has pneumatic tires. There is no turntable but the discharge nozzle can be turned.

MIL-S-23923, Type II (Buffalo)	$4237.00/EA
117050	3740-901-0720

NOTE: The trailer hitch is for commercial vehicles and may require modification before the sprayer can be towed by military vehicles.

11. Sprayer, Insecticide, Frame Mounted, Gasoline Engine Driven. Although this sprayer has no solution tank or agitator it does have many uses in pest control. It is especially important to under-slab treatment for termite control or for the transfer of liquids. This portable sprayer is driven by a 1 1/2 HP gasoline engine. The maximum discharge rate is 3 gallons per minute at a pressure of 300 psi. It is packed complete with one spray gun with adjustable nozzle and 50 feet of oil resistant hose, 3/8 inch ID. The frame is metal.

MIL-S-12511	$568.00/EA
83000	3740-772-0090

12. Mousetrap, Spring. This inexpensive trap is spring loaded with 4-way release action. The base is wood.

TAM K4550 II E 1385A

FED GGG-M-00550, Type 1	$0.57/DZ (dozen)
56900	3740-252-3384

13. Rattrap, Spring. This trap is well made on a wood base. The automatic spring trigger has a 4-way release.

TAM K4750 II E 1394A

FED GGG-M-00550, Type II	$2.20/DZ (dozen)
72910	3740-260-1398

14. Swatter, Fly. This device is not limited to the control of one kind of pest. It can be used effectively against flying and crawling insect pests. The blade may be wire mesh or plastic with binding for strength. The handle may be wire or plastic.

FED GGG-S-00850	$0.74/EA
137700	3740-252-3383

15. Respirator, No. 6058. This respirator is one of those which is recommended for use by all personnel when they are handling pesticides. When in use this device must be equipped with a filter - Filter Cartridge R-58. (Filters packed 6 per box.)

TAM C5905 II E 01343B

American Optical Company, Safety Division, Southbridge, Massachusetts	4240-935-5516

NOTE: Additional items in the Federal Stock Catalog include:

16. Trap, Mosquito, Light. This standardized, New Jersey type, light trap is

powered by an electric motor, 1/100 HP, AC, 115V., single phase, 60 cycle, which drives a 4-blade fan at about 1500 revolutions per minute. The blades have a diameter of 8 inches and a pitch of 29 degrees. There is an automatic timer which can be set to operate the light and the fan. These traps may be procured with electric "eye" control and modified for operation by 12 volt battery.

MIL-T-52062	$85.00-$100.00/EA
147900	3740-607-0337

NOTE: A complete battery-operated light trap is available in a medical kit under number 6545-089-3766.

Trap, Insect, Survey	$600.00

17. Fumigation Kit, Portable. (For use with methyl bromide) This kit provides an excellent method for the fumigation of palletized material which does not exceed 1,650 cubic feet. There is a plastic coated nylon tarpaulin which is 30 by 40 feet in size but it weighs only one pound. The kit is complete with leak detector, mask, sand snakes for anchoring tarp and plastic tubing. No fumigant is included.

MIL-F-54000	$510.00/EA
5044682	3740-565-6076

18. Duster, Insecticide, Mass Delousing Outfit. This device is designed to treat large numbers of personnel in areas where lice and louse-borne diseases are prevalent. The outfit is operated by a gasoline engine driven compressor. Air is supplied to ten dust guns, each of which has a capacity of 1 1/2 pounds of insecticidal powder or dust (Lindane 1%, 6840-242-4219, or as directed). Each gun will be emptied in about 2 minutes. The unit is mounted on a metal frame and weighs about 200 pounds.

MIL-D-2457	$1175.00/EA
MSS 3740-1A	3740-889-2315

19. Trap, Animal, Cage. This non-collapsible trap has a treadle type trip. It is 16 - 19 inches long, 9 - 10.5 inches wide, and 7 - 8 inches high. It is made of heavy gauge wire. There is a carrying handle.

MIL-T-52062	$4.50/EA
142800	3740-267-4799

NOTE: When exhausted use

142900	3740-531-3905

20. Fog Generator, Insecticide. This frame mounted unit is used to disperse insecticide in a thermal fog. Maximum discharge rate is 25 gallons per hour. The apparatus is equipped with a formulation liquid metering valve, calibrated to give particle size in microns. The fog outlet is designed to

enable pointing the fog in any direction. An approved, flexible, metal extension hose may be attached to this outlet. The gasoline engine drives a positive displacement compressor or blower with a capacity of 160 cu. ft. per minute. The unit operates at 950 to 1050 degrees F. There is a formulation tank without an agitator. Agitation is accomplished by pump action in the suction and return lines of the solution manifold.

MIL-F-898, Size 2	$1671.00/EA
41500	3740-132-8330

NOTE: When exhausted use 3740-625-9989 - See Item No. 9

21. Fog Generator, Insecticide. This item is similar to Item No. 20 except the discharge capacity is limited to 5 gallons per hour.

MIL-F-898, Size 2	$254.00/EA
41400	3740-818-6648

22. Fog Generator, Insecticide. This frame mounted unit is similar to Item No. 20 except that the rate of discharge may be 100 gallons per hour and the working range temperature is from 30 to 125 degrees F. Special features of this device may include an electric starter with generator and battery.

MIL-F-898	
41750	3740-901-8236

23. Sprayer, Insecticide. This one quart size sprayer is similar to Item No. 5 except that the solution container is glass. The container is removable for filling.

	$1.50/EA
88400 Consolidate with Item No. 5.	3740-408-3196

24. Sprayer, Insecticide. This sprayer is similar to Item No. 5 and Item No. 23. This one quart capacity container is steel with a rust-resistant liner.

FED RR-S-626, Type 1, Class 1, Size 2	$1.25/EA
90300 Consolidate with Item No. 5.	3740-526-7992

25. Sprayer, Insecticide. This "flit-gun" type sprayer has a capacity of one quart. The solution container has a rust-resistant liner. Although it is similar to Item No. 5, No. 23, and No. 24, it differs in that it produces an intermittent spray.

FED RR-S-00626, Type 2, Class 1, Size 2.	$0.54/EA
90650	3740-171-9772

6220

26. Sprayer, Insecticide. This "flit-gun" type sprayer has a capacity of one pint. The container is made of rust-resistant steel. There is a plunger type pump and non-adjustable nozzle. The spray is intermittent.

FED RR-S-00626, Type 2, Class 1, Size 1	$2.25/EA
90600	2740-171-9771

NOTE: When exhausted use Item No. 5.

27. Sprayer, Pushcart Mounted. This unit is mounted on two large diameter wheels with semi-pneumatic tires. The sprayer is operated by a 1 1/2 HP gasoline engine which produces a maximum discharge rate of 30 gallons per hour. There is a pressure gauge, a pressure regulator, a spray gun with 4 nozzles, a discharge control valve and two discharge hoses, each 25 feet long. It is designed for use along narrow paths or trails.

MIL-S-52066	$834.00/EA
96100	3740-542-4866

28. Sprayer and Duster, Insecticide, Skid Mounted. This apparatus has a mechanical turntable. The gasoline engine drives a pump and a turbine so that liquid and powder insecticide may be discharged separately or simultaneously. The turbine produces 12,000 cu. ft. per minute at a velocity of 150 mph. The solution tank has a capacity of 50 gallons and the dust hopper can carry 100 pounds of powder.

MIL-S-23923	
112900	3740-724-2152

29. Sprayer and Duster, Insecticide, Skid Mounted. This device is similar to Item No. 10 except it is skid mounted.

MIL-S-23923	
112910	2740-901-0721

30. Sprayer, Insecticide. This skid mounted apparatus has a gasoline engine which drives a pump to produce a maximum discharge of 10 gallons per minute at pressures of 400 to 500 psi. The solution tank has a capacity of 150 gallons. There is a pressure regulator and an agitator. The adjustable discharge control valve regulates the quantity of solution and the form of the mist or spray produced.

John Bean Model 11010MTB	
101600	3740-763-3176

31. Sprayer and Duster, Insecticide. This apparatus is similar to Item No. 10 which replaces it.

Buffalo Turbine Model JEBS	
113500	3740-763-3177

6221

32. Sprayer, Insecticide. This trailer mounted device has a solution tank with a capacity of 150 gallons. There is an agitator. The maximum discharge rate is 5 gpm at pressures of 400 to 500 psi. There is a pressure regulator and a control valve. Various sprays are produced by changing the spray discs in the nozzle.

John Bean Model 55T
106750 3740-766-1133

33. Sprayer, Insecticide. This trailer mounted sprayer has a 200 gallon, fiberglass insecticide tank with agitator. The pump is driven by a 5 3/4 HP gasoline engine. The maximum discharge rate is 600 gallons per hour at 400 psi. Accessories include a spray gun with adjustable nozzle, discharge control valve and 100 feet of oil-resistant hose which is mounted on a reel.

MIL-S-28256, Size 1
106925 3740-925-9598

34. Sprayer, Insecticide. This trailer mounted sprayer has a large 300 gallon solution tank. There is an agitator. The maximum discharge rate is 25 gpm at pressures of 700 to 800 psi. A variety of nozzles are included with numerous accessories.

John Bean Model 25MTBT
106950 3740-763-3178

35. Sprayer, Insecticide. This sprayer is trailer mounted and is similar to Item No. 33 which replaces it.

John Bean Model 1010MTBT
106850 3740-763-3179

36. Sprayer and Duster, Insecticide. This trailer mounted sprayer is similar to the skid mounted device described as Iten No. 28. It has a turntable. The two wheels have pneumatic rubber tires.

107025 3740-724-2151

37. Sprayer, Insecticide. This trailer mounted sprayer has a solution tank with a capacity of 400 gallons. There is an agitator. The maximum discharge rate is 25 gpm at pressures up to 700 psi. Accessories include two spray guns with adjustable nozzles and 200 feet of oil-resistant hose. There is also a spray boom with this unit.

MIL-S-82068 (YD)
106975 3740-946-0994

6222

38. Sprayer, Insecticide. This sprayer is similar to Item No. 37 without the spray boom. This item will be deleted.

MIL-S-82068
106985 3740-946-0995

39. Sprayer, Insecticide. This trailer mounted sprayer is similar to Item No. 38. It will be deleted.

107000 3740-925-9594

40. Fog Generator, Insecticidal. This apparatus is similar to Item No. 20 and is replaced by Item No. 9.

MIL-F-898
106950 3740-766-1131

41. Fog Generator, Insecticide. This apparatus is similar to Item No. 20 and is replaced by Item No. 9.

MIL-F-898
41650 3740-764-6558

42. Sprayer, Insecticide. This apparatus is similar to Item No. 11 which replaces it.

MIL-S-12511
83100 3740-763-2173

43. Sprayer and Duster, Insecticide. This apparatus is similar to Item No. 10 which replaces it.

MIL-S-14266
117100 3740-722-3907

44. Sprayer and Duster, Insecticide. This apparatus is similar to Item No. 10 which replaces it.

MIL-S-23923
3740-541-9827

45. Sprayer, Insecticide. This apparatus is similar to Item No. 10 which replaces it.

H.D. Hudson Model 1055
101100 3740-494-1506

46. Sprayer and Duster, Insecticide. This trailer mounted apparatus is similar to Item No. 10 which replaces it.

MIL-S-23923
117000 3740-062-0555

6223

47. Container, Bait, Rodent. This bait container is packed in a folded, collapsed condition. When it is set up to use it will hold about 2 pounds of bait. The plastic coated tip-proof container will operate with wet or dry bait. It is disposable.

MERDL 10270
REF – 000052 3740-089-9358

48. Container, Bait, Rodent. This container for rodent bait is similar to Item No. 47 except for size. It will hold about 4 pounds of bait.

MERDL 10256
REF – 000053 3740-089-9359

49. Oiler, Hand, Forced Feed. This hand held oil dispenser is recommended for placing insecticide solutions in hard-to-reach places. Practice will produce accuracy. The adjustable nozzle may be replaced with an 18-gauge syringe needle and the device used to place liquid insecticide inside non-electrical insulation on steam and water pipes for roach control. When not in use cork can be kept on the needle point for protection and safety. The oiler has a capacity of one quart.

FED GGG-O-00591 $1.72/EA
4930-268-9786

NOTE: Plastic sprayers are available from several companies which have adjustable nozzles and control valves in which high pressures are produced. These are inexpensive and disposable.

50. Insect Bar (netting), Cot Type. This insect netting is made to fit the standard folding cot if it is equipped with a set of poles (Item No. 37). The nylon netting (20 mesh) is 200 inches long and 68 inches wide. It is olive green and mildew resistant.

TAM C5050 II F 1901A

MIL-I-10901 $8.80/EA
7210-266-9736

51. Poles, Insect Bar. This set of four poles is used with the standard Insect Bar (Item No. 50). These poles support the netting over the cot.

TAM C5740 II E 1902A

$0.71/Set of 4
7210-267-5641

52. Head Net, Insect. This head net is made of nylon (26 mesh). It is olive drab and has an oxford crown. There is a steel grommet fastened with an elastic cord through the bottom hem and two front loops for fastening over buttons on breast pockets.

TAM C3180 II F 1704A

MIL-H-11489 QMC (basic only to wear with steel helmet and liner) $1.30/EA
355325 8415-261-6630

6254

53. Goggles, Safety Type. These safety goggles are industrial type with a rubber frame. They are non-ventilated and protect the wearer from pesticide splashes, mists, sprays, fogs and dusts.

TAM
K4390 II T
1273A

$1,60/Each Pair

54. Light, Ultraviolet ("Black-Light"). This device is required for inspection to determine location of rodent urine trails. It operates on 110V., 60 cycle, single phase, AC power and requires 100 watts. It is also battery operated. There are no batteries included but it can be operated with two 45 volt batteries. It is complete with carrying case.

$42.00/EA
6530-663-2140

55. Rat Guard, Ship. This rat guard is lashed to mooring lines to prevent rats from leaving or entering the ship. The diameter of the sleeve is 3 inches; the diameter of the disc is 38 inches.

MIL-G-2767

$7.00/EA
2040-272-2353

56. Rat Guard, Ship. This item is the matching item for Item No. 55. This rat guard has a sleeve with a diameter of 8 inches and a disc with a diameter of 48 inches.

$18.00/EA
2040-272-2255

All equipment should be effectively cleaned before it is properly stored. Contamination of the working environment may be destroyed with careless attention to used equipment. Keep all identification information which will be needed for inventory on hand and procurement of repair parts and complete replacement.

6225

Federal Stock Catalog Index Number	Review Item Number	Federal Stock No. 3740-
No number assigned	See item No. 16 note	089-3766
No number assigned	47	089-9358
No number assigned	48	089-9359
No number assigned	See item No. 9 note	930-9348
No number assigned	18	889-2315
25900	1	132-5935
26100	See item No. 1 note	494-1768
31100	3	267-4802
31195	2	132-5936
31400	See item No. 2 note	494-1767
41400	21	818-6648
41450	40	766-1131
41500	20 delete	132-8330
41650	41	764-6558
41700	22	901-8236
56900	12	252-3384
72900	13	260-1398
83000	11	772-0090
83100	42	763-2173
88200	5	691-1776
88250	6	641-4719
88400	23	408-3196
90000	4	141-3285
90300	24	526-7992
90600	26	171-9771
90650	25	171-9772
91100	7	836-8106
96100	27	542-4866
100000	9	625-9989
101100	45	494-1506
101600	30	763-3176
No number assigned	See item No. 9 note	955-9341
106750	32	766-1133
No number assigned	See item No. 9 note	790-6188
106850	35	763-3179
106925	33	925-9598
106950	34	763-3178
106975	37	946-0994
106985	38	946-0995
107000	39	925-9594

6226

Federal Stock Catalog Index Number	Review Item Number	Federal Stock No. 3740-
112000	8	904-0818
112900	28	724-2152
112910	29	901-0721
113500	31	763-3177
116900	44	541-9827
117000	46	062-0555
117025	36	724-2151
117050	10	901-0720
No number assigned	See item No. 9 note	930-9548
117100	46	722-3907
137700	14	252-3383
142800	19	267-4799
142900	See item No. 19 note	531-0905
147900	16	607-0337
5044682	17	565-6076
No number assigned	See item No. 8 note	884-4638

6227

Federal Stock Number 3740-	Review Item No.	Federal Stock Catalog Index No.
062-0555	46	117000
089-3766	See item No. 16 note	No number assigned
089-9358	47	No number assigned
089-9359	48	No number assigned
132-5935	1	25900
132-5936	2	31195
132-8330	20 delete	41500
141-3285	4	90000
171-9771	26	90600
171-9772	25	90650
252-3383	14	137700
252-3384	12	56900
260-1398	13	72900
267-4799	19	142800
267-4802	3	31100
408-3196	23	88400
494-1506	45	101100
494-1767	See item No. 2 note	31400
494-1768	See item No. 1 note	26100
526-7992	24	90300
531-3905	See item No. 19 note	142900
541-9827	44	116900
542-4866	27	96100
565-6076	17	5044682
607-0337	16	147900
625-9989	9	100000
641-4719	6	88250
691-1776	5	88200
722-3907	43	117100
724-2151	36	117025
724-2152	28	112900
763-2173	42	83100
763-3176	30	101600
763-3177	31	113500
763-3178	34	106950
763-3179	35	106850
764-6558	41	41650
766-1131	40	41450
766-1133	32	106750
772-0090	11	83000
790-6188	See item No. 9 note	No number assigned

6228

Federal Stock Number 3740 -	Review Item No.	Federal Stock Catalog Index No.
818-6648	21	41400
836-8106	7	91100
884-4638	See item No. 8 note	No number assigned
889-2315	18	No number assigned
901-0720	10	117050
901-0721	29	112910
901-8236	22	41700
904-0818	8	112000
925-9594	39	107009
925-9598	33	106925
930-9348	See item No. 9 note	
946-0994	37	106975
946-0995	38	106985
955-9341	See item No. 9 note	

6229

Part III. STORAGE AND DISPOSAL OF PESTICIDES

Storage

Always store pesticides in a locked dry cupboard or storage shed where humans (especially children), livestock, and pets cannot come into unauthorized contact with them. Children and animals are curious. They don't know the hazards of these chemicals and they don't or can't read the labels.

Always store pesticides in the original, labeled container with the label plainly visible. Never store them in old bottles or food containers that could be mistaken for food or drink for humans or animals.

Do not store pesticides near food or feed.

Always keep lids and bungs tightened when containers are not being used.

Keep all "empty" pesticide containers in locked storage areas until disposed of properly.

Containers should be periodically checked for corrosion, leaks, breaks, tears, etc., so that faulty containers may be disposed of or replaced before they constitute a hazard.

Do not permit anyone to sleep or eat in a room where pesticides are stored.

Install an exhaust fan for ventilation in storage rooms to help reduce high concentrations of toxic fumes and to hold temperatures down. Care should be exercised in locating these fans so that the exhaust does not contaminate the environment.

