

# Subject Index

## A

**Active ingredient**  
 alternative sources for, 220-221

**Agglomeration**  
 granule formulation, 199-201

**Agricultural chemicals** *See also*  
**Herbicides; Pesticides**  
 application of, 13-14  
 registration of, 213-224  
 safe practices for use, 15-27, 35-58

**Alachlor**, 178(table)

**Aminocarb**  
 drop size spectra, 148-149, 144(table)  
 formulations, 140(table), 141(table)  
 physical properties of, 145-148, 146(table)  
 residue persistence, 145  
 soil/litter residues, 142-145, 144(table)  
 spray deposition, 148-149  
 suppliers, 140(table)

**Application rate**  
 wettable powder, 104-114  
   vs. drop size on target, 107-108, 107(table), 113-114  
   vs. volume of spray deposited, 107(table), 113-114

**Application systems** *See also*  
**Closed mixing, handling, and application systems; Nozzles; Sprayers**  
 ASTM Subcommittee E35.22: 8-9  
 efficiency vs. efficacy, 134  
 electrostatic spray, 116-131  
 for herbicides, 171-182  
   carpet applicator, 174  
   controlled droplet, 135-138  
   low volume, 136-137, 179-182  
   manual, 136-137  
   pneumatic applicator, 177  
   roller applicator, 174  
   roots in sewers, 183-188  
   ropewick applicator, 173-174  
   wiper applicator, 174  
 for pesticides,  
   controlled droplet, 86-88, 94, 135-138  
   fleas in carpet, 160-166  
   lice on humans, 189-196

  low volume, 93-102, 136-137, 139-151

**Aquatic habitats**  
 pesticide use in, 157

**ASTM Committee E-35:** 5-10  
 future activities, 9  
 history, 5-7  
 membership, 7(table)  
 present activities, 7-9  
 scope of interest, 8-9  
 subcommittees, 6(table), 7(table)

**ASTM Standards**  
 D4229: 155  
 E609: 154  
 E728: 207-210  
 E729: 155  
 G31: 82

**ASTM Subcommittee E35.22**  
 pesticide formulation and application systems, 1-10, 10(table)  
 present/future activities, 10(table)

**Atomizers** *See* **Nozzles**

**Atrazine**, 61, 65(table), 66, 181

**Attrition of granules** *See*  
**Granules, inert clay**

## B

**Bacillus thuringiensis** var.  
*israelensis*(BTI), 152-157  
 bioassay techniques, 154  
 characteristics, 152-153  
 future applications, 157  
 homogenization of, 155-156  
 potency, 153-155

