# Subject Index

24	Andit manuals waste reduction, 45–40
A consumtability, wents competed as 2, 20	Audit manuals, waste reduction, 44
Accountability, waste generators, 2, 30	Autoclaves
Acetone, pyrotechnics, 11	demetallation of used oil, 124–125
Acid acceptance value (AAV)	diammonium phosphate (DAP)
acid acceptor profiles, 96-99	demetallation, 139-140
limits of, 94–95	metal borohydride demetallation, 132-
solvents, 84	133
Acid acceptors	Azeotropic steam injection distillation.
chlorinated solvents, 96–99	See Steam injection distillation unit
inhibitor kinetic studies, 99–100	(SIDU)
Acidic rainfall, open pile storage, 201	
Active pulsed-flow air classifier, efficiency	В
evaluation, 155-156	
Additivity of fractional efficiencies, 154–	Base charge proposals, generator-charged
155	waste management, 33-34
Adsorption media, modified clay, 167-	Baseline generation of wastes, 66
168	Batch distillation, spent solvent recovery,
Aluminum machining, waste oil recovery,	101-102
121–122	Batch membrane unit, reverse osmosis
Answer's fly ash test, 201–203	membrane process, 168-169
Aqueous wastes	Bilge Boy oil/water separator
EPA programs, 163-164	background, 145-146
reverse osmosis membrane process,	cost comparisons vs. standard
168–170	interceptor system, 149
Army hazardous waste minimization	evaluation tests, 146-147
policies, 9	schematic, 146
Army Materiel Command (AMC)	test methods, 148
HAZMIN program, 8	Bilge water, small quantity generators, 145
Army's Environmental Data Management	Boiler Aggregate testing, 199–200
System (AEDMS), 12-16	Bottom ash
Ash products	aggregate and product testing, 199-200
source materials, 198	EP toxicity test, 202-203
used oil demetallation, 125	fly ash contamination, 203-204
utilization, 196-204	processing, 199
ASTM Practices	recycling benefits, 197-198
D 75: 198	sampling procedures, 198-199
D 3665: 198	source materials, 198
E 1051: 198	utilization of, 196-204
ASTM Standards, D 235: 84	Bottom streams, liquid cyclone system,
ASTM Test Methods	195
D 482: 125	Brownian force, deflecting magnetic
D 2942: 84	separation (DMS), 180
D 4006: 125	Butoxymethyloxirane, concentration in
D 3/1/· 1/8	PEDC 08

C

D

Cadmium/cyanide solutions, waste	Data management systems
minimization program, 58–61	army-wide support, 12
California Bearing Ratio (CBR), bottom	reporting requirements, 12–13
ash products, 200	U. S. Army Environmental system
Caustics, metal borohydride demetallation,	(AEDMS), 13–14
130	Deflecting magnetic separation (DMS)
Cellophane film waste recycling, 190–195	defined, 172–173
Cement blocks, fly ash, 204	particle size, 180–182
Centrifugation equipment, waste oil	uranium - DOE sites, 183–184
recovery, 118-119	uranium-magnesium fluoride separation,
Chlorinated solvent inhibitor study, 95-	178-180
99	Demetallation, used oil
Chromium waste	caustic, 130
HAZMIN recycling program, 11	diammonium phosphate (DAP), 133-
minimization program, 61	142
Cleaning solvent	distillation flask reaction studies, 135-
characteristics, 81-82	136
generation, 83-84	equipment, 124-125
reclamation, 81	experimental procedure, 124-125
Common sense waste reduction, 42-43	gel formation, 128-130
Communication techniques, waste	lead and ash analysis, 124-125
minimization, 27-28	liquid-solid separation studies, 140-141
Compaction of trash. See also Treatment,	metal borohydride reagent, 126-133
storage and disposal (TSD)	oil type, 128
facilities	reactor configuration and lead reduction,
high-force compactor, 21–22	136–139
metal drums, 22–24	time/temperature reaction, 134-136
Computerized hazardous materials	TMBR reaction studies, 134–142
tracking, 11	water
Concrete, fly ash particles, 201–203	DAP, 139-140
Conflict resolution, waste miminization	metal borohydride, 131–133
proposals, 32–34	Depleted uranium (DU) generation, 19–20
Consultants	Diammonium phosphate (DAP)
limits of, 46	demetallation, 133–142
on-site employees, 66, 69	distillation flask demetallation, 136–139
process-oriented, 64	steel ball dispersion for TBMR runs,
waste reduction audits, 45–46	137–138
Contaminated materials	time/temperature and demetallation,
depleted uranium, 20	138
<u>-</u>	-50
scrap metal, 25–26	Diesel drain oil recovery, 121
wood pallets, 24 Continuous flow units, reverse osmosis	Distillation see also Flash distillation; and
	Fractional distillation
membrane process, 169–170	waste oil recovery, 119–120
Copper	flask reaction studies, 135–136
scrap metal, 25–26	TC
substitution in smectite clay, 167-	E
168	Farmania anatoria
Cyanide wastes	Economic analysis
HAZMIN recycling program, 11	audit-dependent waste reduction, 44
metal finishing, 164–165	HAZMIN program (U.S. army), 14–15
Cyclohexene oxide, PERC concentration,	Efficiency
96, 98	defined, 153