Fire and Explosion Hazards Involving Pesticides and Other Agricultural Chemicals

Interpretation 18, Revision II of Regulations for the Enforcement of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), requires that fire hazard cautions be based on the flash point of a particular product. Formulations having a flash point at or below 20°F must bear the statement, "Danger - Extremely Flammable! Keep away from fire, sparks, and heated surfaces." Chemicals with flash points above 20°F but not over 80°F shall bear the statement, "Warning - Flammable! Keep away from heat and open flame." Chemicals with a flash point above 80°F but not over 150°F will bear the statement, "Do not use or store near heat or open flame."

When you purchase a pesticide, check the label for these warnings and make sure that you use and store such chemicals in accordance with directions to prevent the hazard of fires and explosions. Those compounds containing oils or aromatic petroleum distillates are the ones most likely to show such warnings. However, some powder formulations also present fire and/or explosion hazards. Examples are herbicides, dessicants, defoliants, and soil sterilants containing sodium chlorate. When a container or sodium chlorate is opened, the entire contents should be used, Do not attempt to store a partial container of this material. Certain wettable powder formulations have been suspected of starting fires by spontaneous combustion. Never mix or dilute Malathion in containers used for free chlorine (for example, calcium hypochlorite). A spontaneously combustible mixture may result.

Fires involving organophosphorus and carbamate insecticides as well as some fertilizers present great hazards to firemen and others in the vicinity. The following suggestions will reduce such personal hazards:

1. Plainly label the outside of such warehouses on all sides with the word(s) "Danger" and/or "Poison" along with the familiar skull and crossbones, or simply "Pesticide Storage."

2. Post a list of the types of chemicals on the outside of the warehouse.

3. Keep the storage area or building locked at all times when not in actual use, to help reduce the possibilities of fires set by man.

4. Inform fire departments, hospitals, public health officials, and police departments, in writing, of the nature, quantities, and hazards these compounds may present in the event of fire. Ask the fire chief to inspect your facility at least once a year.

5. Keep the above departments and officials informed by phone and letter of any major change in the nature, quantities, and hazards that those compounds may present in the event of fire.

6. The fire chief should be furnished with the home phone numbers of people responsible for the pesticide storage facility.

7. Glass containers of chemicals should not be placed in sunlight where they concentrate heat rays and start fires.

8. All combustible materials should be kept away from steam lines or other heating devices.

9. Use fire proofing material such as sheet rock in the building.

10. Install a sprinkler system in the storage building where possible when large quantities of such chemicals are to be stored.

11. Be thoroughly familiar with the fire fighting equipment, alarms, and fire exits.

12. Fire fighting equipment should be checked periodically and ready to use at all times.

13. Locate such storage facilities as far as possible from other dwellings and populated areas.

Firemen Should be Instructed to:

1. Wear air-supplied breathing apparatus, and rubber clothing when fighting such fires.

2. Avoid breathing or otherwise contacting toxic smoke and fumes whenever possible, to reduce hazards.

3. Wash completely as soon as possible after an encounter with smoke and fumes.

4. Wash clothing, boots and other equipment thoroughly after such a fire.

5. Have cholinesterase tests run after fighting a fire involving organophosphorus pesticides if they have been heavily exposed to the smoke.

6. Evacuate persons near such fires who may reasonably come in contact with smoke and fumes from the fire or contaminated surfaces.

Storage Life of Pesticides

Some pesticides such as DDT and other chlorinated hydrocarbons are very stable and can be stored for a number of years with little or no chemical change.

Some of the organophosphorus pesticides such as tepp, parathion, and others, have a shorter storage life. Atmospheric conditions such as high temperature and high humidity or sunlight may bring about a chemical breakdown or degradation of such materials, especially when they are in wettable powder or dust formulations. The labels of compounds subject to these reactions will warn of such limitations and generally will specify steps to be taken to avoid these reactions.

Some pesticides, and especially those formulated as liquid concentrates, are not to be stored at temperatures below those listed on the labels. Prolonged storage at low temperatures may result in crystallization, or breakdown and the resultant material is even more toxic, phytotoxic, or will leave a higher residue.

It is not advisable to keep unsealed packages of powdered pesticides longer than one year; however, some pesticides in liquid form packaged in airtight containers may retain

their effectiveness for several years if kept sealed.

If a pesticide has been stored for some time and doubt exists as to its effectiveness, try small quantities of it, according to label directions. If the treatment proves satisfactory, use the stored pesticide. If in doubt, discard the package.

Cross Contamination in Storage

In order to avoid the possibility of cross contamination of materials in storage, it is suggested that hormone type herbicides be stored in a separate building. They should not be stored near other pesticides or fertilizers.

Disposal of Pesticides and Their Containers

Remember: "Empty" containers are never completely empty! They are like the "unloaded" gun, and are to be considered hazardous and treated as potential killers.

Importance

*Hazard to children and unsuspecting persons.
*Hazard to those who can't or don't read the label.
(Domestic farm animals, pets, wildlife and fish.)
*Contamination of water and soil.
*Contamination of crops.

General

Regardless of the disposal plan you follow, you can lessen the degree of hazard by:

*Rinsing glass, metal and plastic containers several times before discarding.
*Keeping all empty containers in a secure storage area until they can be disposed of safely.
*Large metal drums (30-55 gallon sizes) can be disposed of most safely and easily by returning them to the supplier or selling them to a cooperage firm equipped to handle drums contaminated with toxic materials.
*Disposing of unlabeled containers and their contents.
*Completely emptying the contents and, if possible, burying the unused chemical at least 18 inches deep in an isolated location away from water supplies.
*Never puncturing aerosol containers.
*Not using containers that have held pesticides. For example, 2,4-D containers cannot be cleaned sufficiently to use them for any other purpose where traces of the compound would be harmful.

*Never standing in the smoke or fumes of burning containers or pesticides.
*Never disposing of aerosol containers in a fire, they will explode.
*Never burning hormone type herbicides (such as 2,4-D) or their containers. Fumes and smoke from these may damage crops for great distances.
*Never burning herbicides or defoliants containing chlorates as they may explode when heated.

Combustible Containers (paper, cardboard, plastic)

*Burn empty containers completely (except those referred to above).

*Caution: Some municipalities have restrictions against burning. Consult local authorities before burning containers. If burning is not permitted in your area, it would be best to store such containers under lock and key until enough of them are collected to make it practical to transport them to a sanitary land fill where their burial can be insured.

Noncombustible Containers

Glass Containers: Rinse and break the containers and bury them in an isolated location away from water supplies. If the above procedure is impractical, rinse thoroughly with water and detergent or caustic soda several times and pour rinse solution into a pit in the soil.

*Caution: Handle caustic soda (household lye) with extreme care. Do not get on skin, in eyes, or on clothing. Note: See various formulations for rinsing solutions at end of this report. Then invert container and let it drain for 15 minutes into the pit. Dispose of container in the dump.

Metal Containers: Punch holes in top of metal containers (except aerosols) and heat containers until they are red hot and hold at that temperature for at least five minutes. Before burning out containers, check to make sure smoke won't drift over nearby homes, people, or livestock.

If the burning procedure suggested is not followed, use the following procedure: After the container has been thoroughly drained of the pesticide, pour water and detergent or caustic soda (see amount below) into the container. Rotate the can carefully to wet all inner surfaces with the solution. Bury the rinse solution at least 18 inches deep in an isolated location away from water supplies.

Punch holes in the top and bottom of the container, crush containers of the five gallon size and smaller if possible. Then either bury or put in the dump. If a dump caretaker is on duty, inform him that the containers had contained toxic pesticides.

RINSING SOLUTIONS FOR VARIOUS CONTAINERS

Container Size	Water	Detergent	or	Caustic Soda
5 gallons	2 quarts	2 tablespoons		1/2 cup
30 gallons	3 gallons	1/2 cup		1 pound
55 gallons	5 gallons	1 cup		2 pounds

Note: Endrin, aldrin, dieldrin metal containers cannot be detoxified properly using water and detergent or caustic soda. Aldrin, dieldrin and endrin containers can be detoxified by burning as described under Metal Containers. The containers should then be buried.

ESTIMATED RELATIVE ACUTE TOXIC HAZARDS OF PESTICIDES TO SPRAYMEN*

The estimates of hazards in this table are based primarily on the observed acute dermal and to a less extent oral toxicity of these compounds to experimental animals. Where it is available, use experience has also been considered. It should be noted that the classification into toxicity groups is both approximate and relative. These toxicity categories are not related to specific categories spelled out for label requirements.

Most Dangerous	Dangerous	Less Dangerous	Least Dangerous
carbanolate, Temik (M)	aldrin (CH)	azinphosmethyl, Guthion (OP)	Aramite (M)
demeton, Systox (OP)	Bidrin (OP)	BHC (CH)	captan (M)
disulfoton, DiSyston (OP)	carbophenothion, Trithion (OP)	binapacryl, Morocide (N)	carbaryl, Sevin (C)
mevinphos, Phisdrin (OP)	DDVP, dichlorvos (OP)	chlordane (CH)	chlorobenzilate (CH)
parathion (OP)	dieldrin (CH)	coumaphos, Co-Ral (OP)	2,4-D (CH)
phorate, Thimet (OP)	dioxathion, Delnav (OP)	diazinon (OP)	DDD, TDE (CH)
schradan, OMPA (OP)	DNOC (N)	dicapthon (OP)	DDT (CH)
tepp (OP)	DNOSBP (N)	dichloroethyl ether (M)	dicofol, Kelthane (CH)
thionazin, Zinophos (OP)	endrin (CH)	dimethoate, Cygon (OP)	Dilan (CH, N)
	EPN (OP)	endosulfan, Thiodan (CH)	dinocap, Karathane (N)
	ethion, Nialate (OP)	fenthion, Baytex (OP)	diquat (M)
	methyl parathion (OP)	heptachlor (CH)	IPC, propham (M)
	nicotine (M)	lead arsenate (M)	malathion (OP)
	pentachlorophenol (M)	lindane (CH)	maneb (M)
	phosphamidon, Dimecron (OP)	naled, Dibrom (OP)	methoxychlor (CH)
	sodium arsenite (M)	oxydemetonmethyl, Meta-Systox-R (OP)	mirex (CH)
	Zectran (C)	toxaphene (CH)	Morestan (M)
		VC-13 (OP)	NAA (M)
			Perthane (CH)
			piperonyl butoxide (M)
			ronnel, Korlan (OP)
			rotenone (M)
			simazine (M)
			2,4,5-T (CH)
			tetradifon, Tedion (CH)
			thiram (M)
			zineb (M)
			ziram (M)

*Source of Data: Safety In the Use of Pesticides, Homer R. Wolfe, William F. Durham. Proc. 2nd Eastern Wash. Fertilizer and Pesticide Conf. Pullman; Washington State University, pp 14-21, 1966. The fumigant compounds acrylonitrile, D*D, and Telone have systemic toxicities which would indicate their placement under the "Less Dangerous" category. However, special notes should be taken of the fact that the volatility of these compounds and their capacity to produce irritation of skin, eyes and other tissues indicate that appropriate caution should be exercised in their use.

Note: The chemical class to which the pesticide belons is designated as follows: C - carbamates; CH - clorinated hydrocarbon; M - miscellaneous; N - Nitro; OP - organic phosphorous.

14 AUG 1970

6237

HEADQUARTERS
UNITED STATES FORCES KOREA
EIGHTH UNITED STATES ARMY
APO SAN FRANCISCO 96301

REGULATION
NUMBER 700-17

10 July 1980

LOGISTICS
Use of Herbicides in Korea

1. Purpose. This regulation establishes policy and prescribes procedures for the control of herbicides used by United States Forces, Korea (USFK).

2. Scope. This regulation is applicable to all component commands of USFK.

3. Responsibilities. Component commanders are responsible for the implementation of this regulation.

4. Definitions. For the purpose of this regulation, a herbicide is defined as a chemical compound which will kill or damage plants.

a. Based on physiological action, herbicides are grouped and described as:

(1) Contact herbicide. A herbicide which kills or inhibits plant growth primarily by contact with plant tissues.

(2) Plant growth regulators. A herbicide which kills or inhibits growth as a result of translocation of the herbicide chemical primarily through the root system to the plant cells (referred to also as "plant hormones"). When used in sufficient concentrations it will damage or kill plants and is therefore herbicides or weed killers.

(3) Defoliant. A chemical (herbicide) which will cause a plant to prematurely shed its leaves.

(4) Dessicant. A chemical which will cause the foliage of a plant to dry up.

b. Based on use, herbicides are grouped and described as:

(1) Selective or specific herbicide. A herbicide which in effective concentration will kill, damage, defoliate, dessicate, or inhibit the growth of some types of plants without significantly affecting other types of plants.

(2) Soil sterilants. A nonspecific herbicide which renders soil incapable of supporting plant growth.

5. Background. The dangers associated with the handling and application of herbicides demand establishment of strict controls for their use since nearly all herbicides are potentially dangerous in one way or another. Personnel injury or unnecessary damage to desirable vegetation and local crops adjacent to military installations can be prevented if herbicides are used properly and if recommended precautions are observed. Claims and/or adverse publicity resulting from use of herbicides in Korea negate the advantages of herbicides versus conventional brush and weed removal procedures.

6. Policy. Herbicides will not be used in Korea except where plant growth control clearly cannot be accomplished by other means, and safe and controlled application of herbicides is assured. Additionally, the following specific constraints apply to use of herbicides in Korea:

a. Herbicides will not be disseminated by aerial spraying.

b. Herbicides will not be used by US Forces outside compounds controlled by US Forces.

c. Herbicides will not be applied in the demilitarized zone, or south of the southern boundary when there is any possibility that drift or spray or run-off may carry any trace of the herbicides into the demilitarized zone.

d. Herbicide agent ORANGE or any herbicide or other agricultural material containing the herbicide formulation 2-4-5 T will not be used in Korea.

*This regulation supersedes USFK/EA Reg 700-17, 19 Aug 71.

6238

e. Herbicides shall be applied only under the direct supervision of personnel qualified and trained in accordance with applicable regulations of the component command concerned.

f. Application of herbicides and procedures for flushing and cleanup of dispensing equipment will preclude contamination of water supplies used for domestic consumption by domestic animals, wildlife, aquatic life, or water used for irrigation pruposes.

g. Additional specific precautions established by the US Department of Agriculture for the specific herbicide being used will be followed. USDA Registration Number 6308-20 applies to herbicides PHYTAR 560 and agent BLUE. USDA Registration Number 434-360 applies to herbicide TORDON 101 or agent WHITE.

7. Potential Hazards. A knowledge and appreciation of the factors that influence results in the use of herbicides are essential to the best control. The potential hazards which require special consideration in the use of herbicides are:

a. Poisoning of personnel. This applies to persons who, while mixing and applying the spray or spreading the dry product, can be poisoned from swallowing the herbicides, from skin absorption, or through inhalation.

b. Inadvertent misuse. Security and control of herbicides is essential to prevent inadvertent use or misuse by persons not knowledgeable of their effects.

c. Drift hazards. These are greatest when herbicides that affect leaves of plants are used. Plants more than a mile downwind from the sprayed area may be affected.

d. Leaching. This is a process by which the herbicide is dissolved and diffused into the ground. If chemicals are readily absorbed by roots, plants whose roots extend under the treated area are likely to be injured.

e. Washing. This is a significant hazard on slopes, bare ground, and pavements. The herbicides may be carried by surface run-off to valuable plants downslope or contaminate streams or other bodies of water to the detriment of crops, fish, or other aquatic life.

8. Storage, Issue, and Handling. a. Requests to procure, use, or dispose of herbicides or fertilizers containing herbicides will be submitted to HQ, USFK/EA, ATTN: ENJ-FE.

b. Herbicides will be securely stored and issues will be rigidly controlled. Disposal of herbicides will only be accomplished as directed by this headquarters. Sale or issue of herbicides to non-US Government activities or to non-Department of Defense activities within Korea is specifically prohibited without approval of this headquarters.

c. Adequate individual safety precautions will be emphasized and necessary protective devices shall be provided for all persons engaged in handling herbicides.

d. Records will be maintained in sufficient detail to provide the necessary information to permit evaluation of claims against the government which may arise.

9. References. a. Joint Service Pub DATM 3-215/AFM 355-7 (Military Chemistry and Chemical Agents) with Changes 1 and 2.

b. DOD Directive 4150.7 (DOD Pest Management Program), 6 November 1978.

c. AFR 91-21 (Pest Management Program).

d. AFR 91-22, AR 40-574 (Aerial Dispersal of Pesticides).

e. AR 385-32 (Safety - Protective Clothing and Equipment).

f. AR 420-74 (Facilities Engineering - Land, Forest, and Wildlife Management).

g. AR 420-76 (Facilities Engineering - Pest Control Services).

h. Army TM 5-629, Navy NAVFAC MO-314, Air Force AFM 91-19 (Herbicide Manual) August 1970.

i. USDA Handbook No. 269, Herbicide Manual.

The proponent agency of this regulation is the Office of the Engineer. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to CDR, USFK/EUSA, ATTN: ENJ-FE, APO 96301.

6239

FOR THE COMMANDER:

OFFICIAL:

[redacted] b6
Captain, AGC
Assistant Adjutant General

KENNETH E. DOHLEMAN
Major General, USA
Chief of Staff

DISTRIBUTION:
A and J (J less PPCK, ACJ-AP)
15 - Engineer (ENJ-FE)

6240

7-15-11 SD

Nara - CP

RG 550

E 147 Publication Records Files Korea 1980 (83-057)

Box 1

F 227-01 Logistics

6241

WEED CONTROL IN KOREA

[redacted] b6

INTRODUCTION

One of the most important barriers in food production in Korea is limited arable land. With a population increase rate of about 1.7% and food production increase rate of 3.3%, the nation requires a land expansion of 1,300, 000 ha for food production and food grain production of 3,400,000 mt per year[15].

Rice occupies approximately 13% of total land area while all other farm crops combined account for only about 23% of the 9.8 million hectares arable land[12]. This, in turn, is reflected in the comparative land use and production which indicate that rice occupies slightly more than one-half of the cultivated lands of Korea. The acreage per farm household in Korea is less than one hectare, however, yield per unit area is considerably high due in large to intensive farming. In recent years, agricultural practices have been gradually changed from a labor-intensive type to a labor-saving one which aims to maximize labor productivity.

Presently, chemical weed control in Korea is a common practice which is replacing handweeding. Herbicide use was negligible in 1966. To date more than 75% of paddy field is receiving herbicide treatment for control of weeds. Within the next 10 years it is expected that herbicides will be applied to more than 150% of paddy fields, meaning that paddy field will be treated with herbicides more than once, provided that the present benefit is maintained. A similar increasing trend was noticed in upland crops although consumption, volumewise, is much less than that of paddy fields. Herbicides already ranked second in pesticide consumption since 1977. The rapid increase of herbicide use thus far seems to be closely associated with fast industrialization resulting in movement of idle labor from country side to urban industrialized area. This resulted in farm labor shortage with accompanying farm wage increase.