**Balsam fir**, 105

**Binders**  
 in granular formulations, 210

**Biocidal area**  
 pesticide desposition, 88

**BTI** *See* **Bacillus thuringiensis**  
 var. *israelensis*

**Butylate**, 65(table), 66

## C

**CaDDBS** *See* **Dodecylbenzene sulfonate, calcium salt**

**California**  
 Department of Food and Agriculture, 15, 29, 48

- Department of Industrial Relations, 15
  - pesticide-related illness, 15, 16 (table), 17, 18, 27
  - Public Health Services, 15, 28
  - Can probes *See* Probes
  - Canopy spraying, 58
  - Carpet
    - spray penetration of, 159-166, 166(table)
  - Carpet applicator
    - for herbicides, 174
  - Carriers *See also* Formulations
    - effect on residue persistence, 144(table)
    - emulsifier systems, 61-66
    - liquid fertilizer, 66
    - oil, 137, 149
    - spray drift, 94-102, 99(table)
    - powder, 193-196
    - Pyrax ABB, 194-196
    - water,
      - spray drift, 94-102, 99(table)
  - Carver-press table
    - for granule formulation, 201
  - Cat flea
    - life cycle of, 159
    - pesticide application, 159-167
  - CDA *See* Drop size, controlled
  - Charge/mass ratio
    - electrostatic spray system, 122-131
  - Chemeasure
    - for measuring pesticide levels, 39-41, 39(illus)
  - Chemrinse,
    - for washing containers, 41(illus)
  - Cholinesterase activity
    - and human pesticide exposure, 17
  - Chromatography, gas-liquid, 142
  - Clabber formation, 61-63
  - Closed mixing, handling, and applications systems, 13-58
    - criteria for, 29-30
    - design of, 17-25, 45-46, 48
    - and personnel safety, 17-26
    - problems in use, 30-34, 47-48
    - promotion of use, 53-54
    - regulation of, 13-14, 28-34, 48, 50-52
    - standards for, 13-14
  - Closures
    - California regulations, 29
    - EPA regulations, 50
  - Clothing, protective, 17, 29, 31-32, 52
  - Cloud current
    - electrostatic spray system, 124-129
  - Cold temperature storage *See* Storage, cold temperature
  - Component selection
    - emulsifiers, nonionic, 63-66
  - Compression
    - granule formulation, 199-205
  - Computer systems
    - for analysis of pesticide dose transfer, 86-91
  - Containers
    - disposal of, 13-14, 26
    - materials for, 13, 21
      - glass, 51(table)
      - plastic, 50(table)
      - steel, 49(table)
    - probes for *See* Probes
    - returnable type, 26, 38
    - size of, 21, 44, 49(table)
    - standardization of, 31, 37-39, 42, 44, 48-52
    - washing of, 14, 19-23, 26, 30, 33, 41-42, 45
  - Contamination *See also* Residues
    - in delousing process, 193-195, 194(table)
    - liquid pesticides, 43-44
    - litter, 142-145
    - personnel, 15-17
    - probes, 43
    - soil, 137, 143-145, 148-151
  - Corn crop
    - weed control in, 180-181, 180(table)
  - Corrosion
    - imazaquin
      - ASTM Standard G31: 82
  - Crystal growth
    - imazaquin, 76-81
    - pesticides in soybean oil, 68, 72-73, 72(table), 73(table)
  - Ctenocephalides*, 159-166
  - Cyanazine, 181
- D**
- Dapple image analysis system, 86-89
  - Delousing of humans, 189-196
    - efficacy, 191-196
    - equipment for, 189-191
  - Densification
    - granule formation, 199-205

- Departments of transportation  
regulation of toxic materials,  
13-14
- Deposit pattern *See* Spray  
deposition
- Dichlobenil, 185-188
- Diflubenzuron, 104-114  
deposit volume, 107-108,  
107(table), 113-114  
drop size spectra, 107-108,  
107(table), 113-114  
physical properties of, 108-113  
109(table)
- Dimilin® *See* Diflubenzuron
- Disease vectors  
use of microbial pesticides,  
157
- Disposal of pesticides  
biological degradation, 57  
in containers, 14, 19-23, 26,  
30, 33, 41-42, 43  
underground tanks, 57
- Dodecylbenzene sulfonate, calcium  
salt of (CaDDBS), 63
- Dose transfer process, 85-91
- Drift *See* Spray drift
- Drop size  
controlled (CDA), 86-88, 135-  
138, 175  
distribution *See* Drop size,  
spectra  
and pesticide effectiveness,  
88-91  
and physical factors, 111  
spectra,  
aminocarb vs. mexacarbate,  
143, 148  
vs. application rate, 105-114  
vs. emission rate, 107,  
107(table), 113-114  
for ENS nozzle, 120-122,  
122(table), 131  
for hydraulic nozzle, 134-135  
measurement of, 119-120  
for spray into carpet, 165  
and target specificity, 104  
volume spray deposited vs. drop  
density, 135(table)
- Droplet generator, uniform, 86-88,  
86(illus)
- Dry pressing  
granule formulation, 199-205
- "Dry-break" couplings, 44
- E
- Economic yield,
- controlled droplet application,  
133-138
- Economical use, pesticides,  
134-135
- Efficacy, pesticides, 9, 134, 213
- Electrostatic spray system, 122-  
130  
charge/mass ratio measurements,  
122-130  
cloud current measurement, 124-  
129  
formulation effects, 130
- Emission rate  
vs. drop size on target,  
107(table), 114-115  
vs. spray volume deposition,  
107(table), 114-115
- Emulsifiable concentrate, 62, 73
- Emulsifier systems, 61-66  
components of 62-63, 64(illus)  
design of, 63-66, 64(illus)
- Emulsifiers  
anionic, 63  
nonionic, 63
- Environment effects, pesticides  
*See also* Contamination;  
Residues  
ASTM Committee E-35; 1-10
- Environmental fate, pesticides,  
217-218 *See also* Residues
- Environmental Protection Agency  
(EPA)  
inerts, 219(table), 220(table),  
221(table)  
non-target organism studies,  
217  
pesticide efficacy testing, 9,  
213  
pesticide package standardiza-  
tion, 48, 50-52  
regulation  
of chlordimeform, 53  
of closures, 50  
effect on formulation  
research, 217-219  
of packaging, 48, 50-52  
of protective clothing, 32  
role in formation of ASTM  
Committee E-35; 5-7
- Exposure hazard *See also*  
Personnel safety  
dry vs. liquid pesticides, 37-  
38  
pesticide handlers, 36-38,  
37(table), 52-53  
reduction of, 38, 52, 57