Considerable researches on weed control have been made since phenoxy herbicide was introduced in Korea in late 1950s. These were however, concentrated mostly on herbicide screening and only very few were on basic research. This obviously indicates that weed science is still in the beginning stage. However, it is obvious that these research works and registration trials contributed much to the present wide use of herbicides. In addition, some agricultural colleges recently recognized the necessity of including weed science as a main subject in agronomy and have added it in their curriculum.

The rapid increase in agrochemical use has had not only positive but negative effects as well. We are, thus, faced with a challenge to cope with the undesirable effects, such as development of resistant weeds, weed population shift, environmental contamination and crop injuries, etc. This paper reviews the present status of weed science and the past activities of various institutes and researchers, and projects future approaches and challenges, focusing on a general trend of weed control in Korea.

MAJOR WEEDS OCCURRING IN KOREA

Yield losses of various crops due to weeds ranged from 20 to 65%[6] (Table 1). The highest yield reduction (65%) was recorded in upland rice and the least in tobacco (13.6%). The data indicate strongly that crops have different competitive ability against weeds. Yield reductions are much severe in upland conditions than that of paddy.

The average labor requirement in major food crop production occupied 43.2% of total production cost, with labor requirement for weeding approximately 28% of total labor demand. Labor demand varies with crops and weed species present. For example labor needed for weeding in upland is about 30% while that in paddy is only 10.8% (Table 2). These figures may be reduced yearly because of increased herbicide use.

Because of seasonal peaks of labor demand, farmers will rely on easy planting methods using machines with herbicide. Herbicide is easy to apply and is much cheaper and inexpensive method for weeding. It is therefore obvious that increase in herbicide use may contribute to a great reduction of labor demand in Korean agriculture, providing much economic benefits to farmers.

Parker[13] pointed out that three classes of weed problem will defeat even abundant and cheap labor, and herbicides may be advantageous in places where the following factors are prevailing: (1) seasonal peaks of labor requirement, (2) dominance of perennial weeds, (3) absence of a fully satisfactory control method for parasite weeds.

About 453 species of weeds belonging to 92 families, occur in both paddy and upland fields. Of these, 92 species of 27 families are mainly found in paddy fields, 300 species of 65 families in upland, 61 species of 17 families in both paddy and upland[4,8,14] (Table 3). According to life cycle, the 30 species of annuals recorded were composed of 5 grasses, 9 broadleaves, and 16 sedges. Biennials had only 3 species belonging to grasses. Out of 59 perennial weeds, perennial broadleaves dominated in terms of number, totaling 33 species. In upland, annuals, biennials and perennials were reported to have 93, 59 and 119 species, respectively, with perennial broadleaves dominating. Thirty one (31) species of annuals, 10 biennials and 20 perennials were reported to emerge in either paddy or upland.

In terms of frequency of occurrence and competitive ability, about 15 weed species were regarded as the most important weeds in Korea (Table 4). This list can be varied depending upon observers, areas and crops. Grasses such as *Echinochloa crusgalli*, *Digitaria adscendens* and *Alopecurus aequalis* emerged mainly on paddy, upland and in both paddy and upland, respectively. These three weed species are the most dominant grasses in Korea. Out of 15 species listed, 9 species mainly occurred in paddy, out of which 6 species are perennials. Five sedge weeds were considered dominant weeds, among them, *Cyperus difformis* and *Cyperus iria* which were both mainly found in paddy. *C. iria* was also found in upland. Three perennial sedges (*Cyperus serotinus*, *Eleocharis Kuroguwai*, and *Scirpus maritimus*) were dominant weeds in paddy fields of certain areas. Among 7 broadleaves, 4 species occurred on paddy and 3 on upland. *Potamogeton distinctus* and *Sagittaria pygmaea* were dominant perennials in paddy. Unlike in paddy fields, annuals are still dominant weed species in upland where herbicides have not been heavily used.

A. Common weeds in paddy

Of the 92 species that occur in paddy fields, about 30 species are considered most common[11] (Table 5). Broadleaves and sedges are much more numerous than grasses. Most of these weeds are

 6243

relatively well controlled by the presently available herbicides in Korea such as butachlor [2-chloro-2', 6'-diethyl-*N*-(butoxy-methyl)-acetanilide], nitrofen [2, 4-dichlorophenyl-4-nitrophenylether] and saturn [*S*-(4-chlorobenzyl)-*N*, *N*-diethyl thiolcarbamate]. However, most of the perennials are tolerant to these herbicides. In order to avoid undesirable shift of weed population, trials on the mixture and combination of herbicide are under study; however, cost and crop injury should be important considerations in carrying out these trials and in evaluating effectiveness and usefulness of results.

Table 1. Yield losses of various crops affected by weeds[7]

Crops	Yield loss (%)	Crops	Yield loss (%)
Transplanted rice	20.8	Potato	47.6
Direct seeded rice	40.0	Tobacco	13.6
Upland rice	65.0	Peanut	34.2
Barley	20.0	Flax	22.0
Wheat	22.9	Rape	62.9
Soybean	34.2	Sesame	28.0
Corn	33.2	Onion	45.4
Mean	33.7		36.3

Table 2. Labor requirement in producing major food crops per hectare

Crops	% farm labor composition				
	Seeding or transplanting	Weeding	Harvest-processing	Other management practices	Sub-total
Rice	10.3	10.8	36.5	42.4	100
Barley wheat	17.7	25.9	49.0	7.4	100
Beans	24.1	54.0	21.1	0.8	100
Potatoes	17.4	22.3	34.9	25.4	100
Other cereals	20.4	51.2	25.3	3.1	100
Vegetables	21.9	26.0	21.9	30.2	100
Industrial crops	6.6	18.4	48.9	26.1	100
Fruits	1.0	12.4	14.8	71.8	100

Source: Analysis of Farm-labor Input, MAF, 1977.

B. Common weeds in upland

More or less 30 species out of 300 species listed can be considered as important weeds in upland (Table 6). This includes weeds that mainly emerge in barley and wheat crops, and other upland crops.

Weeds in upland are much more numerous than paddy fields. Crabgrass (*D. adscendens* Henr.) is the most important and a noxious weed in upland crop. In barley planted in field after rice, *A. aequalis* is the most noxious weed; *Stellaria media* Villars, *Capsella bursapastoris* M., *Chenopodium album* L., *Stellaria alsine* Grimm, are commonly regarded as important weeds in barley crop. *Portulaca oleracea* L. is also a very important weed in most upland crops. An annual, *Acalypha austalis* L. and perennials such as *Pinellia ternata* Breit. and *Rumex japonicus* Houtt. are becoming troublesome weeds in fields where herbicides are applied repeatedly. Broadleaf weeds in upland play an important role in reducing crop yield due to their frequency of occurrence and abundance. Alachlor and simazine are herbicides available against upland weeds. More herbicides effective against a wide spectrum of weeds is required.

Table 3. Weed species in paddy and upland in Korea

Field	Annual				Biennial				Perennial				Total
	G*	S*	B*	Sub-total	G	S	B	Sub-total	G	S	B	Sub-total	
Paddy	5	9	16	30	3	—	—	3	4	22	33	59	92
Upland	21	1	71	93	8	—	51	59	26	3	119	148	300
Paddy and upland	4	9	18	31	1	1	8	10	5	6	9	20	61
Total	30	19	105	154	12	1	59	72	35	31	161	227	453

* G = grasses; S = sedges; B = broadleaf

Table 4. Most important weeds in Korea

Classification	Family	Scientific name	Life cycle*	Occurrence**
Grasses	Gramineae	*Echinochloa crusgalli* Beauv.	a	p
	Gramineae	*Digitaria adscendens* Henr.	a	u
	Gramineae	*Alopecurus aequalis* Sobol. var. *amurensis* Ohwi	a	p, u
Sedges	Cyperaceae	*Cyperus difformis* L.	a	p
	Cyperaceae	*Cyperus iria* L.	a	u, p
	Cyperaceae	*Cyperus serotinus* Rottb.	p	p
	Cyperaceae	*Eleocharis kuroguwai* Ohwi	p	p
	Cyperaceae	*Scirpus maritimus* L.	p	p
Broadleaves	Pontederaceae	*Monochoria vaginalis* Presl.	a	p
	Portulacaceae	*Portulaca oleracea* L.	a	u
	Potamogetonaceae	*Potamogeton distinctus* Benn.	p	p
	Alismataceae	*Sagittaria trifolia* L.	p	p
	Alismataceae	*Sagittaria pygmaea* Miq.	p	p
	Euphorbiaceae	*Acalypha australis* L.	a	u
	Amaranthaceae	*Amaranthus mangostanus* L.	a	u

* a = annual; p = perennial

** p = paddy fields; u = upland

6245

Table 5. Common weeds in paddy fields in Korea

Classification	Family	Scientific name	Life cycle*	Dominance**
Grasses	Gramineae	*Echinochloa crusgalli* Beauv. var. *oryzicola* Ohwi	a	D
	Gramineae	*Echinochloa crusgalli* Beauv. var. *caudata* Kitagawa	a	D
	Gramineae	*Echinochloa crusgalli* Beauv. var. *praticola* Ohwi	a	D
	Gramineae	*Leersia japonica* Makino	p	S
Sedges	Cyperaceae	*Cyperus armuricus* Maxim. var. *laxus* Nakai	a	D
	Cyperaceae	*Cyperus difformis* L.	a	D
	Cyperaceae	*Cyperus iria* L.	a	D
	Cyperaceae	*Cyperus serotinus* Rottb.	p	D, S
	Cyperaceae	*Eleocharis kuroguwai* Ohwi	p	D, S
	Cyperaceae	*Eleocharis acicularis* Roem. et Schult.	p	D, S
	Cyperaceae	*Fimbristylis dichotoma* Vahl.	a	S
	Cyperaceae	*Scirpus hotarui* Ohwi	a	D, S
	Cyperaceae	*Scirpus maritimus* L.	p	D, S
Broadleaves	Commelinaceae	*Aneilema japonica* Kunth.	a	D
	Compositae	*Centipeda minima* Braun et Aschers.	a	S
	Eriocaulaceae	*Eriocaulon siedoldianum* Siebit et Zucc.	a	S
	Scrophulariaceae	*Gratiola juncea* Roxb.	a	S
	Lemnaceae	*Lemna minor* L.	p	D, S
	Lemnaceae	*Lemna polyrhiza* L.	p	D, S
	Scrophulariaceae	*Lindernia procumbens* Philcox	a	S
	Lobeliaceae	*Lobelia chinensis* Lour.	p	S
	Onagraceae	*Ludvigia prostrata* Roxb.	a	D
	Marsileaceae	*Marsilea quadrifolia* L.	p	S
	Pontederaceae	*Monochoria vaginalis* Presl.	a	D
	Polygonaceae	*Polygonum hydropiper* L.	a	D
	Potamogetoaceae	*Potamogeton distinctus* Benn.	p	D, S
	Lythraceae	*Rotala indica* Koehne	a	D
	Alismataceae	*Sagittaria aginashi* Makino	p	S
	Alismataceae	*Sagittaria pygmaea* Miq.	p	D, S
	Alismataceae	*Sagittaria trifolia* L.	p	D, S
	Salviniaceae	*Salvinia natans* All.	a	S

* a = annual; p = perennial

** D = dominance; S = sub-dominance

6246

Table 6. Common weeds in upland in Korea

Classification	Family	Scientific name	Life cycle*	Dominance**
Grasses	Gramineae	*Alopecurus aequalis* Sobol var. *amurensis* Ohwi	a	D[c]
	Gramineae	*Avena fatua* L.	b	S
	Gramineae	*Digitaria adscendens* Henr.	a	D[d]
	Gramineae	*Eleusine indica* Gaertn.	a	D[d]
	Gramineae	*Imperata cylindrica* P. var. *Koenigli*	p	S
	Gramineae	*Setaria viridis* Beauv.	a	S
Sedges	Cyperaceae	*Cyperus iria* L.	a	S
	Cyperaceae	*Cyperus armuricus* Maxim. var. *laxus* Nakai	a	D[d]
	Cyperaceae	*Cyperus rotundus* L.	p	S
	Cyperaceae	*Fimbristylis dichotoma* Vahl.	a	S
Broadleaves	Euphorbiaceae	*Acalypha australis* L.	a	D[d]
	Amaranthaceae	*Amaranthus mangostanus* L.	a	D
	Amaranthaceae	*Amaranthus lividus* L.	a	S
	Compositae	*Artemisia princeps* var. *orientalis* Hara	p	S
	Convolvulaceae	*Calystegia japonica* Choisy	p	S
	Brassicaceae	*Capsella bursa-pastoris* Medicus	a	S
	Compositae	*Centipeda minima* (L) A. Brau. et Aschers.	a	S
	Compositae	*Cephalonoplos segetum* Kitamura	b	S
	Chenopdiaceae	*Chenopodium album* var. *centrorubrum* Makino	a	D[c]
	Commelinaceae	*Commelina communis* L.	a	S
	Compositae	*Erigeron canadensis* L.	b	S
	Rubiaceae	*Galium spurium* L.	b	S
	Compositae	*Ixeris dentata* Nakai	p	S
	Labiatae	*Lamium amplexicaule* L.	b	S
	Oxalidaceae	*Oxalis corniculata* L.	p	S
	Araceae	*Pinellia ternata* Breit.	p	S
	Polygonaceae	*Persicaria blumei* Gross	a	S
	Polygonaceae	*Persicaria hydropiper* Spach.	a	D[c]
	Portulacaceae	*Portulaca oleracea* L.	a	D[d]
	Polygonaceae	*Rumex japonicus* Houtt.	p	S
	Caryophyllaceae	*Stellaria alsion* var. *undulata* Ohwi	b	D[c]
	Caryophyllaceae	*Stellaria media* Villars	b	D[c]

* a = annual; b = biennial; p = perennial

** D = dominance; S = sub-dominance
c = dominant weeds in barley and wheat crops; d = dominant weeds in most of upland crops

 6247

Chemical Weed Control

There was hardly any use of herbicides for rice and other crops before 1966. In 1977, 65% of the total rice area and 20% of upland crops were treated with various herbicides, averaging about 40% of all the crops (Table 8). It is assumed that more than 75% of paddy rice have been treated with various herbicides in 1980 although data are not available yet. The kind of herbicide used increased yearly from 3 in 1966 to 17 in 1978. Figure 1 indicates the increase in herbicide use in Korea from 127 mt in 1966 to about 30,000 mt in 1978, showing an increase of 236 times. The rapid increase in herbicide use has been markedly influenced by labor shortage, and farm wage increase due to shift of labor forces from rural to urban industrialized areas. The increased number of herbicides in paddy fields indicates that one specific herbicide may not be satisfactory to several weeds, meaning that a specific herbicide is effective to specific weed species. Considering all these factors, further increase in use of herbicide will be inevitable in the future.

It is expected that within the next 10 years, the entire area planted to rice will use herbicide 1.5 times, meaning that paddy will receive more than one herbicide treatment per rice culture. Herbicide consumption already ranked second in pesticide use (Figure 2) and herbicide consumption may catch up with the amount of insecticide use in the future.

The first herbicide practically applied was 2, 4-D [2, 4-dichlorophenoxy acetic acid] followed by PCP [pentachlorophenol (sodium)], however, PCP was eliminated in 1974 because of its environmental contamination hazard. On consumption basis butachlor (machete) has been the principal and leading herbicide in Korea from the early 1970s followed by nitrofen, reaching to approximately 100,000 tons and 40,000 tons in 1978, respectively. These herbicides gave outstanding annual weed control in transplanted rice. Other herbicides used are benthiocarb, molinate (*S*-ethyl-*N*, *N*-hexamethylene thiol-carbamate), avirosan and several others. The continuous use of these herbicides such as butachlor and nitrofen which are effective against annuals is causing perennial weed problems such as *P. distinctus*, *E. kuroguwai*, *C. serotinus* and *S. pygmaea* etc.[1]. Among these weeds *P. distinctus* is effectly controlled by avirosan and *C. serotinus* by bentazon. The rest are not effectively controlled by the presently available herbicides.

Increased crop susceptibility and development of resistant weeds to the repeated application of herbicides to paddy fields are two common effects of chemical control. The build-up of resistant weeds will cost more to control and this has already been observed in paddy fields in Korea. However, this problem can be avoided by practicing some traditional control methods. Another undesirable effect may be a long term reduction in soil fertility although there is no evidence at all from long term experiments. This is likely to be a possible problem in the future.

The Pesticide Management Act which was promulgated in 1957, and amended in 1969 and 1977, requires the reevaluation of efficacy of pesticides presently being used every five years[3]. The criteria being used on toxicity, safety and efficacy are similar to that of other countries. The National Agricultural Material Inspection Office (NAMIO) admits and evaluates application forms submitted by various chemical companies for registration purpose with data on efficacy, injury, toxicity, from results of evaluations by various government research stations. The NAMIO director recommends it to the Minister of the Ministry of Agriculture and Fisheries for final decision.

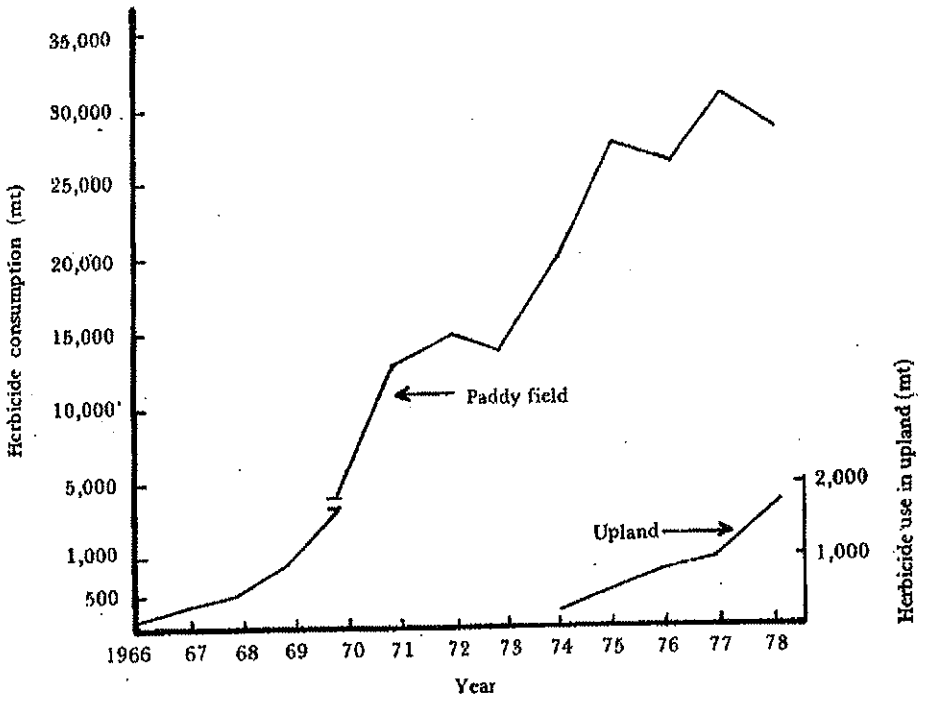


Figure 1. Yearly increment of herbicide use in Korea

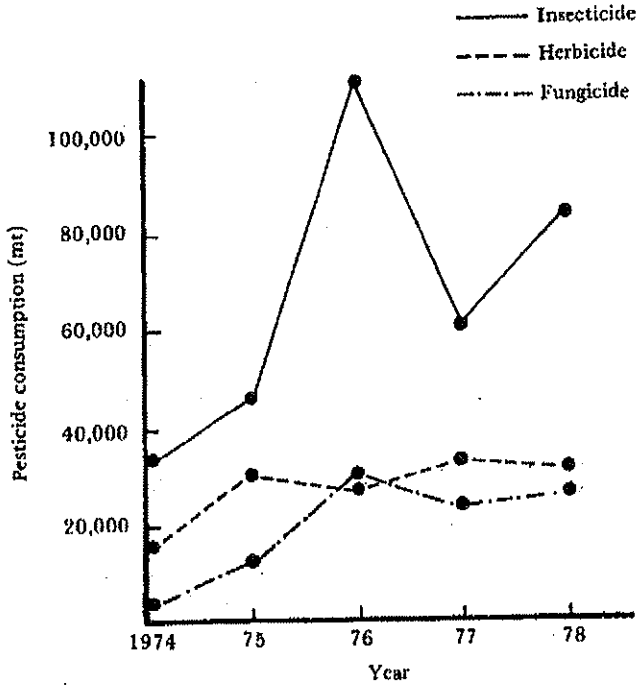


Figure 2. Pesticide consumption comparing herbicide to others

6249

WEED CONTROL METHODS

Manual weeding has been the prevalent control method for centuries. Hand or rotary weeding was considered as the normal weed control method in transplanted rice, particularly in the 1950s and 1960s. At that time most farmers used 'Homi' (small hoe) or hand for hand weeding. The farmers usually weeded three times per rice growing season except in fields with very low weed population. The most common weeding systems (Table 7) can be classified into: hand weeding (once) + rotary (twice), rotary (once) + handweeding (twice) and rotary (twice) + handweeding (once)[4]. Implementation of these systems may vary based on areas and prevalent weed species. The first weeding is generally made two weeks after transplanting, and the second and the third are generally practiced every 10 days after the first weeding.

The introduction of herbicide triggered a great change in weed control, resulting in reduction of manual weeding. Herbicide use has become the primary weed control method in the 1970s. In recent years, the frequency of weeding was reduced from 2–4 to 1–2 times after herbicide was extensively used by farmers. Presently manual weeding only complements chemical weed control. It is expected that manual weeding will be completely replaced with chemical control in paddy fields. A similar trend will be expected in upland crops although it would take more time to replace manual weeding with herbicide as compared with paddy rice.

Table 7. Changes in weed control methods in rice culture (1950—1980)

Decade		Weeding times and types*				Main herbicide used against weeds		
		1st	2nd	3rd	4th	Grass	Broadleaf	Sedge
1950	1)	H . . . . . H (R) . . . H (R)					2, 4-D	
	2)	R . . . . . H. . . . . H			H			
	3)	R . . . . . R. . . . . H						
1960	1)	H (R) . . H (R) . . . H				PCP	2, 4-D	
	2)	H (R) . . HC			H	Stam F-34	MCP	
	3)	HC . . . . H (R)			H	Nitrogen		
1970	1)	H (R) . . H (R) . . . H				Stam F-34	Abirosan	Silvex
	2)	H (R) . . HC			H	Nitrofen	2, 4-D	Bentazon
	3)	HC . . . . H			H	Butachlor	Saturn-S**	
						Ronstar		
	4)	HC . . . . HC				Molinate		
1980	1)	HC . . . . H			H	Butachlor	Abirosan	Bentazon
	2)	HC . . . . HC				Nitrofen	2, 4-D	
						Molinate		
						Benthiocarb		
						Ronstar		
						Others		

* H: hand weeding; R: rotary weeding; HC: herbicide; . . . . : compulsory; ——: optional
** Saturn-S: benthiocarb-simetryne

6250

Table 8. Status of herbicide use in Korea (1977)

Land classification	Area (1,000 ha)	Area applied with herbicide (1,000 ha)	% herbicide use
Paddy field	1,214	790	65.1
Barley and wheat	752	302	40.2
Other upland crops	178	88	49.5
Orchard and mulberry	1,148	128	11.2
Total	3,292	1,308	39.7*

$$* \ 39.7\% = \frac{\text{Herbicide-treated land}}{\text{Total area}} \times 100$$

Weed Control in Rice Seedbed

Normally seedlings are grown in seedbeds for about 40 to 50 days. Seedbeds are mostly tunnel shaped and covered with vinyl to protect the seedlings from low temperature during April in the temperate region. This method of seedbed preparation became common after indica-japonica crosses were introduced in early 1970.

The most dominant weeds in seedbed are *E. crusgalli*, *Monochoria vaginalis*, and some sedges which are not much different from paddy fields[5]. Stam F-34 has been most commonly used to control *E. crusgalli* at 2 to 3 leaf stage since 1966, and it is very safe against rice. Nitrofen was also recommended to be applied 3 to 4 days before seedbed preparation in the southern part of Korea. However, its safety greatly depends upon land preparation. Benthiocarb seems highly promising in controlling these annuals, but more research should be required to ascertain its safety when used in vinyl-covered seedbeds. This restricted environmental conditions make it more difficult to evaluate selective herbicides for seedbeds.

Weed Control in Transplanted Rice

Rice production in Korea is mostly done by hand transplanting. Areas for direct-seeded rice or upland rice are recorded to be negligible, and there seems to be no possible increase in acreage in the future. In recent years, rice has been transplanted by two types, more commonly by hand transplanting and about 5% of the total paddy with machine transplanters. It is expected that machine transplanting will dramatically increase in the near future. It can eventually ease labor requirement, particularly at seasonal peaks of labor demand, and it seems to be more economic than hand transplanting. Chemical weed control has been relatively well established in hand-transplanted rice. However, there is no established chemical control method in machine-transplanted rice. Machine transplanting is done about 10 days earlier than ordinary one, thus, seedlings are less capable of competing with weeds especially under low temperature. The longer duration of weed occurrence requires more accurate herbicide application. Furthermore, young seedlings planted with shallow depth are more likely to be damaged by herbicide due to exposure of meristem to herbicide. Irregularly transplanted rice by machine makes it quite

difficult to practice rotary or hand weeding. For successful weed control in machine-transplanted rice, thorough land leveling, adequate water management and proper application of herbicide are essential factors[10].

Herbicide use in hand-transplanted rice is a common practice in Korea. The herbicides available, which are mostly pre- and post- emergence are all effective against annuals, but most perennials are resistant to them. Presently, studies on herbicide mixture and combination are underway in order to improve herbicide efficacy which can be effective to wide spectrum of weeds. Another consideration we keep in mind is that rice varieties planted in Korea have relatively a wide range of genetic sources which respond differently to the recommended herbicides. Another possibility to look into is selection or development of herbicide which can be used together with fertilizer as a preplanting method.

Weed Control in Upland Crops

Chemical weed control is relatively new in upland crops. Weed control in upland is more difficult because upland is more versatile in terms of weed species and moisture level than paddy fields[2]. Hand weeding plus mechanical control like hilling up has been the common weed control practice in soybean culture. Alachlor (*N*-methoxymethyl-2, 6-diethyl-α-chloroacetoanilide) has been used in various upland crops such as soybean, corn, potato, red pepper and sesame. One application of herbicide per cropping season may not be enough because of irregular emergence of weeds, thus, combination of pre- and post-emergence herbicides may give positive results. Preemergence herbicide plus hilling up by machine is another alternative control method. Crabgrass is the most noxious weed in upland and this can be easily controlled by alachlor, but under crabgrass free conditions, *A. austrais* L. becomes a dominant species.

In barley, *Alopeculus* spp. is the most noxious weed. Butachlor is used to control this weed and it is relatively safe to the crop. In addition, benthiocarb, molinate, nitrofen, simazine are used to some extent. These are all preemergence herbicides applied immediately after sowing of barley crop. Moisture level and formulation types are highly related with their efficacy. Paraquat and glyphosate are also used as preplanting herbicides in the southern part of Korea where weeds emerge much ahead of crop planting time. More studies are required in upland crops to get successful weed control.

ECONOMIC IMPORTANCE OF CHEMICAL WEED CONTROL

It was estimated that 300 man-hours are needed to control weeds satisfactorily in one hectare of paddy field with hand transplanted rice[5]. Labor cost of hand weeding was about 381 won or US$1.36 per man/day in 1968, but it dramatically increased to 5,140 won or US$8.57 per man/day in 1979 (Table 9). Partial budgeting analysis was done to compare the cost of weeding between hand weeding and chemical weed control, with the assumption that 3 kg (product) of butachlor 6% (granular) per 1/10 hectare would give relatively good control equivalent to hand weeding. The data indicate that about 13,272 won or US$22.12 per 1/10 hectare can be saved by using one time application of butachlor as compared with hand weeding. Of course, this figure will be greatly reduced in case butachlor would not be satisfactory to control weeds, and one more hand weeding or other postemergence herbicide would be required after butachlor treatment. It seems that one herbicide application per rice culture would not be enough to obtain successful weed control equivalent to hand weeding. However, the trend is very clear and the benefits from chemical weed control are obvious. Increase of labor costs will be much greater in comparison with the cost of herbicide. Further it indicates that herbicide application

twice per rice culture will be still compatible with handweeding, meaning that herbicide mixture or combination for pre and post-emergence weed control looks feasible in Korean conditions. A number of studies along this line are under progress.

WEED RESEARCH, TRAINING AND EDUCATION

Several hundred research works have been thus far conducted by various institutes[1 5]. Among these institutes, the Office of Rural Development (ORD) has played the main role in the advancement of weed science in Korea. Thus far most weed control research made by ORD were on herbicide performance (45%), the rest covered various subjects dealing with biology, mode of action, competition, weed survey and cultural practices. In recent years, basic and fundamental research have received much attention.

It is quite recent that some universities recognized the importance of weed control and included it as a main subject in the agronomy curriculum. There were a few qualified and trained weed scientists until early 1970s. Even at present time, most weed research are being conducted by agronomists on part-time basis. The chemical companies have also actively participated in weed control programs and have to some extent taken the lead in weed control research in Korea.

Two symposia on weed control were held, the first in 1971 and the second in 1978, dealing with various aspects of weed control. These meetings promoted the understanding of weed control as an important field in agronomy and gave incentives to those who are not familiar with weed science and those who do not understand its importance. At the same time, these symposia gave way to the idea of organizing the Weed Science Society of Korea.

RESEARCH DIRECTIONS AND APPROACHES

There is a need to develop joint research programs and active participation of researchers from the different institutes. An interdisciplinary approach through institutional cooperation may economize research budget, and may give more productive results.

Future research endeavors on weeds should focus on the following:

1. Identification and classification of weeds growing locally and nationwide.

2. Biological and ecological studies of important weeds

By fully understanding the biological and ecological characteristics of weeds, we may be able to manipulate cultural practices such as crop variety, fertilizer, planting time and space, and irrigation, to provide crops better advantage over weeds.

3. Determination of crop yield loss

Reliable information on crop loss is very essential, particularly to justify economic consideration and allocation of resources for control, including prevention of weeds and establishment of effective control systems.

4. Physiology of herbicide

Increase of crop injury or decrease of crop safety to a certain herbicide becomes evident most probably due to the repeated use of herbicide. It is unknown what kinds of mechanism may be involved in such a case. The fact that the increased rates of the most commonly used herbicides significantly increased crop injury to unacceptable level indicates that the wrong use of herbicide can cause toxicity at any moment. Therefore, we have to fully understand and determine the mechanism of a newly recommended herbicide. In doing this, morphological, anatomical and biochemical effect of herbicide on crop and weed should be determined.

5. Development of weed control systems

a. Development of weed surveillance program

Weed surveillance can be of value in identification of weed problems, evaluation of present weed programs, monitoring of the spread of weeds, and providing clues to the development of improved procedures[9]. Weed surveillance could track the rate of weed invasion, monitor changes in tolerance to herbicide and shift in weed species composition in response to herbicide application and cultural practices. Such a knowledge would be crucial in development of appropriate control programs in anticipation of a new weed problem.

b. Development of integrated control systems

In developing an integrated control system, there is a need to establish long term experiments integrating all possible factors such as environmental aspects, cultural practices and herbicide.

6. Research on aquatic weeds and others

Aquatic weeds in canals, ponds or reservoirs, and ditches, must be investigated and classified, and their important characteristics and effects should be determined prior to consideration of chemical control methods.

Table 9. Partial budgeting on hand weeding vs. chemical weed control

(Farm wage rate (won) 1/10 ha, 1979)

a. Added costs		c. Added returns	
Materials[1]	1,120	Changes in production[3]	—
Application labor[2]	1,028		
b. Reduced returns		d. Reduced cost	
Change in production[3]	—	Labor for hand weeding[4]	15,420
Subtotal (A)	2,148	Subtotal (B)	15,420
		Estimated change (A-B)	13,272 = US$22.12

Note: 1. 3 kg of butachlor herbicide applied per 1/10 ha.
2. 2 man-hours x 514 per hour (based on 5,140/man/day in 1979) = 1,028 won.
3. No statistically significant change in yield.
4. 30 man-hours (for 300 man-hours per hectare required for satisfactory weed control) x 514 per hour = 15,420 won.
5. butachlor (Machete) applied once to flooded paddy 5 days after transplanting.

6254

REFERENCES

1. Ahn, S. B., S. Y. Kim and K. U. Kim. 1975. Proc. of 5th Asian-Pacific Weed Sci. Soc. Conf.
2. Guh, J. O. and K. Y. Park. 1978. Journ. of Korean Soc. of Crop Sci.: 23 (3): 55–65 (in Korean with Eng. summary).
3. Jeung, J. Y. and S. P. Jeon. 1978. Journ. of Korean Soc. of Crop Sci.: 23 (3): 16–18 (in Korean with Eng. summary).
4. Kim, D. K. 1974. Journ. of Korean Soc. of Crop Sci. Vol. 16: 21–34 (in Korean).
5. Kim, D. S. 1969. Proc. of 2nd Asian-Pacific Weed Sci. Soc. Conf.
6. Kim, K. U. and H. O. Choi. 1976. Journ. of Korean Soc. of Crop Sci.: 21 (1): 20–23 (in Korean with Eng. summary).
7. Lee, J. H. and B. H. Kang. 1978. Journ. of Korean Soc. of Crop Sci.: 23 (3): 5–11 (in Korean with Eng. summary).
8. Lee, C. B. 1979. Illustrated Flora of Korea. Seoul, Korea (in Korean).
9. Motooka, P. and T. Nishida. 1977. Workshop on Weed Control in Small Scale Farms. BIOTROP. Bogor, Indonesia.
10. Noda, K. 1975. Integrated Control of Weeds. Univ. of Tokyo Press, Japan.
11. Office of Rural Development. 1978. Common Rice Weeds of Korea. Suweon, Korea. (in Korean with Eng. summary).
12. _____ . 1976. Scope of Rice Production, Use, and Reseearch in Korea. Suweon, Korea.
13. Parker, C. 1974. BIOTROP/TPT-1/74/114A; BIOTROP, Bogor, Indonesia.
14. Weed Flora in Korea. 1972. National Agri. Material Inspection Office, MAF, Seoul, Korea. (in Korean with Eng. list)
15. Yang, H. S. 1979. *In* Report. Grant-aid Fund. Institutional Cooperation: '79–3; 1–31 ORD. Suweon, Korea. (in Korean with Eng. summary).

Tri-Service FCPC file

~~Reprint~~ 2875 3 [redacted] 66

MONITORING SUBCOMMITTEE
FEDERAL COMMITTEE ON PEST CONTROL
Room 2422, DHEW, South Building
December 28, 1966

United States Government
MEMORANDUM

TO : Members
Subcommittee on Pesticide Monitoring

FROM : Assistant Executive Secretary
Federal Committee on Pest Control

SUBJECT: Meeting Announcement and Agenda

The 36th meeting of the Subcommittee on Pesticide Monitoring will be held on January 19, 1967 at 2:00 p.m. in Room 2211, South Building, U.S. Department of Health, Education, and Welfare. The agenda is as follows:

1. Approval of minutes of meeting, December 20, 1966. (copy attached)

2. Report on the status of the questionnaire to "Offshore Dumpers" (see minutes of September 22, 1966) - Mr. Jensen.

3. Problems of Disposal of Pesticide Wastes - Recommendations to the FCPC. Attached are the nine recommendations. Each member will be asked specifically by the Chairman his views on each of these recommendations (since time did not allow this in December). Please be prepared to suggest in some detail how each recommendation can be implemented, and what relative priority it should have.

4. Consider the applicability of offshore disposal of pesticide waste as a subject for a future meeting. Several members feel strongly that national and international implications elevate the practice of offshore dumping to great significance.

5. Preliminary review of the catalog of Pesticides Monitoring Data. A draft of the catalog, without indices, is being prepared for distribution prior to the January 19, 1967 meeting so that you may see the progress that is being made.

6256

6. Announcements

7. Date and place of next meeting.

[redacted], Ph.D. b6

Enclosures

Copy to: Members
Federal Committee on Pest Control

6257

MONITORING SUBCOMMITTEE
FEDERAL COMMITTEE ON PEST CONTROL
Minutes of Meeting, December 20, 1966

1. The 35th meeting of the Monitoring Subcommittee was held on December 20, 1966 at 2:00 p.m., in Room 3065, South Building, U.S. Department of Health, Education, and Welfare.

2. Present at the meeting were:

Department of Health, Education, and Welfare
Dr. [redacted]
Mr. [redacted] b6
Mr. [redacted] b6

Department of the Interior
Mr. [redacted] (vice Mr. [redacted] b6) b6

Department of Agriculture
Mr. [redacted]
Mr. [redacted] b6
Mr. [redacted] b6

FCPC Secretariat
Dr. [redacted] b6
Dr. [redacted] b6

3. Mr. [redacted] b6 the Chairman, presided.

4. The minutes were approved as written.

5. Dr. Upholt announced approval of the Pesticides Monitoring Journal by the Bureau of the Budget. In summarizing the ensuing discussion, the Chairman said that since Mrs. [redacted] is temporarily acting as editor she should be asked to meet with the Editorial Board. Dr. [redacted] b6 should sit in on this meeting. The Chairman will check with Mr. [redacted] b6 the Chairman of the Editorial Board, to assure that he is still willing to serve in that capacity. The suggestion would then be made that Mr. [redacted] b6 conduct a similar check of each of the Editorial Board members.