*See also* Closed mixing,  
handling, and application  
systems

research personnel, 52  
Extractor  
reusable for closed system, 45-46

## F

Faraday cage, 123-128  
Farm chemicals *See* Agricultural  
chemicals  
Farming, no-till, 136  
Fatty acids, methyl esters of  
as pesticide co-solvents, 67-74  
phytotoxicity of, 73-74  
safety of, 73-74  
Federal Insecticide, Fungicide,  
and Rodenticide Act (FIFRA),  
31, 48, 53  
Fertilizers, liquid  
mixed with pesticides, 66  
Field storage *See* Storage,  
imazaquin  
Fleas *See* Cat fleas  
Flowables  
dry flowable herbicide  
formulations, 177-182  
liquid/solid compatibility, 62  
Fluorescein sodium  
use to measure pesticide  
penetration of carpet, 160  
Fluorometric analysis  
of spray distribution, 89  
Forest (conifer) pesticides  
aminocarb, 139-151  
diflubenzuron, 104-115  
mexacarbate, 139-151  
Formulation, 61-85, 216-219 *See*  
*also* Carriers; Granules;  
Liquids; Powders  
ASTM Subcommittee E35.22: 9  
cold-resistant, 75-82  
emulsifiable, 61-66, 67-74  
liquid-solid, 61-66  
research, 216-219  
cost of, 217  
types of, 216-217  
Freeze-thaw effects  
on imazaquin, 76-77  
Freezing point depressant  
urea in imazaquin formulation,  
78-79, 81

## G

Glass plate  
for measurement of spray  
deposition, 105-108

Glyphosphate, 172-175  
Government agencies *See*  
California;  
Environmental Protection  
Agency; Departments of  
transportation; Worker  
Health and Safety  
Granular formulations  
applicators for, 207-210  
Granules  
dry application, 177-182  
inert clay,  
ASTM Standard E728: 207-210  
attrition resistance, 207-210,  
208(table), 209(table)  
production of, 199-206  
water dispersible, 62, 178-182  
alachlor, 178  
atrazine, 181  
cyanazine, 181  
metachlor, 179  
metribuzin, 178-179

## H

Hazardous waste *See* Disposal,  
pesticides  
Haze point  
pesticides in soybean oil, 68,  
71-72, 72(table)  
Herbicides  
alachlor, 178(table)  
application systems *See*  
Application systems, for  
herbicides  
atrazine, 61  
for corn crop, 180-181,  
180(table)  
cyanazine, 181  
dichlobenil, 185-188  
dodecylbenzene sulfonate,  
calcium salt of, 63  
glyphosphate, 172-175  
granules, water-dispersible,  
177-182  
imazaquin, 75-82  
metam-sodium, 184-188  
metolachlor, 179, 178(table)  
metribuzin, 179, 178(table)  
pre-crop emergence application,  
181  
for root control in sewers,  
183-188  
foaming method, 186-188  
soaking method, 184-186  
Roundup®, 172-175  
SCEPTER®, 75-82  
for soybean crop, 75, 177-180

Vaporooter®, 183-188  
 Humans  
   mass delousing of, 189-196

## I

Illness/injury  
   pesticide-related, 15,  
     16(table), 18(table), 25,  
     28, 33(table)  
 Image analysis, computerized  
   pesticide dose transfer, 86,  
     88-91  
 Imazaquin  
   in cold temperature storage,  
     75, 79-81  
   corrosion effects, 82  
   crystal growth in, 76-77  
   light stability of, 82  
   pH stability of, 76, 81  
 Inerts  
   EPA list, 219(table), 220  
     (table), 221(table)  
   purchasing supplies for, 216  
   selection of, 218-220  
   toxicology of, 219(table)  
 Insect  
   response vs. pesticide drop  
     size, 89-91  
 Insecticides  
   emulsifiable formulations,  
     74(table)  
   microbial, 152-157  
   solvents for, 73-74