6. Dr. Kraybill provided details on the New York Academy of Sciences meeting "Conference on Biological Effects of Pesticides in Mammalian Systems" to be held on May 2-3, 1967.

7. A report on the progress of the Catalog of Pesticides Monitoring Data was presented by Mr. [redacted] b6. Input from the Office of Water Data Coordination has caused a delay in completing the catalog, but the contribution will be well worth it. The indices should be completed by April. No cost can yet be estimated; the only out-of-pocket costs will

6258

be by agencies for copies. (The report from which Mr. [redacted] drew his summary is attached.) b6

8. Members made several word and related editorial changes in "Problems of Disposal of Pesticide Wastes" prior to its being sent to the FCPC as the Subcommittee's report of this particular activity.

In the process of discussing the report, Mr. [redacted] b6 noted that authority for The Oil Act of 1924 had been transferred to the Secretary of the Interior. As a result of a conference in August in New York City on Offshore Waste Disposal Practices (See minutes of Meeting September 22, 1966, page 2, paragraph 5) a questionnaire was to have been distributed to agencies and industry that have need to dump wastes offshore, according to Mr. [redacted] b6

The Chairman called attention to two references provided by Mr. [redacted] b6 (1) "Deep well injection of liquid waste" dated April 1965 and available from Mr. [redacted] Publication Office of FWPCA; (2) "Deep disposal of liquid wastes on land and at sea", a draft is being prepared by a task group of the Interior Committee on Water Resources Research (not yet available in quantity).

The Chairman suggested that the subject of deep sea disposal of wastes might well be the main subject of a future subcommittee meeting with outside consultants.

The recommendations on the last page of "Problems of Disposal of Pesticide Wastes" were reviewed closely and each considered valid. The Chairman asked that the next meeting agenda reflect clearly the responsibility incumbent upon each member to come prepared for a meaningful discussion of the nine recommendations, what can be done to implement them, and their relative priorities.

9. The next meeting will be on January 19, 1967, at 2:00 in Room 2211, South Building, U.S. Department of Health, Education, and Welfare.

Problems of Disposal of Pesticide Wastes
Monitoring Subcommittee
Federal Committee on Pest Control

The Monitoring Subcommittee feels that some degree of interdepartmental coordination is necessary to achieve adequate progress in solving the problems created by pesticidal wastes.

The Subcommittee meeting of October 27, 1966, was devoted to a panel discussion on the nature of the problems, how the problems are now being handled, and what further action is needed. This panel included representatives from industry and from a wide variety of Federal agencies such as Corps of Engineers, Coast Guard, Atomic Energy Commission, and others as well as the regular members of the Subcommittee. In reviewing the ideas developed at this panel discussion, the following conclusions seem justified:

I. Pesticidal wastes create two types of hazards: (1) direct hazards to man's health, and (2) hazards to the environment which may directly or indirectly, over a long period of time, affect the suitability of the environment for normal biota (fish, wildlife, production of agricultural crops, domestic animals) or man.

II. Pesticidal wastes may be from industry, from large-scale users such as farmers and commercial pest control operatiors, or from individual home and garden use. Each of these sources creates distinctive problems of disposal.

III. Disposal techniques may be broadly divided into those that disperse the waste widely relying upon dilution and/or rapid decomposition to innocuous materials for safety on the one hand and those that concentrate the waste and contain them in a safe location on the other.

IV. The most desirable disposal technique involves rapid decomposition and dilution (or concentration) of end products.

A. Incineration

Persumably all of the organic pesticides are susceptible to oxidation to innocuous materials given sufficiently high temperatures in the presence of adequate oxygen. This technique is in use by industry, both in disposing of certain wastes from the manufacturing processes and also in reclaiming contaminated steel drums. It is also the recommended method of disposing of "empty" paper and cardboard containers.

Unfortunately there seems to be inadequate reliable information of temperatures and conditions necessary to make this system reliable with various pesticides. Therefore, both research and development is desirable to determine the necessary conditions and to develop suitable equipment for use not only in industry but also on farms or in local communities. However, at least one pesticides manufacturer has developed what appears to be a suitable combustion and scrubbing system for disposal of organic pesticide wastes in which there is no noxious element such as arsenic flourine, lead, mercury, etc.

6260

B. Chemical Decomposition

Chemical decomposition may be practical under certain conditions with some materials. The use of caustic soda (lye) is currently recommended by industry for the decontamination of steel containers (5 gallon capacity and larger) used for organic phosphate insecticides. It has also been used by industry in connection with burying some waste materials. This procedure has shortcomings both because the process may be incomplete and because the reagents themselves may create hazards in the environment. Therefore they are currently useful only where the wastes and reactants are disposed of by concentration and storage under controlled conditions.

More research on suitable reagents and procedures with a variety of specific pesticides may make this technique more widely useful.

C. Natural Decomposition

Soil microorganisms are important in degradation of residues in the soil, and oxygen and sunlight are important in air-borne residues. In both cases dilution appears to be an essential condition. More research is needed on the speed and adequacy of these reactions. Some good research on both aspects is under way but much more would be justified.

V. One of the most practical disposal techniques at present seems to be concentration and storage.

A. Burial

Burial is widely used for all three sources of waste (industrial, large-scale, and home users).

1. Industrial wastes are sometimes buried in controlled sites, usually in steel drums. Problems of potential hazards from changed use of the site in the long-term future seem insoluble at present. Problems of diffusion from the site to neighboring areas used for other purposes can be reasonably controlled by adequate geological study of the soil structure and provision of suitable buffer zones. Probably these latter two considerations should be required for any industrial waste disposal site and they should be acceptable to industry as protection against future damage claims.

2. Burial of wastes and "empty" containers by farmers and other "large-scale" users is more of a problem because the sites are numerous and widely scattered and in few cases are the necessary geologic studies economically feasible. As a result "dumping" of "empty" containers and waste materials, even in municipal sanitary landfills, may create special hazards to ground water or to future land uses. The extent of this problem is not clearly known, nor does there seem to be any adequate suggestion for its solution at present, except for reducing the volume of the wastes by better packaging (to be discussed below) and the possibility of more practical ways for rapid chemical decomposition of the wastes before dumping. Another possibility would be centralized collections of drums either with or without premiums paid for returned containers.

B. Deep Well Disposal

In at least two cases, industry has attempted concentration and disposal of liquid waste by pumping into deep wells that store the waste below (and well insulated from) usable ground waters. In one case there was a suspicion of such storage being a factor in minor earthquakes. This aspect is being carefully studied by the Geological Survey. Obviously careful control by adequate geological studies are essential to this technique which appears very promising in locations where it is economically feasible. While still part of Health, Education, and Welfare, the Federal Water Pollution Control Administration published a report "Deep well injection of liquid wastes" dated April, 1965.

C. Deep Sea Disposal

There seems to be little documented information on the extent to which pesticidal wastes (including related industrial chemicals) are dropped at sea. This practice with sludge and garbage is under considerable discussion at present. There seems to be no Federal control. The Department of Interior Committee on Water Resources Research has in draft a report entitled "Deep disposal of liquid wastes on land and at sea." During the panel discussion it was brought out that: (a) this technique may involve tankers which are simply drained when they reach the selected spot at sea; (b) towed barges which dump their contents may be used; (c) the technique may involve sinking weighted containers; (d) canneries and food processing plants dump a considerable amount of wastes containing pesticide residues into the ocean; (e) the technique is no longer used by AEC which feels it does not have adequate control over such storage of long-life isotopes. It was also brought out that the disposal of sewage, sludge, and garbage may be contributing significant amounts of pesticide residues to our rivers and oceans.

There needs to be some control over these techniques whether they are to be used more or less in the future. International agreement would be preferred but land-poor nations might have greater difficulties.

VI. A reduction in size of the problem may be achievable through improved packaging.

A. Re-Use of Containers

The technique of decontamination and re-use of containers is still being used and advocated to some extent with larger drums. The re-use of containers by individuals is always dangerous and is, in fact, one of the principal agents of deaths by pesticides. Often the deaths are a result of re-use of contaminated containers as furniture, as storage for other materials, or for any one of a number of deliberate uses; perhaps more frequently children play with, in or around the containers. Thus there is universal agreement that re-use by individuals should be discouraged by education or by designing containers that are not suitable for re-use.

Smaller containers can be burned if they are combustible, or broken, pierced, or crushed and buried if not combustible. Larger containers create more of a problem and therefore it has been suggested that they

should be assembled in a convenient locked storage yard and then transported to a suitable plant for decontamination and salvage. Frequently the salvage value does not make this economically self-supporting but some subsidy or premium for returned drums could be made available as a public service. Returning empty containers to the salvage center by common carrier is not satisfactory because of the danger of leakage and cross contamination enroute.

Design of containers to discourage re-use has been suggested but does not appear very likely at this point.

B. Reduction of the residue on or in the container might be possible by design of a suitable system for more complete drainage; by a system of chemical neutralizers (discussed above); or by design of disposable liners (plastic or paper).

C. Design of a disposable container coupled with the use of small-unit size packages may prove practical if it can be made economical. Some progress has been made along these lines in the way of tablets of weedkiller or fertilizer that dissolve in a hose attachment during application. Such packaging is not only a convenience to the home gardener in handling the material but it also reduces the wastage of mixing excess that has to be dumped.

If a suitable plan could be developed to restrict the home market to this type of packaging, at least for the more hazardous pesticides, the economics would probably not be too objectionable and a major disposal problem would be greatly reduced if not eliminated. The plan would have to include the reduction of attractiveness of the individual packages to children and a solution to the problem of labeling small units.

Disposable unit packages have long been used in agriculture where water-wettable powders are commonly packaged in paper bags of a size designed to fit the most common spray equipment. The additional step of making the bag out of a water-soluble material is probably not yet practical for large-scale users.

VII. There are some general problems of container disposal that are not limited to pesticides. The home disposal of aerosol containers is perhaps most dramatic of these, for which no solution is apparent.

The dumping of surplus diluted spray materials and the cleaning of equipment in large-scale usage is a hazard (particularly to the aquatic environment) for which no solution has been suggested.

Guidelines for handling emergencies such as fires in warehouses and freight train or truck accidents involving pesticides should be developed.

There was much discussion about improved labelling of pesticides and the Department of Agriculture reported that they are now requiring disposal instructions on the label of registered pesticides; the nature of the acceptable instructions has not yet crystallized and continuing problems of labelling are expected.

VIII. Possible recommended actions include:

1. A survey of the extent of the container problem, which would include information on the numbers of various types and sizes of containers being used, as well as present ways of disposing of containers.

2. Development of improved methods of draining and decontaminating large containers.

3. Research on temperatures and atmospheres necessary to incinerate various pesticides and development of suitable equipment for local as well as industrial use.

4. Research on suitable reagents and conditions for chemical decomposition of various pesticides and additional research on the possibilities of microbiological decomposition of pesticides.

5. Determination of status of needs for further research on the fate of pesticides diluted in air, soil, and water.

6. More administrative controls over industrial "storage" and disposal of wastes whether by burial, deep well, or deep sea.

7. Development of improved packaging with especial reference to disposable packages, small unit packaging, and reducing attractiveness of used containers.

8. Encouragement of ingenuity in improving labelling, educational techniques, and in developing new ideas for improved packaging and disposal.

9. Reconsideration of the National Monitoring Programs or the use of supplementary departmental studies to determine the possible effects of disposal of wastes, sewage, sludge, and garbage on the levels of pesticide residues in our environment, particularly in our water systems.

Federal Committee on Pest Control
Subcommittee on Pesticide Monitoring
(December 8, 1966)
Corrections December 22, 1966

6264

COPY

December 16, 1966

To: [redacted] b6
Chairman
Pesticides Monitoring Subcommittee

From: [redacted] b6
Pesticides Monitoring Data System Task Force

Subject: Catalog of Pesticides Monitoring Data - Progress Report

The Subcommittee on Pesticides Monitoring at its September 22, 1966, meeting instructed the Pesticide Monitoring Data Systems Task Force to implement a Catalog of Pesticides Monitoring Data.

The outline of this Catalog is as follows:

CATALOG OF PESTICIDES MONITORING DATA

Foreword and Purposes of the Catalog
Agencies or Organizations - Code
Office at which Data Available
Address
Definitions and Uniform Nomenclatures
Methods of Pesticides Analysis (Reference Citations)
Indices
Agencies or Organizations
Code - Monitoring Activities
in effect July 1, 1966
- Number or Code
- Geographic Location (County, State)
- Date Data Record Began (Month, Year)
- Frequency of Measurement
- Substrates
- Pesticide Classes Examined
- Remarks
Geographic Locations - Agency or Organization Code and Monitoring Activity
Substrates - Agency or Organizatoon Code and Monitoring Activity
Pesticide Classes Examined - Agency or Organization Code and Monitoring Activity
General Data Exchange Agreements

The Task Force has made steady progress toward the collection of all data required for the Catalog and essentially only the information relating to the indices remains to be collected. It is a pleasure to report that the Office of Water Data Coordination, Department of Interior has agreed to provide the name, location, and other pertinent information on each water quality station for which pesticides monitoring data are available. Since OWDC collects this type of information for all Federal Agencies, their cooperation will simplify the Task

Force's efforts to obtain Catalog information on pesticides monitoring activities in water.

It is now estimated that all sources will be able to provide the information for the indices before April 1967. In the meantime, other parts of the Catalog will be completed in draft form.

s/ [redacted] b6

cc: [redacted] b6 b6 b6

[redacted] b6

6266

US Army Rpts.

0654 4

DCS 121818

R PTTUZYUW RUEDPHA8675 3492106-UUUU--RUEDROA.#

PTTUZYUW RUEDPHA8675 3492106-UUUU--RUEDROA.

ZNR UUUUU 16Dec67 01 0Hz

P 151840Z DEC 67

FM COMDR DGSC RICH VA

TO RUMSGA/CO 14TH ICC LONG BINH RVN

RUMNVA/CO US ARMY DEPOT CAM RANH BAY VTN

RUMSGA/CO CSA 1ST LOG COMD SAIGON VTN

RUAPMZ/CO 2ND LOG COMD OKINAWA RYIS

RUHHRGA/CO USARPAC MMA FT SHAFTER HAWAII

RUMNVE/CO US ARMY SUPPORT COMD QUI NHON VTN

RUMSBE/CO US ARMY SUPPORT COMD VUNG TAU VTN

RUMSVS/CO 506TH FIELD DEPOT SAIGON RVN

RUAGHK/CO BSA 6987 SECURITY GP SHU LIN KOU TAIWAN

INFO RUEDROA/DSA HQ US ARMY PETROLEUM CTR CAMERON STA ALEX VA

BT

UNCLAS FROM DGSC-S-A2 349-1181 DEANE

DSA ROUTING	A	I
DSAH-E		
DCAS		
DSAH-C		
DSAH-G		
DSAH-I		
DSAH-K		
DSAH-L		
DSAH-M		
DSAH-O		
DSAH-P		
DSAH-S		
DSAH-W		
DSAH-X		
DSASC		

1. REFERENCE MESSAGES

A. DGSC-S-A2 181-13085 DEANE DATED 30 JUNE 67, NOTAL.

B. AVCA SGN-IC-50GM 013389 DATED 22 NOV 67, NOTAL.

2. REFERENCED MSG 1A ADVISED YOUR COMD THAT THE TOTAL NATIONAL PRODUCTION OF BUTYL ESTERS OF 2, 4, 5-T, HAD BEEN RESTRICTED TO A SPECIFIC APPLICATION FOR THE SEA DEFOLIATION PROGRAM.

3. REFERENCED MSG 1B CITED VIETNAMS NEEDS FOR FSN 6840-664-7060, HERBICIDE 2,4-D, HOWEVER, THE SEA DEFOLIATION PROGRAM HAS ALSO AFFECTED THE AVAILABILITY OF ITEMS CONTAINING THE INGREDIENT 2, 4-D.

6267

4. THE FOLLOWING FSNS CONTAINING THE INGREDIENTS 2, 4, 5-T AND/OR 2, 4-D ARE NO LONGER AVAILABLE FROM INDUSTRY, AND ARE AVAILABLE ONLY IN THE FOLLOWING QTYS FROM DGSC STOCK

FSN (2, 4, 5-T)	QTY	FSN(2, 4-D)	QTY
6840-577-4201	NONE	6840-577-4194	1700 DR
6840-582-5440	100 DR	6840-577-4195	NONE
6840-625-7792	NONE	6840-664-7060	1500 PL

5. SINCE THE PRODUCTION OF FSN 6840-882-4810, HERBICIDE, SILVEX ESTER, PREVIOUSLY RECOMMENDED AS A SUBSTITUTE IS BASED ON THE SAME PRIME RAW MATERIAL AS THAT USED FOR 2, 4, 5-T, THIS ITEM LIKEWISE IS NO LONGER AVAILAVLE FROM INDUSTRY OR DGSC STOCK.

6. CONSEQUENTLY THE FOLLOWING OUTSTANDING REQNS PLACED AGAINST THIS CENTER FOR STOCK OF THE FOREGOING FSNS WHICH CAN NOT BE FILLED HAVE BEEN CANCELLED WITH CODE CA

REQUISITIONS	SUPP ADDR
AT8033-7212-0415	YT80RG
AT8152-7192-5067	YT80AS
AT80MM-7248-2041	AT8149
AT808W-7160-0161	Y00000
AT80MP-7215-8021	AT8151

AT80MP-7216-8022	AT8150
AT80MP-7216-8023	AT8149
AT80MP-717-8011	AT8151
AT80MP-7217-8212	AT8150

AT80MP-7217-8004	AT8150
AT80MP-7247-8005	AT8151
AT80MP-7247-8006	AT8151
AT8033-7206-0447	YCE@CO
AT8149-7239-7731	YT82AB
AT80MP-7247-8001	AT8149
AT0004-7184-0003	YT0004
AT80MP-7217-8013	AT8149
AT8150-7260-0165	YT81SC
AT80MP-7257-8016	AT8149
AT80MP-7257-8021	AT8150
AT80MP-7257-8022	AT8151
AT8149-7235-7783	YT80RJ
AT8149-7235-7869	YT82AB
AT80MP-7258-8119	AT8149
AT80MM-7233-3591	AT8149

AT80MP-7311-8006	AT8151
FB5247-7321-1048	
F05247-7310-1705	

7. HERBICIDES WHICH ARE POSSIBLY AVAILABLE FROM INDUSTRY ARE AS FOLLOWS

6840-514-0644, MONURON, POWDER(80PERCENT)

6840-577-4204, DALAPON, SODIUM SALT, POWDER(85PERCENT)

6840-684-8975, CHLORATE(25PERCENT)--BOARATE MIXTURE, POWDER

6840-810-6920, FENURON, PELLETS(25PERCENT)

6840-814-7334, SIMAZINE, POWDER(80PERCENT)

6840-825-7790, DIVRON, POWDER(80PERCENT)

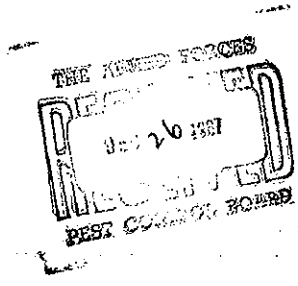
6840-833-1217, AMITROLE, POWDER(90PERCENT)

8. REQUEST YOUR COMMAND AGRONOMIST DETERMINE IF ANY OF THE ABOVE HERBICIDES CAN SATISFY YOUR NEED. IF SO SUBMIT NEW REQUISITIONS.

BT

NNNN≠

6270


THE ARMED FORCES
DEC 26 1967
PERS COUNCIL BOARD

Report WGP-DS-1

SUMMARY OF INTERIM GUIDELINES FOR DISPOSAL OF SURPLUS OR WASTE PESTICIDES AND PESTICIDE CONTAINERS

Working Group on Pesticides
Washington, D. C.

DECEMBER 1970

BLANK PAGE

STANDARD TITLE PAGE FOR TECHNICAL REPORTS	1. Report No. WGP-DS-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle SUMMARY OF INTERIM GUIDELINES FOR DISPOSAL OF SURPLUS OR WASTE PESTICIDES AND PESTICIDE CONTAINERS			5. Report Date December 1970 6. Performing Organization Code
7. Author(s) Working Group on Pesticides, Washington, D.C.			8. Performing Organization Rept. No. WGP-DS-1
9. Performing Organization Name and Address Working Group on Pesticides CS-22, Parklawn Building, Room 11-82 5600 Fishers Lane Rockville, Maryland 20852			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Agency Name and Address Working Group on Pesticides CS-22, Parklawn Building, Room 11-82 5600 Fishers Lane Rockville, Maryland 20852			13. Type of Report & Period Covered 14. Sponsoring Agency Code
15. Supplementary Notes			

16. Abstracts An interim guideline for surplus or waste pesticides and pesticide container disposal has been drawn from the combined important points of three Working Group reports, WGP-DR-1, Ground Disposal of Pesticides: The Problem and Criteria for Guidelines; WGP-DR-2, Proceedings of National Working Conference on Pesticide Disposal; and WGP-DR-3, Information Available on Handling Surplus Pesticides, Empty Containers and Emergency Situations. Presented in concise form for ready reference, the subjects of ocean disposal (not recommended), ground disposal and incineration (air disposal) are reviewed. Orientation is to different pesticide users: householders, farm operators, commercial operators, governmental authorities, industrial users, formulators, manufacturers. Ground disposal, its attendant precautions and controls, are discussed as well as methods and disposal site requirements. Incineration technology to date is outlined as the most applicable method of disposal for large amounts of toxic wastes and unusable pesticides. Sections on collection systems as practiced and recommended in various areas including transportation of surplus pesticides and containers, storage considerations with fire and safety precautions, disposal site monitoring and suggested research bring the whole problem into focus. The summary of guidelines provides preliminary guidance with expectation of revision when more definitive solutions are available. Not a set of specific recommendations on disposal.

17. Key words and Document Analysis.	17a. Descriptors (*Pesticides, *Disposal, Guides /Instructions/), (*Waste Disposal, Pesticides, Guides /Instructions/), (*Containers, Pesticides, Disposal, Guides /Instructions/), Earth Fill, Incineration, Houses, Farms, Local Government, Safety, Contamination, Collection, Soil Water, Monitors, Collecting Methods, Transportation, Storage,
17b. Identifiers/Open-Ended Terms *Pesticide Disposal,	
17c. COSATI Field/Group 06F/13B	

18. Distribution Statement Releaseable to the public. Available from NTIS, Operations Division, Springfield, Virginia 22151	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages
	20. Security Class (This Page) UNCLASSIFIED	22. Price P.C.$3 MF $.95

FORM CFSTI-35 (4-70)

USCOMM-DC 65002-P70

6274

BLANK PAGE

The Working Group on Pesticides is the inter-departmental coordinating mechanism for use of pesticides in the federal government. It is concerned with the proposal of programs and policies concerning pesticides. The Working Group is responsible to the Council on Environmental Quality. It is composed of scientist-administrators, of diverse disciplines, from approximately 30 agencies concerned with the human health, conservation, agriculture, land, water and timber management, national defense, quality of air, water and other natural resource aspects of pesticides in terms of safe and effective use.

Further information on this document may be obtained from: Dr. [redacted] b6
Executive Secretary, Working Group on Pesticides, CS-22, Parklawn Building, Room 11-82, 5600 Fishers Lane, Rockville, Maryland 20852

6276

ACKNOWLEDGEMENT

This summary represents an interdepartmentally coordinated effort in which federal, state and private research and experience were essential components. Without the basic information contributed there could, of course, have been no summary.

The interest, time and cooperation of the many individuals who made suggestions and reviewed drafts of the summary are gratefully acknowledged.

6277

TABLE OF CONTENTS

6278

Table of Contents (Continued)

INTRODUCTION

A growing awareness of the necessity to maintain the quality of the environment has resulted in a new focus on old practices that contribute to degradation of our natural resources. Pesticides are an important one of a number of products, or by-products, that have potential for contributing to pollution of our land, air and oceans. The basic need for pesticides in the production of an adequate supply of food, feed and fiber and in the protection of human health is generally recognized and accepted. Also recognized is that widespread—sometimes indiscriminate—use of pesticides and their residues and left-over containers has resulted in a threat to man, animal and plant life.

Authorities are taking steps to reduce the amounts and kinds of pesticides to those absolutely needed for the intended purposes. Concerned citizens and private groups, often without adequate knowledge of the attendant hazards, have in some instances solicited and collected unused or unwanted pesticides. As a result, there are large stocks of pesticides whose use has been curtailed or discontinued and are now awaiting safe disposal.

These surplus or unwanted pesticides, added to day-to-day accumulations of pesticide manufacturing wastes and growing piles of "empty" pesticide containers, represent an urgent national problem.

To provide information and guidance to federal agencies and others having pesticide disposal problems, the Working Group has sponsored three informal publications: (1) Ground Disposal of Pesticides: The Problem and Criteria for Guidelines (1970); (2) Information Available on Handling Surplus Pesticides, Empty Containers and Emergency Situations (1970); and (3) Proceedings of the Working Conference on the Disposal of Pesticides (1970).

The Ground Disposal document is, as the title indicates, confined to the disposal of pesticides in the ground only and of concern primarily to those who must be aware of fundamental issues such as ground water contamination. Guidelines for Disposal is of larger scope, including "do's," "don't's" and unsolved problems in handling pesticides, detoxification of containers and storage of pesticides for disposal. The Proceedings are a collection of papers delivered before the Working Conference by federal, state and industrial officials knowledgeable in various aspects of pesticide disposal.

Each of the three documents was intended to provide an indication of the state of the art relative to its particular subject. Each was compiled from contributions submitted by different writers. As would be expected, any one of the three documents contains some information that may be repeated in one of the others or, by intention, be of considerably less scope than the three taken together. Certainly there was an awareness by the authors that, even though there has been much background work and some continuing research, there is a regrettable lack of definitive data on the subject of safe disposal of pesticides and pesticide containers.

PURPOSE

The intention of this review is to combine the essence of important points from three documents. Orientation is to different pesticide users, whose responsibility it is to properly use pesticides so as to avoid excessive amounts applied or remaining as unused materials and to safely dispose of the containers.

This document should be considered an *interim* guide to disposal of pesticides and their containers and not a set of specific recommendations on disposal. Technology has, at this point, not entirely foreseen the events of the times which have resulted in the seriousness of the problem of disposal of unwanted pesticides and pesticide containers. Some excellent research is in progress. This review, therefore, is intended to provide preliminary guidance until definitive solutions may be available.

Chapter 1

GENERAL METHODS OF DISPOSAL

1. General

Each pesticide user is responsible for its proper use and for the safe disposal of unwanted pesticides and containers. The selection of a method of disposal will be influenced by several factors such as state or local legislation, distance to an authorized disposal site and the amount and type of the pesticide or containers involved. Unfortunately, disposal methods are not equally satisfactory to all disposers of pesticides and containers.

Ocean, ground and air are the places traditionally thought of as recipients of unwanted pesticides and containers. The following three subsections summarize the applicability of disposal in these segments of the environment.

2. Ocean Disposal

Formerly the solution to pollution was thought to be dilution. Findings in recent years have shown that some compounds disposed of in the ocean, among them pesticides, may be concentrated by important ocean organisms including some used as food by humans. In the summer of 1970 a group of scientists studied ocean pollution and concluded that pesticides were a primary contributor. For these reasons pesticides or pesticide wastes and containers should not be disposed of in the ocean.

3. Ground Disposal

Disposal of pesticides in the soil presents a potential for contamination of surface and ground water supplies. However, this varies considerably depending on location, amount and kind of pesticides and methods of disposal. In general, burial of pesticides—according to specific criteria—represents one of two feasible methods of disposal.

4. Incineration (Air Disposal)

Pesticides are among the lesser of many air pollutants; yet, biologists and others are concerned over the role of air in the international distribution of pesticides. Most pesticides are readily volatilized by intermediate combustion temperatures.

Current research has shown that high temperatures reached in commercial incinerators are capable of pesticide breakdown. *However,* it is important to understand that unless by-products from incineration in such units are immediately collected by special equipment and methods, serious air pollution will result.

A system of flue scrubbers is expected to be perfected so that quantities of pesticides may be safely incinerated. In the meantime, incineration in home-type units may be allowed for *very* minor amounts of pesticide containers and their residues (less than a pound or gallon), particularly in open, unpopulated areas of the country, where permitted by local authority.

6282

Chapter 2

METHODS AVAILABLE TO THOSE WHO MUST DISPOSE OF PESTICIDES AND THEIR CONTAINERS

1. General

Disposal methods are presented in this section consistent with what experience has shown to be typical types and amounts of pesticides and their containers. For convenience, several types of users have been combined. For example, householders and small farm operators are considered together; it is acknowledged, however, that small acreages of certain crops sometimes require amounts and kinds of pesticides approaching the requirements of large farm operators/farm combines. It should be constantly kept in mind, regardless of type of user, that the disposal of surplus pesticides and pesticide containers is the responsibility of the individual, company or corporation who purchases or uses the pesticide.

2. Householders and Small Farm Operators

The cumulative effects of many small sources of urban and suburban waste pesticides and containers have been discovered to be important contributors to pesticide pollution. Home and home garden users sometimes discard these individually small amounts of excess pesticides and containers in sanitary and storm sewers, in back-of-lot situations sometimes involving streams, and in municipal dumps; and their cumulative totals may be considerable. Pesticide wastes or empty containers from small farm uses are likely to be small when compared to large farm operations, but are probably disposed of less properly. Availability of discarded pesticides and containers in the farm situation can result in pesticide exposure in farm animals. Until such a time as adequate means are available for proper disposal, surplus pesticides and containers should be stored in a safe, secure location in the home or on the farm.

a. *For the urban and suburban householder* normally generating individually only small quantities of surplus pesticides and used containers, some important instructions and precautions can help reduce hazards and minimize environmental pollution:

(1) Use pesticides you have on hand for the purpose(s) indicated on the label and in accordance with the safety precautions and limitations specified thereon. NOTE: This of course cannot be done in states where the uses of certain pesticides have been banned by law. In these states, disposal of the banned pesticide should be undertaken as advised by the state. The County Agricultural Agent or Commissioner's Office, the County Extension Agent or Farm Adviser's Office, the City or County Health Department or the local office of the State Department of Natural Resources or Conservation should be contacted to obtain this necessary information.

(2) Purchase only as much pesticide as you have definite plans to use during one season.

(3) Prepare only as much pesticide as needed at any one time for the control of a specific pest(s).

(4) Use all the spray, dust or granules you prepare for any single application.

(5) Use all pesticide that can be drained or removed from a container prior to its disposal.

(6) Rinse the container with several small portions of the diluent being used (usually water) and add the rinsings to the spray.

(7) Keep all container tops, lids or bungs in place and all other containers securely closed when pesticides are not being used.

(8) Keep all containers, including empty ones, under secure storage until they can be disposed of properly.

(9) Wrap empty pesticide containers in several thick layers of newspaper, tie securely, crush and/or break all empty containers, except the aerosol types (never puncture or burn aerosol type containers), and place in garbage cans. NOTE: As this is only an alternative method until a more satisfactory disposal means can be recommended, one of the local offices mentioned in paragraph "a. (1)" above should be contacted to find out if this procedure is permitted in that locality. Some agencies require that the pick-up crew be notified of pesticide containers in the refuse so that disposal will be in approved-type landfills to minimize stream and underground water pollution.

b. *For small farm operators* all of the above instructions and precautions should be followed except perhaps the last one, since city or county refuse collection for disposal in approved-type landfills may not be available to small farms. However, the farmer may readily use the burial method as follows:

(1) Light, single-trip containers, after crushing and/or breaking, may be buried in safe locations on the farm premises. Burial should be in clay or loam soil, with 18 to 24 inches of similar soil cover, in an isolated, level spot at least 500 feet from livestock feeding areas, wells and streams, and where water supplies will not be contaminated. NOTE: The County Agricultural Agent or Commissioner's Office, the County Agricultural Extension or Farm Adviser's Office, the County Health Department or the local office of the State Department of Natural Resources or Conservation should be contacted for specific instructions for correct farm burial, as these instructions may vary from state to state.

(2) Many of the larger, 30- to 55-gallon containers and all of these containers in which Class B POISON pesticides (See page 16 for definition) have been packaged can often be reused or recycled. Information on such reuse can be obtained from the offices mentioned in paragraph "b. (1): above and quite possibly from the pesticide supplier. Disposal of these used containers should be through delivery to a collection site for reusable containers or, if practical, to one of the companies that has the knowledge and facilities to recondition pesticide containers. (Care must be exercised in handling and transporting these empty containers to avoid contamination.) This could save effort in having to crush, in excavating a deeper hole and in burying the larger containers. Reusable containers delivered to the reconditioning company's site are of value both from the standpoint of the money received and from the reuse of a natural resource.

c. *Surplus pesticides* from both householders and small farms are best used for the purposes indicated on the label and in accordance with the safety precautions and limitations on the label. Surplus mixed pesticide solutions or emulsions can most often be disposed of by carefully respraying the area that has been treated, by spraying the residual on adjacent borders or by spraying on a safe, protected waste area. Care should be used in the case of herbicides to avoid damage to crops, lawns, etc. Careful attention to the volume mixed will help in minimizing surpluses. If this cannot be done, designated collection and disposal sites for pesticides should be established by governmental authority. Such sites should be reasonably convenient so that householders and small farmers having small quantities can bring their surplus pesticides to the designated sites. (See the section of this summary on collection systems.) Instructions and precautions should be given in the call for surplus pesticides, such as: (1) use the original container if at all possible; (2) close the container tightly and tape shut if necessary to avoid even slight accidental spillage; (3) if the container cannot be made secure, put the container in a polyethylene bag or wrap in newspaper; (4) use a surplus pesticide container with an identical label if the original container cannot be used.

The days and hours the local pesticide collection site will be open for the receiving of surplus pesticides and used pecticide containers should be publicized. Easy-to-follow directions to the collection sites must be provided. It might be well to add the admonition that participation should only be in pesticide collection programs that are under the immediate direction and control of recognized local or state agencies that have facilities for handling these materials. Well-meaning but improperly directed and controlled collection programs can result in accidents.

6284

3. Large Farm Operators and Farm Combines; Commercial Pest Control Operators; and Federal, State and Local Authorities

A substantial volume of pesticides is associated with the larger farming operations and with operations of professional pesticide applicators. Residuals from small leakages and spills accumulating over a period of time at a central operations facility, such as mixing or loading sites, may present a hazard. Large accumulations of returnable and nonreturnable containers are normally associated with such operations. Informal disposal of containers, wastes and surplus pesticides in open ditches or other "out-back" locations must not be condoned. Federal, state and local governments may store, transport and use large quantities of pesticides with the attendant opportunity for warehouse accidents, spillage and container disposal problems. On occasion, outdated or no longer needed (surplus) pesticide stocks may be made available to community or private needs by government sources. This resale or transfer may not convey the needed warnings and specific directions for use, resulting in handling or use patterns that produce misuse and waste. Old containers being transferred may have deteriorated or may leak and need to be discarded, with their partial contents, before anticipated use can be made of them.

a. *Empty containers* from large volume users are probably the biggest problem these users face. Whenever possible, pesticide containers should, after thorough rinsing, be returned to the supplier or to a firm properly equipped for reclaiming or reconditioning pesticide containers. If these methods are not available, it will be necessary to dispose of these containers in the same manner as recommended for smaller users, i.e., through delivery to collection sites operated by the community or proper burial at landfills approved by the State Departments of Health, Natural Resources and Agriculture, or by burial on privately owned premises dedicated to this purpose.

(1) When a container (metal, glass or plastic) is empty, it should be rinsed several times with the diluent (generally water) and the rinses poured into the tanks of application equipment during the mixing operations.

(2) After being rinsed, pesticide containers that do not drain readily and cannot be recycled should be punctured in such a manner that the container will drain readily, and should then be buried.

(3) Burial, if on privately owned premises, should be in an area with a minimum opportunity for being disturbed and where water runoff is least likely to occur. The burial site should be located at least 500 feet from livestock feeding areas, wells, and streams, and where water supplies will not be contaminated. The County Agricultural agent or Commissioner's Office, the County Agricultural Extension or Farm Adviser's Office, the County Health Department, or the local office of the State Department of Natural Resources or Conservation should be contacted to verify the safety of the selected burial site and advise on local instructions and possible restrictions.

(4) Empty containers must not be discarded along airstrips or, irresponsibly, in public dumps or other nonattended, easily accessible areas. Likewise, used containers should not be allowed to accumulate. The individual or company purchasing or using the pesticide continues to be responsible for the empty containers until they are disposed of properly.

b. *Surplus pesticides* are not usually a problem to the commercial user; however, the disposal of surplus mixed pesticides and the rinsings from pesticide application equipment frequently pose problems. The volume and variety of pesticides used by any single commercial user can be fairly accurately calculated in advance so that purchases can encompass specific or monthly operations. In addition, these users can and do carry over stocks of pesticides from one year to another. As for surplus solutions and emulsions, careful attention to mixing the pesticide will reduce these. The increased use of low-volume application will further decrease this problem and that of equipment rinsings as well.