## K

Kromekote card  
   for measurement of spray  
     deposition, 105-107, 141-  
     142

## L

Larvicide, mosquito, 152-157  
 Lice  
   on humans, 189-196  
 Light stability  
   imazaquin, 82  
 Lindane  
   carrier dusts for, 193-196  
   for delousing, 193-196,  
     194(table)  
 Litter, forest, contamina-  
   tion of, 142-145

## Liquids

drop size *See* Drop size  
 emulsifier selection for, 61-66  
 handling properties, 75-82  
   cold storage, 75, 79-81  
   light stability, 82  
   pH stability, 75, 81  
 spray deposition *See* Spray  
   deposition

## M

Metam-sodium, 184-188  
 Metering systems  
   granular herbicides, 177-179  
 Methyl esters, fatty acids  
   *See* Fatty acids, methyl  
   esters of  
 Metolachlor, 178(table), 179  
 Metribuzin, 178(table), 179  
 Mexacarbate  
   drop size spectra, 148-149  
   formulations, 140(table), 141  
     (table), 143(table)  
   physical properties of, 145-  
     148, 146(table)  
   residue persistence, 145  
   soil/litter residues, 142-145  
   spray deposition, 149  
 Microbial insecticides  
   bioassay technique, 154-157  
     ASTM Standards D4429/E729:  
       155  
   efficacy of, 152-157  
   future applications, 157  
 Micron Herbi sprayer, 136-137  
 Micron Ulva CDA sprayer, 136-137  
 Mylar targets  
   spray deposition, 95

## N

National Agricultural Chemicals  
   Association  
     standardization of containers,  
       51, 57  
 Nozzles *See also* Sprayers  
   air-assist atomizer, 94-102,  
     116-118, 117(illus), 125  
     (illus)  
   spray characteristics,  
     95(table), 96-97(table),  
     102(table), 118-119  
   calibration error, 134  
   design of and spray drift, 93-  
     102

ENS, 116-118, 117(illus), 125  
 (table)  
 flat-fan, 94-102, 160-166  
   spray characteristics, 99(table),  
   102(table), 162(table)  
 hydraulic, 134, 172  
 rotary, 94-102  
   economic pesticide applica-  
   tion, 137  
   spray characteristics, 95  
   (table), 96-97(table)  
 twin orifice flat-fan, 94-102  
   spray characteristics, 99  
   (table), 102(table)  
 Nurse tank, 135

## O

Off-target drift *See* Spray  
 drift  
 Oil carriers *See* Carriers, oil

## P

Packaging *See also* Containers  
   dry pesticides, 37  
   liquid pesticides, 38  
 Patents, 217  
 Pediculicides  
   applications system, 189-196  
   190(illus), 191(illus)  
   equipment, 189-196  
 Personnel safety  
   use of closed systems, 17-26  
   use of controlled drop  
   applicator, 137  
   and protective clothing, 17,  
   29, 31-32, 52  
 Pesticide terminology  
   ASTM Standards,  
   E609:154  
   E729:155  
 Pesticides  
   aminocarb, 139-151  
   atrazine, 181  
   butylate, 65  
   lindane, 193-196  
   mexacarbate, 139-151  
   microbial, 152-158  
 pH stability  
   imazaquin, 76, 81  
 Physical properties  
   aminocarb, 145-148  
   mexacarbate, 145-148  
 Phytotoxicity, 73-74, 213, 216  
 Pneumatic applicators, 177

Potency  
   mosquito larvicide, 153-157  
 Pour point  
   pesticides in soybean oil,  
   68, 70, 71(table)  
 Powders  
   conversion to granules, 199-205  
   wetable  
   diflubenzuron, 104-115  
   liquid/solid compatibility,  
   62  
   use with ENS nozzle, 130  
 Probes  
   for measuring pesticides in  
   containers, 19-27, 23  
   (illus), 39-41, 39(illus),  
   44  
   built-in, 45, 48  
   contamination of, 43  
 Product development  
   agricultural chemicals, 214-219,  
   214-215(illus)  
 Pyrax® ABB  
   carrier dust for lindane,  
   194-196