(1) When it is necessary to dispose of dilute pesticide mixtures or rinsings, whenever possible they should be carefully applied to the area that has been treated, adjacent borders or safe, protected waste areas. Extreme care must be exercised so that the extra pesticide applied will not result in phytotoxicity, over-tolerance residues or other undesirable results.

(2) When this method will not suffice, the dilute pesticide solution, emulsion or rinsings should be run into a shallow holding pit dug in an area where there will be no runoff or downward percolation and where the water table is at least 10 feet below the surface. Under no circumstances should dilute pesticides or rinse water be allowed to enter streams, lakes, sewers, drainage ditches or other areas where water contamination can result. The holding pit area should be properly identified so that no other use is made of this area and so that subsequent contamination of other areas will not occur.

(3) If possible, surplus unused concentrates should be returned to the pesticide dealer for his return to the manufacturer. Because of the volume of pesticides being continuously purchased by commercial users, the dealer will in all probability accept such surplus materials.

4. **Formulators, Industrial Users and Pesticide Manufacturers**

Pesticide spillage may occur in the process of formulating finished pesticide products from concentrates and diluents. However, there may be as many variations of excess pesticide waste and container disposal situations as there are various industrial uses of pesticides. Pesticide manufacturing wastes and related production products normally require formal disposal. Some have been pumped underground in deep wells; the bulk of industrial pesticide waste, however, has been consigned to the ocean, incinerated, or disposed of in sanitary-type landfills.

The booklet, "Waste Disposal," published by the National Agricultural Chemicals Association, Washington, D.C., provides guidelines which may also be considered in disposal of waste from pesticide manufacturing and formulation operations.

a. *Disposal in the ground* of large amounts and concentrates of pesticides represents one of two possible methods of disposal (incineration is the other) for large commercial and industrial users or producers. Attendant precautions and controls are numerous, as the following indicates:

(1) *Ground water resources to be protected:* Ground water is that water below the ground surface which is under pressure in the pores and crevices of rocks but free to move under the influence of gravity. This unseen source of water is one of our most important resources. It supplies one-fifth of our nation's direct water withdrawal needs; and this is in much greater proportion in arid areas. Ground water reservoirs store more water than the surface reservoirs which we are able to see. Water clarity, microbial purity and chemical quality are unique.

Ground water is universal in distribution; it is an important source of water in each of the 50 states. Though not always obvious, there is an intimate interconnection between ground and surface water.

(2) *Susceptibility of ground water to contamination:* The contamination of surface streams in the U.S. has been widespread. Similarly, ground water is susceptible to contamination through interchange with contaminated surface water. Also, pollutants may percolate to ground water directly from the land surface, sewers, disposal lagoons, and landfills. The degree of threat to ground water from pesticide waste disposal of, in or on the ground depends on a large number of factors. However, two factors of primary importance are pesticide *persistence* and *movement* in the soil.

(3) *Pesticide persistence in the soil:* The length of time pesticides will remain in the soil depends on a variety of factors; the most important of which are:

Type and concentration of pesticide compound

Type of soil

Temperature

Oxygen availability (less at greater depths)

Rainfall and ground water incidence

necessary. Legal responsibilities may be considerable, depending on location. Pesticide waste injection operations should be instrumented to monitor and record volume and injection pressures; well integrity must also be continuously monitored.

Deep-well disposal of pesticides or pesticide-related wastes is not likely to be resorted to often except in unusual circumstances. The need to dispose of large volumes of toxic concentrates, not amenable to other methods of disposal, could conceivably be disposed of by a large company having found and proved a site amenable to environmental requirements. Cost alone could be expected to limit use of this method.

(b) *Sanitary landfill* - The definition of a sanitary landfill is: A method of disposal of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area to reduce it to the smallest practical volume and to cover it with a layer of earth at the conclusion of each day's operation or at such more frequent intervals as may be necessary. Only an estimated 6% of the refuse disposal sites in the U.S. are operated within this accepted definition of a sanitary landfill. Very few of those considered true sanitary landfills were established in sites studied and selected for the special purposes of toxic waste disposal and with the capacity to serve commercial requirements.

Pesticide formulators, industrial users and pesticide manufacturers should not use existing, general use landfills.

The sanitary landfill type of disposal is adaptable for commercial disposal of pesticides and their containers *under specific conditions.* Site selection is more important. It should be located on highground not subject to flooding. It should be owned by the disposer and reserved for the burial of toxic wastes. Also, it should be marked on the site and permanently recorded in land and county offices. The site should be securely fenced, identified and trespassers kept out.

A thorough geologic and hydrologic investigation should assure that the site is comprised of uniform, impervious soil, removed from the hydraulic gradient. This should be so certified by the state geologist. Soil and water of the sites should be routinely sampled and analyzed for escaping leachate. The disposer should undertake these responsibilities in addition to related legal permits as assumption of the right to use land beneath which may flow ground water, a public natural resource.

As an example, at one sanitary landfill owned and operated by a pesticide manufacturer, a large diesel bulldozer digs 20-foot deep corridors into which company trucks dump concentrated manufacturing wastes. This is covered and compacted in cells. This isolated site is mapped, carefully managed and monitored.

(c) *Other methods* of ground disposal are *not recommended* for formulators, industrial users and pesticide manufacturers at this time. These include disposal pits, lagoons or surface disposal.

Research and technology may provide the means for encapsulation, detoxification or prior chemical decomposition that may someday allow for wide use of the ground for pesticide waste that has been processed. Also, the possible use of salt dome sites for disposal is under current investigation.

(7) *Disposal site requirements:* Prospective disposal sites, designed to receive annually several thousand pounds of unused starting materials, reaction by-products and excess final products (liquid or solid), must first be surveyed and monitored to produce the following data for analysis:

(a) *Geologic data* - Site maps and vertical cross sections showing surface and subsurface distribution of rocks and sediments and a classification of soils in relation to topographic and water sources

Location, nature and uses of wells in and adjacent to the proposed disposal site

Data on folds, faults and joints in the geologic structure of the site

Chlorinated hydrocarbon pesticides, such as DDT and dieldrin, are most persistent. Most organic phosphate pesticides, such as malathion and parathion, are much less persistent. Herbicides may be intermediate, rather ephemeral or long lasting, depending on chemical composition. Pesticides buried at greater depths, where ground temperature is cool and oxygen very low, are most likely to remain unchanged for long periods. Research on longevity of certain chlorinated hydrocarbon pesticides applied to soil at subsurface levels shows persistence and effective pesticidal action against subterranean termites for over 20 years without significant lateral or horizontal movement within the soil.

Preliminary results from research on disposition patterns of 2,4-D waste liquor in highly alkaline soil show that the basic material was stable under conditions of test. A volatile phenolic fraction was readily volatilized from surface treated plots. This fraction was apparently retained when the waste was injected to a depth of 10 inches.

(4) *Pesticide movement in the soil:* Consideration of pesticide movement is necessary because movement away from a disposal site represents a potential source of environmental pollution. The amount of movement depends on physico-chemical properties of the pesticide and its interaction with soil particles and water.

Except for the volatilization of pesticides with high vapor pressure, the movement of pesticides from the soil *surface* is largely dependent on water and wind erosion. From *subsurface* deposits, the movement of pesticides depends on essentially two factors: (1) leaching by water (moisture) and (2) absorption of pesticides onto soil particles such as clay or organic matter. As a general rule, less leaching of pesticides occurs on organic soils and heavy-textured soils (clay) than in lighter textured soils (sand). Consequently, the depth of penetration of most pesticides is inversely proportional to the clay and organic matter content of the soil.

Results from before mentioned research with 2,4-D waste liquor indicated a downward movement from the surface to a depth of 4 feet below in 10 days where the application rate was as high as 1,000 gallons per acre with 9 inches of (simulated rain) water applied incrementally over that period. Most of the material, however, was found from 1½ inches below the surface to 12 inches below the surface. Removal of soil surface material through wind erosion occurred. Injection studies using the same material showed that there was about 6 inches of vertical movement above and below the injection point (10 inches deep) but little detectable lateral movement after 26 days. Measurements 87 days later detected only small additional movement vertically and practically none laterally.

(5) *Contamination of well and ground water:* Recent sampling of well water in a southeastern state, by the Public Health Service, showed pesticides (at very low concentrations) in 60% of the samples. This suggests that pesticide pollution of ground water may be more widespread than commonly realized. The probable sources of contamination were not investigated as part of this study; however, it indicates that potential sources of well water contamination by pesticides may have been due to poor well construction, inadequate sanitary seals, or entrance into the water table by termite-hollowed tree roots or other unexpected subterranean fissures in the soil.

There have been scattered incidents indicating growing evidence that the uppermost water table can be contaminated by pesticides. The importance of this is the fact that this resource is the most important source of water supply for municipalities, industries and individuals in many areas of the country. Pesticides which have been disposed of may contaminate the uppermost water table directly through cracks or fissures in rock formations, leakage through man-made core or bore holes and abandoned wells and through direct or indirect percolation.

(6) *Methods of ground disposal:*

(a) *Deep-well* - Deep-well refers to well disposal of pesticides in a geological formation far below fresh water aquifers and separated from them by impervious geological strata. Such well depths are generally between 1,000 and 12,000 feet; estimated costs per well range between $75,000 and 1½ million dollars.

Extensive preliminary geological and hydrological investigations are necessary to determine the location and extent of an appropriate disposal stratum. Depending on the particular state and its requirements, other factors must be determined and recorded. A technical study of well design, construction and operation is also

(b) *Hydrologic data* - Thorough description of all pertinent surface water such as lakes, ponds and drainage networks in or adjacent to the site; any uses to which this water is put; and an indication of maximum and minimum stream flow levels

Chemical quality of the surface water

Definition of surface water infiltration and ground water discharge that might affect the movement of liquid wastes on or away from the site

Description and location of aquifers and the height of the water table in general as documented by hydrologic testing data

Location of water wells

Location of ground water recharge and discharge and method of recharge and discharge at the site and adjacent area

Direction and rates of ground water movement as determined by pumping tests

Ground water fluctuations due to seasonal climatic or man-made factors

(c) *Geochemical data* - Ion exchange characteristics of the soil at the proposed site

(d) *Monitoring data* - For *deep-well disposal,* monitoring is to be by continuous recording instruments to provide information on volume and nature of waste injected, injection pressure, annular pressure between well and casing and the injection tubing. Nearby wells should be tested regularly for chemical quality.

Monitoring wells should be installed around sanitary landfills. Water level measurements and water quality should be routinely taken from these monitoring wells. Surface water should be sampled at several diverse locations and the samples analyzed. Site vegetation should be periodically observed, and analyzed where warranted, to detect incidence of volatile or dry pesticide compounds escaping to the air.

(e) *Records* - The following should be a permanent and up-to-date record of the disposal site:

Chemical composition and concentration of the waste, including toxicity to humans, biodegradability, mobility and volatility

Solid or liquid waste

Volume or quantity of waste disposed of to date

b. *Incineration* under carefully controlled time and temperature conditions now appears to be the most applicable method of disposal for large amounts of toxic pesticide wastes and unusable pesticides. As used here, incineration refers to combustion in commercial burners capable of high, controlled temperatures, that are or may be equipped to scrub objectionable gases. Open, on-site burning is not recommended because of air pollution and the incombustible residues that remain.

This method has applicability to the detoxification of pesticide containers. It is, at this point in the development of the method, inadequate for very dilute pesticide formulations in water or inert dusts and for those that contain heavy metals. It should also be noted that until chemical detoxification methods are perfected, incombusted ash and scrubbed-out residues should be concentrated as much as feasible and buried. (See Methods of Ground Disposal.)

Complete incineration of pesticides and scrubbing of gases should yield harmless carbon dioxide and water. Incomplete combustion of pesticides releases into the air a variety of chemicals, depending on the compound(s) being burned. Carbon monoxide would be a common pollutant. Nitrogen containing organic compounds would produce noxious oxides of nitrogen. Chlorinated organic compounds could result in the release of hydrogen chloride, chlorine and phosgene. Thiophosphates, even under perfect combustion conditions, are precursors of sulphur dioxide.

Research and development on a method of incinerating pesticides, its applications and limitations, have not yet been concluded. To date there are good indications that a moderately priced ($10,000 to $15,000) incinerator equipped with scrubbers to eliminate hazardous gas escape is feasible for nonindustrial amounts of pesticides. The basic, unmodified unit is commercially available.

Several very large, special purpose incinerators that accommodate pesticides are privately owned and operated. These much more expensive units have shown that this method works. However, most formulators, industrial users and pesticide manufacturers would not find units of this size economically feasible. (Investigations by the Bureau of Solid Waste Management are now underway to determine the feasibility and location of regional disposal sites.)

Incineration of reagent grade pesticides in a small pilot model showed that complete incineration could be achieved from about 250° C. (482° F.) to 850° C. (1,562° F.). Five pesticides required up to 900° C. (1,652° F.). Commercial formulations reflected a similar range. Of interest is the observation that at 1,000° C. (1,832° F.) four common pesticides still contained an incombustible residue of about 10%; two other pesticides yielded 19 and 23% ash at this high temperature. Pesticides which are recalcitrant to biodegradation break down to readily biodegradable products when fired at 200° C. (392° F.) to 400° C. (752° F.) for 30 minutes ("thermal shocking").

Although incineration is presently superior to chemical methods for the destruction of waste pesticides, further research may lead to combinations of the methods that could enhance the efficacy of complete degradation.

Important operating information such as optimum liquid pesticide feed rate and fuel and air feed rates is under study. These will vary somewhat depending on the formulation and type of pesticide. Certain agents added to the pesticides to be burned are themselves combustible and could therefore lower the temperatures necessary for complete combustion. Mineral oil and lightweight polyethylene have been found to serve this purpose; the latter provides the additional advantage of providing a packaging agent as well.

Technically trained personnel will be required to operate incinerators for combustion of pesticides. Through the cost and size of the unit as perfected may allow use by commercial interests, the responsibility of safe use and the maintenance of clean air for all is a responsibility that must be accepted.

c. *Chemical degradation* (notation only): Research that is being completed shows some promise for effective chemical degradation.

The chemical reactions that are involved may make this approach feasible only for industrial-size users capable of providing special facilities.

Chapter 3

DISPOSAL SITE MONITORING

1. General

Safe disposal is the responsibility of the disposer or of the authority operating a disposal facility.

A vital component of the safe operation of any type of disposal facility is the establishment of an adequate monitoring system. Since the pesticides managed in a disposal system are present in a substantially higher concentration than in normal use, the risk of environmental contamination is extremely high. Samples of the various parts of the system and of the surrounding air, water, soil, wildlife and plant environment must be analyzed in a regular program to make certain that no risk is present.

2. Sanitary Landfills

Sanitary landfills and industrial sanitary landfill-type of disposal sites should be monitored periodically to determine the continuing integrity of the site. Some state or local authorities have regulations that apply to this need. For those that do not, there are several suggested monitoring activities, as follows:

a. *Runoff water* together with sediments should be collected in draws below the disposal site. V-shaped aluminum pans with glass bottles attached have been used successfully for this purpose.

b. *Surface water* samples from nearby streams and ponds should be collected. These should be both above and below the disposal site, where applicable, and should include stream bed or pond edge bottom silt.

c. *Ground water* samples from existing wells or wells dug for monitoring should be collected at varying depths. These should be at various distances from the margins of (parameters around) the disposal site.

d. *Core samples of soil* should be taken from time to time. These should be taken along several margins of the disposal site as well as from a few stratigraphic horizons beneath the disposal pit itself (without actually penetrating the contents of the pit).

3. Deep Wells

Monitoring of deep-well disposal sites is to be by continuous recording instruments to provide information on volume of waste injection, injection pressure and annular pressure between the well casing and the injection tubing. Nearby water supply wells should be tested regularly for chemical quality.

4. Incinerators

Limited experience with incineration of pesticide wastes and the lack of published information leave what monitoring should be required somewhat in the realm of speculation. We know, of course, that even at higher recommended temperatures there will be some incombusted ash from a few pesticides. Supervision by incompletely trained personnel, incineration of masses of other combustibles that may inhibit pesticide degradation, and other practical problems of operation could be responsible for remaining toxic incinerator residues (ash). These residues should be treated as other undegraded pesticides for which ultimate disposal warrants surveillance through recommended monitoring techniques.

One incidental account of pesticide incineration refers to the production of fog arising from a small amount of sodium salt from organic acid in the feed material. It was observed to settle to ground level as a lingering haze under certain weather conditions. The equipment was outfitted with a scrubbing tower. This only serves to suggest that monitoring procedures in the vicinity of incinerators in which pesticides are to be degraded would be appropriate.

5. Monitoring Sample Analysis

The meaningful collection of monitoring samples so as to avoid contamination will require technical assistance from experienced personnel, at least initially. Subsequent handling and shipment to a laboratory for analysis are also important in obtaining an accurate evaluation of possible exposure of the environment to disposed-of pesticides. Samples must be analyzed, through exceedingly precise techniques, in qualified laboratories specializing in this type of service. Assistance in the location of such service and in sampling procedures in general may be obtained through inquiry to the state or county geologist, County Extension, Health Officer or Department of Natural Resources offices.

6. Records

Part of the proper disposal of pesticides and pesticide containers includes the maintenance of records. These may include the type and quantity of that to be disposed of, method of disposal and continuing data from site monitoring activity. Site study data (noted under Methods of Disposal and Disposal Site Requirements) are fundamental to the record, particularly in terms of disposer liability considerations. State and county laws and ordinances vary and should be carefully reviewed.

Chapter 4

COLLECTION SYSTEMS FOR PESTICIDES AND PESTICIDE CONTAINERS

1. General

Spontaneous or unsupervised collection of surplus or unwanted pesticides can be extraordinarily hazardous. Often the containers in which these materials have been stored, in the home or garage, on the farm, and in storages of commercial pest control firms and governmental agencies, have been opened for partial use, broken in handling or just deteriorated with age and weather exposure. Therefore, their condition prompts much more careful handling to avoid spillage and contamination.

Collection of pesticide containers likewise poses problems in pesticide contamination in that small quantities of pesticides adhering to these unwanted containers may be dislodged in the collection process. Therefore, collection of these items, which have the innocuous appearance of ordinary trash, must be as careful as the collection of pesticides themselves. An added hazard is that a pesticide container in good condition may be mistakenly salvaged and used for other purposes.