## R

Recovery rate, spray *See*  
   Spray deposition  
 Registration  
   EPA requirements, 9  
   procedure for, 219-224, 222-  
   223(illus)  
 Regulation *See* California;  
   Environmental Protection  
   Agency, regulation  
 Residues *See also* Environmental  
   fate  
   on clothing, 17  
   on forest litter, 142-145,  
   144(table), 149-150  
   persistence of, 149-150  
   soil, 142-145, 144(table)  
 Risk  
   exposure hazard, 36-38, 47-55  
 Roll compacting  
   applications of, 200-201  
   design of machinery, 202-204  
   feed characteristics, 201  
   properties of product, 201-202  
 Roller applicator, 174  
 Root control  
   in sewer, 183-188  
 Ropewick applicator, 173-174  
 Roundup® *See* Glyphosphate

# S

Safety *See* Personnel safety  
Sanitary landfills, 14  
SCEPTER® *See* Imazaquin  
Sewer line  
    root control in, 183-185  
Shear requirement  
    liquid/solid formulation, 62  
Shipping, pesticides *See*  
    Containers; Transportation  
Soybean crop  
    weed control in, 178-179,  
    178(table)  
Soybean oil  
    use as solvent, 67-74, 94-103  
Spectrophotometer  
    analysis of spray penetration  
    into carpet, 163  
Spray deposition  
    aminocarb vs. mexacarbate, 144  
    vs. application rate, 105-111,  
    107(table)  
    correlation with biological  
    effects, 88, 91  
    patterns, 86-91  
    penetration  
        to kill fleas in carpet, 159-  
        166  
Spray drift  
    "in canopy" spraying, 58  
    factors contributing to, 93-94  
    and granule size, 182  
    oil vs. water carriers, 95-102,  
    95(table), 99(table), 102  
    (table)  
    and shielded booms, 94  
Spray systems *See* Applica-  
tion systems  
Spray waste, 134-135  
Sprayers *See also* Nozzles  
    Micron Herbi, 136-137  
    Micron Ulva CDA, 136-137  
    recirculating, 173  
    shielded, 94, 173  
Standards *See also* Environmental  
Protection Agency  
    for closed systems, 13-14,  
    28-34, 48, 50-52  
    for containers, 51-57  
    developed by ASTM Committee  
    E-35: 8, 9  
    developed by ASTM Subcommittee  
    E35.22, 8-9, 8(table)  
    for microbial insecticides,  
    154-157

Steel ball test  
    ASTM Standard E728: 207-210,  
    208(table)  
Storage  
    imazaquin, 75-81  
        cold temperature, 75  
        field, 76-77  
    various herbicides, 76(table),  
    79-80, 80(table), 81(table)  
Surfactant content  
    effect on imazaquin, 77(table),  
    78(table)  
Symposia  
    ASTM Committee E-35: 8(table)

# T

Tank-mix compatibility  
    liquid/solid, 61-66  
Target/non-target organisms, 217  
Test methods  
    ASTM Subcommittee E36.22: 8-9  
Toxicology, 217  
Transportation of pesticides, 14

# U

Underdeveloped countries  
    economic pesticide applica-  
    tion, 135-137  
Universal Closed System  
    for handling liquid pesticides,  
    45-46  
Urea  
    freezing point depressant, 78-  
    79, 81  
Urine  
    pesticide levels, 17, 44

# V

Vaporoooter® *See* Dichlobenil;  
Metam-sodium  
Vegetable oils  
    as solvents for pesticides, 67-  
    70  
    viscosity, 68-70  
Video tape systems  
    for dose transfer analysis, 87  
Viscous pesticides  
    problems in closed systems, 31

W

- Warming pour point
  - pesticides in soybean oil, 68, 71(table)
- Waste disposal, 57-58
- Water dispersible granules(WDG)
  - See* Granules, water dispersible
- Water supply
  - contamination of by pesticides, 137-138
- Water-based pesticides *See* Carriers, water
- Wet powder suspensions *See* Powders, wettable
- Wicking (dose application), 173-174
- Wind speed
  - and spray drift, 95-102, 96-97(table), 99(table)
- Wiper applicator, 174
- Worker Health and Safety, Food and Agriculture Department, 15
- Worker safety *See* Personnel safety