2. Collection Program

Pesticide and pesticide container collection is an essential part of the whole waste pesticide storage and disposal problem. A systematic and reliable collection method *must* be developed for each community, county or other political entity that envisions or legally has the responsibility for pesticide disposal. Initially, with proper newspaper, radio and TV publicity, a properly planned collection program can be fairly successful; however, continued motivation is required to keep the used pesticide containers moving from points of use to the collection site or disposal area. Although many pesticide users are becoming more concerned about minimizing the hazards associated with pesticide application, changes in disposal practices which involve the expenditure of additional time and effort are difficult to induce. The motivation for proper disposal of surplus pesticides and pesticide containers can be renewed by several methods:

a. *Collection drives:* Well-publicized periodic collection drives such as have been carried out in Florida, Kansas, Maryland, Massachusetts, Wisconsin and other states are effective in obtaining pesticides and pesticide containers, especially from homeowners; however, farmers, commercial applicators and governmental agencies (municipal, state and federal) will respond and contribute used materials and containers. These drives are best announced via newspaper, radio and TV media.

b. *Use of special labels:* Special labels or stickers printed and distributed to pesticide suppliers in the area, to be placed on all pesticide containers as they are sold, are of value in reminding pesticide users of the need for proper disposal, the location of collection or disposal sites, and who to call for further information. A copy of the sticker used in Klamath County, Oregon, is provided on page 17.

c. *Local advisory committees:* Where special motivation may be required to produce results, the formation of local Pesticide Disposal Advisory Committees can provide a broad base of interest. Well-known and informed persons in diverse occupations and residential areas in the community should be selected to form such an advisory committee, to hear progress reports and to advise the agency responsible for collection and storage on how better to solicit public cooperation. Publicity on selection, on their meetings and on their recommendations should provide continuing public interest.

3. Collection Agency

The governmental agency responsible for collection should be the same agency which by law or regulation is to provide for pesticide and pesticide container storage and disposal. This may vary from the State Department of Agriculture (through its County Extension Offices or Noxious Weed Control Offices) to the State Department of Natural Resources (through its Fish and Game Offices, Forestry Offices or State Park Offices). This may also be a cooperative effort between state departments including the Health Department. These state agencies and combinations have been used in Florida, Kansas, Maryland, Massachusetts, Michigan, Montana, Wisconsin and other states. In the final analysis, the state will determine which of its agencies will be responsible for the collection program.

It should be kept in mind that any agency planning a collection program and providing collection sites will have assumed the responsibility for the safe operation of the program. This responsibility is assumed in spite of the fact that any system used will have less environmental impact than those collection and disposal methods formerly in use. Also, by implication, the agency is insuring that no deleterious environmental, personnel or population effects will develop. Initiating collection is a tacit commitment by the agency for long-term support of all aspects of the collection and disposal program.

4. Collection Methods

Careful consideration must be given to the method of collection selected considering the hazardous nature of the materials and used containers being collected. The preponderance of informed opinion indicates that it should be the responsibility of the pesticide user, whether this be a homeowner, a grower or a commercial applicator, to safely carry surplus or waste pesticides and used pesticide containers to the point designated as the collection or accumulation site for these materials. It is considered too costly to provide a publicly or privately operated collection service for a specific collection. It is not appropriate that collections be made by public spirited groups such as the Boy Scouts or service clubs (in the manner of a scrap paper drive), since it would not be possible to insure absence of hazard from spillage of pesticides or leakage from containers to the various untrained persons who might be involved in such a drive.

5. Collection Sites

The proper selection of a collection site is a critical factor in the collection program. There are a number of factors which will affect site selection.

a. It will be necessary to consider the area which will be served, the location of the areas from which the surplus pesticides and containers would be generated, and the amount of pesticides and number and sizes of containers likely to be generated in each area to minimize transportation requirements.

b. The amount of pesticide and the number of various-sized containers likely to be held within this collection site, including seasonal variations, must be anticipated so that the site will be of adequate size. This volume will depend both on the rate at which pesticides and empty containers are being generated within the areas served and the rate at which they are moved out of this collection site.

c. It must be assumed that there will be some spillage of pesticide materials at the collection site. Therefore, the land must be in a location suitable to long-term dedication for this purpose. In addition, the possibility of leakage or spillage during storage means that the site must be selected and managed so that there will be no environmental contamination resulting from surface water runoff or percolation into ground water. Capability should exist for drainage to be directed into a seep-proof sump or storage basin for accumulation and evaporation if possible (if not for all the site area, at least for a portion where critical persistent pesticides and their containers may be temporarily stored awaiting removal). The balance of the runoff would be less critical but should be controlled to the extent that it is not introduced directly into natural bodies of water or waterways or exposed to critical agricultural areas such as forage or pasture acreage or cropland. The site should also be such that it can be protected against the airborne transport of contaminated materials from the area, such as dusts.

6294

d. There should be a degree of isolation and protection conferred by site selection so that human populations are not adjacent nor likely to be exposed to collection and temporary storage operations. This will not only protect humans from poisons but also reduce fire hazard from some of the solvents, such as xylene, which are used in pesticide formulations.

6. Collection Site Procedures and Management

Instructions given to homeowners, farmers, commercial firms and government agencies should state that surplus pesticides are to be delivered to the collection site in their original container, if possible, or in strong plastic bags or containers or in other used pesticide containers. However, it must be assumed that pesticides and their containers will be brought to the site in every conceivable manner. Therefore, properly prepared, used, 55-gallon containers in good condition should be kept in supply at the collection site to receive poorly packaged and spilling surplus pesticides and used containers.

Surplus pesticides should be stored in containers able to withstand further handling and transport to the disposal site storage. If the original container is adequate it should be used because the label in many instances will be sufficient for identification. Containers without labels or pesticides placed in other containers should be labeled at the collection site. Empty pesticide bags may be folded and packed in large empty carton-type containers. If these are not available, metal drums may be used for safety and for economy of storage and transport to the disposal storage site. All pesticide containers, whether containing surplus pesticides or just residues, should be carefully checked for leakage, and lids or bungs tightened or sealed if necessary. Adsorptive clay, hydrated lime and clorox should be kept on hand for detoxification and treatment of spills or leaks as appropriate. Detoxification of some pesticides may have to be accomplished by the use of other chemicals. If in doubt, contact the chemical manufacturer for specific guidelines.

Surplus pesticides and used containers awaiting transport to the disposal storage site should be kept in a dry, well-ventilated area, under cover if possible. The entire collection area should have a climb-proof fence and be locked to prevent unauthorized entry. All containers should be stored in an upright position and in an orderly way so as to permit ready access and inspection. Labels should be visible and similar pesticide containers should be stored together. Critical persistent pesticides should be protected from rain, and runoff from their storage location should be collected in a seep-proof sump or accumulation basin where the runoff will be allowed to evaporate. Thirty to 55-gallon drums should not be stacked; however, smaller containers may be stacked but only to the extent that they are secure from displacement by wind. If a building or buildings separated from other buildings and storage are available for use, exhaust fans should be installed to reduce possible concentrations of toxic pesticide fumes. All the precautions taken for normal pesticide storage must be followed at all times on the collection site. Adequate signs, indicating the nature of materials held at the collection site, and warnings should be placed on buildings and fencing; and entry of unauthorized persons prohibited.

All personnel receiving, handling and temporarily storing surplus pesticides and used containers must wear protective clothing sufficient to insure protection from contact with the toxicants. Where appropriate, respiratory equipment should be employed to prevent exposure to volatile or aerosol fractions. The degree of protection should be for the most toxic pesticide used in the community or area, and therefore presumed to be passing through the collection site. Soap and adequate showers must be available for decontamination of personnel, both routinely and for accidental spillage. As an added safety precaution, routine cholinesterase and other medical tests should be run on all personnel employed in operating the collection site.

The supervisor or responsible individual at the collection site must have a knowledge of pesticides and be able to identify and sort containers on the basis of their principle toxic content. He should also be thoroughly familiar with safety procedures and the appropriate reactions to spills and incidents involving human or animal exposure.

A monitoring system on a small scale, supplemented by periodic thorough inspection and review of the collection site practices should be established to prevent the collection site itself from becoming an excessive and intolerable hazard.

Site design and management plans should be made in cooperation with the local fire and police departments and other emergency services.

7. Transport to Disposal Storage Site

Periodically the surplus pesticides and the accumulated used pesticide containers must be moved from the collection sites to the disposal storage site or disposal site for ultimate disposal. This is most easily done with trucks and should be done as carefully as possible to avoid spillage in loading, during transport and unloading, especially to avoid contamination of the truck. (Trucks with wooden platforms should not be used, as spills in these trucks will probably require complete replacement of the platform planking and other contaminated members to be completely decontaminated.) After transport, the truck should be decontaminated as required at the disposal storage site. If spillage, container leakage or other accident occurs during transport, all the precautions and clean-up procedures required for a pesticide spill involving Class B POISON pesticides (See below for definition) should be taken unless it can be positively established that a less hazardous pesticide was involved in the accident.

Open trucks used for such transport should have tarpaulin covers tied down over full or partial loads. Dump trucks may be used with tarpaulins but should never be "dumped" while transporting pesticides or pesticide containers. Decontamination of tarpaulins should be undertaken along with the truck at the disposal storage site. Signs indicating the hazardous nature of the materials being transported should be displayed, and the truck should be dispatched from the collection site early enough in the working day so as to arrive at and enter the disposal storage site before the end of the working day. Trucks used to transport pesticides must not be used to transport any items of food, clothing, household goods, animal feeds or other commodities, the contamination of which may endanger man, his animals or his environment.

Movement of surplus pesticides and accumulated used containers from collection sites to disposal storage sites or the ultimate disposal site must be coordinated with local transportation agencies to insure compliance with the applicable federal, state and local regulations.

The definition of a Class B POISON

Substances, liquids or solids (including pastes and semi-solids), other than classes A, C, or D poisons, which are known to be so toxic to man as to afford a hazard to health during transportation, or which, in the absence of adequate data on human toxicity, are presumed to be toxic to man because they fall within any one of the following categories when tested on laboratory animals:

(1) *Oral Toxicity.* Those which produce death within 48 hours in half of more than half of a group of 10 or more white laboratory rats weighing 200 to 300 grams at a single dose of 50 milligrams or less per kilogram of body weight, when administered orally.

(2) *Toxicity on inhalation.* Those which produce death within 48 hours in half or more than half of a group of 10 or more white laboratory rats weighing 200 to 300 grams, when inhaled continuously for a period of one hour or less at a concentration of 2 milligrams or less per liter of vapor, mist, or dust, provided such concentration is likely to be encountered by man when the chemical product is used in any reasonable foreseeable manner.

(3) *Toxicity by skin absorption.* Those which produce death within 48 hours in half or more than half of a group of 10 or more rabbits tested at a dosage of 200 milligrams or less per kilogram body weight, when administered by continuous contact with the bare skin for 24 hours or less.

Specimen label as referred to on page 13.

Prevent Environmental Pollution

Dispose of waste pesticides and empty containers safely.

Klamath County has established a disposal procedure and site.

For information call your Klamath County Weed Supervisor or Extension Agent at 882-7761, Extension 391.
OSU 1820

6297

Chapter 5

STORAGE FOR SURPLUS PESTICIDES AND PESTICIDE CONTAINERS PRIOR TO DISPOSAL

1. General

Storage of surplus pesticides and used pesticide containers prior to disposal or recycling presents a considerably hazardous condition, mainly because of the large concentrations of pesticides and containers that may accumulate. Strict operational procedures must be placed in effect to prevent contamination of the surrounding environment as well as operating personnel and other persons in the vicinity. Site selection, design and management plans should be made in cooperation with the local fire department, police and other emergency and security services.

2. Storage Site

Similar to collection sites, storage sites will have to be selected with due regard to the area to be served, the amount and nature of pesticides and number and sizes of containers to be generated and the rates at which these will flow into the storage and out for disposal or recycling. In this respect, it should be recognized that the disposal problem is not likely to become any more critical in the future than it is today. Current projections indicate increased pesticide usage, but it can be expected that these will be the pesticides that are less persistent and more readily degraded. Eventual changes in packaging and merchandizing are also probable.

Also, as in collection sites, unavoidable spillage will require long-time retention of the storage site; the surrounding areas must be protected from surface water runoff and percolation into ground water, and windblown pesticide dusts or particles; and the threat of exposure to human populations requires a certain degree of isolation in site selection. The prime considerations in location of the storage site should be that of security. Secondary considerations should be convenience to the user, availability of land and existing facilities.

Control of surface drainage can be a major problem. Drainage for the site preferably will be directed into a seep-proof sump or storage basin for accumulation and evaporation where rainfall-evaporation ratios permit a practical-sized facility. Where this is not physically possible, a smaller area within the site should be isolated, so that runoff can be impounded. This area should be used for accumulation of critical persistent pesticide containers. Storage of these under a roofed structure would also be satisfactory as long as it is secure. Runoff from the balance of the area will be less critical but should be controlled to the extent that it is not introduced directly into natural bodies of water or waterways, or exposed to critical agricultural areas such as forage or pasture acreage or cropland. Wells should not be subject to contamination by this runoff.

3. Storage Facilities

Surplus pesticides should be stored in a dry, well-ventilated area, preferably in a separate, fireproof building. If this is not possible, a satisfactory storage would be one under cover. Both of these should have locks and should be kept locked except when actually being used by authorized personnel. Pesticide containers are probably too numerous to be kept in a building; however, where possible an effort should be made to provide cover. The entire storage area should have a climb-proof fence surrounding it and must be locked to prevent unauthorized entry. Lighted signs should be placed on buildings and fences to advise of the contents and warn against unauthorized entry.

Buildings used for storage should be equipped with an exhaust fan to help reduce possible concentrations of toxic fumes. Care should be taken in locating the fan or fans so that the exhaust is not directed toward populated areas.

Adjustable vents at floor levels and on the roof are desirable. Heat, thermostatically controlled, should be ample to keep at least one section of storage above freezing so that sensitive liquid formulations will not settle out. It is desirable that the building be equipped with a sprinkling system.

A fork-life or other material-handling equipment should be on hand to facilitate unloading of trucks and moving of the larger drums and pails. Pallets should also be available to facilitate unloading and handling of surplus pesticides and used containers brought to the storage site. All items of movable equipment at the storage site should be labelled "contaminated with pesticides" and should not be removed from the site until thoroughly decontaminated.

Provision must be made for decontamination of personnel and equipment such as trucks, tarpaulin covers, etc., which bring in pesticides and containers. Ample water and soap must be available for routine, end-of-the-day washup for personnel and for emergency use if an accidental spill on a person should occur. A wash basin and shower with a delayed-closing, pull chain valve must be provided. A decontamination area for equipment with ample water availability should be set aside. This area should be constructed of concrete or hard-top asphalt paving and should include gutters so runoff can be collected and managed easily. Drainage from personnel and equipment decontamination facilities must be collected in the seep-proof sump or storage basin described under storage site.

Other facilities, such as a small tool bench, desk and file for record keeping, personnel lockers for clean clothing, etc., should be provided as required.

4. Storage Management

Pesticides received in the original labeled containers should be stored with the label plainly visible. If containers are not in good condition when received, the contents should be transferred to a good container and labeled properly as to content. If dry pesticides are received in paper bags that are damaged, the pesticide and the bag should be placed in a plastic or metal container that can be sealed. When pesticides are received in metal or rigid plastic containers, their condition should be checked carefully to insure that the lids and bungs are tight.

Each pesticide formulation should be segregated and stored under a sign containing the name of the formulation. All containers containing surplus pesticides should be stored in an upright position off the ground. The containers should be checked periodically for corrosion and leaks. If such corrosion or leakage is found, the contents should be transferred to a good container and properly labeled. If a leaking container containing a Class B POISON pesticide (See page 16 for definition) is discovered, no attempt should be made to handle it except where it is possible to position a container so leakage will be minimized. Close off the area of leakage and commence decontamination and cleanup procedures. If specific decontamination procedures are not available to or known by operating personnel, the local health or agriculture officials are to be notified immediately. They will advise on decontamination procedures for these more toxic pesticides. Adsorptive clay, hydrated lime and clorox should be kept on hand for detoxification and treatment of spills or leaks as appropriate. Other detoxicants may also be required. Consult the manufacturer for specifics on chemicals in question.

Storage of used containers on the site should be undertaken in an orderly way, so as to permit ready access and inspection. All containers should be stored in an upright position, preferably on pallets, but in any case, off the ground. They should be accumulated in orderly rows or units so that all labels are visible and with lanes to provide effective vehicle access. Thirty- to 55-gallon drums should not be stacked unless space is unavailable. Smaller containers may be stacked only to the extent that they are secure from displacement by wind. A complete inventory should be maintained indicating the number and identity of containers in each storage unit. Containers should be segregated on receipt into storage units as follows:

a. Persistent pesticides, including the chlorinated hydrocarbon insecticides, certain designated herbicides and any pesticides containing mercury or arsenic compounds.

b. Organophosphate insecticides

c. Carbamate pesticides

d. Herbicides

e. Fungicides

f. Fumigants

g. Other identifiable pesticide containers

Other classifications within these may be desirable. For instance, if ultimate disposition is known to be incineration, compounds containing mercury and arsenic would be stored separately as these would not be incinerated.

Any unidentifiable container or any containers whose contents are suspected of not being those indicated by the label, must be segregated and stored with the persistent pesticides.

The storage area should be inspected at weekly intervals and maintained in good order. Any leakage should be promptly investigated and appropriate corrective action, as outlined above, should be taken. It is preferable that deteriorating labels be replaced with a duplicate, but as a minimum requirement, the principal toxicant and its concentration should be painted on the container.

A responsible individual should be designated site manager. His training and background must be such that he can receive approval of the appropriate state departments. This individual should be able to use information available to identify and sort containers on the basis of their principle toxic content. He should also be thoroughly familiar with safety procedures and the appropriate reactions to spills and incidents involving human or animal exposure.

5. **Safety Precautions**

Nearly all pest control compounds are poisonous and potentially harmful to human health. Since most of the pesticides received and stored will probably be in concentrated form, protective clothing should be worn. If clothing becomes contaminated by pesticides, particularly those in concentrated form, the clothing should be removed immediately and the individual washed thoroughly with soap and water. The clothing must be laundered before worn again. (Contaminated clothing should be laundered separately and with great care, using a very strong detergent and liquid chlorine bleach.) If pesticide gets in the eyes, flush with ample water for 5 minutes and get medical attention. Lavatory, shower and locker facilities should be outside but adjacent to the storage buildings or sheds to provide quick access to these facilities. Extra sets of clean clothing must be maintained in the lockers.

Particular care should be taken when handling Class B POISON pesticides (See page 16 for definition) since many of these can be readily absorbed through the skin. Also, if containers are open or leaking, inhalation of fumes could be dangerous. Respirators and gas masks with proper canisters should be available for use in emergencies.

Persons working regularly with pesticides should have periodic physical examinations including cholinestrase tests.

Five rules for personal safety and five rules for working safely, or similar information such as listed below, should be posted in lavatory and locker facilities, office areas and other areas where personnel congregate:

a. *Five rules for personal safety*

(1) DO NOT store food, beverages or tobacco, eating utensils or smoking equipment in the work area.

(2) DO NOT drink, eat, smoke or use tobacco in the work area.