equations, 158–160	Flash distillation
experimental data comparisons, 160-161	mobile solvent recovery system (MSR),
performance quantification, 154	108–109
waste processing, 153-161	solvent waste, 75–76
Efficiency curves, experimental data, 160–	Fly ash
161	cement blocks, 204
Efficiency expression	concrete additives, 201
curve-fit on actual data, 160–161	defined, 196–197
implementation, 155–158	hazardous classification exclusion, 203-
Electroplating wastes	204
HAZMIN recycling program, 11	Fractional distillation, mobile solvent
minimization program, 58-61	recovery system (MSR), 108
Employee suggestions, waste minimization	Frantz model L-1 separators, 175-176
audits, 66, 69	DMS - MGMS testing, 178
"End of pipe" treatment programs, 32-33	Fuel blending, waste oil recovery, 120
Energy/material recovery, waste oil	•
disposal, 118–121	G
Environmental Protection Agency (EPA)	
hazardous waste volume reduction, 163-	Gel formation
170	caustic solution, 130
physical/chemical separation projects,	demetallation of used oil, 128–130
164 FD T 1 1 1 1 1 202 202	Generators (waste)
EP Toxicity test, bottom ash, 202–203	conflict resolution, 32–34
т.	F002/F004 waste management, 56-58
F	mobile solvent recovery profile, 107–108
E002	small quantity waste management, 143–
F002 waste management, generators, 52-	149
56 F004	waste reduction audits, 41–42, 44–45
F004 waste management, generators, 52-	Gravity settling, waste oil recovery, 118–
56	119
F006 waste management, generators, 56-58	н
- <del>-</del>	п
Feed Materials Production Center (FMPC) metal drum minimization, 22–24	Halogenated organic compounds (HOCs),
process waste minimization, 26–27	74
scrap metal elimination, 24–26	Hazardous material tracking system
training, communication and incentives,	Army program, 15–16
27–28	background, 1–2
trash minimization program, 20–21	Hazardous waste, Oak Ridge National
uranium production process, 18–19	Laboratory categories, 34–35
waste generation, 19–20	Hazardous waste generation inventory,
waste minimization program, 17–28	64–65
wood pallet elimination, 24	Hazardous waste minimization program
Fernald waste	(HAZMIN)
magnetic separation, 188-189	Army Environmental Data Management
matrix-gradient magnetic separation	System (AEDMS), 13-14
(MGMS), 180	army policy and, 9
Ferrous scrap metal, 25–26	background, 8-9
Filtration	case studies, 10-12
diammonium phosphate (DAP)	command emphasis, 9-10
demetallation, 141–142	economic analyses, 14–15
waste oil recovery, 119	goals by process, 9
Fixed fee proposals, generator-charged	program support, 10, 12
waste management, 32-34	reporting requirements, 12-13

Hazardous waste minimization program Lead-bearing paint waste, mobile (cont.) solvent recovery system (MSR), 111 tracking system, 15-16 Lead reduction waste characterization, 10 reactor configuration, 136-139 Hazardous Waste Minimization used oil demetallation, 125 Workgroup (U.S. Army), 9-10 Limits to minimization, 69-70 High-force compactor (HFC), 21–22 Liquid cyclone system, 193–195 Hydrochloric acid (HCl) Liquid low-level radioactive waste chlorinated solvents, 98-99 (LLLW) inhibitor kinetic studies, 99-100 minimization, 34-35 Hydroxide sludge, metal recovery tracking system, 36 programs, 164–165 Liquid-solid separation studies, 140–141 Hypothetical efficiency distribution, 158-Listed wastes K071, 49-56 Hypothetical recovery efficiency equation, K106, 49-56 158 London force, deflecting magnetic separation (DMS), 180 I Low-level radioactive waste (LLW), 19-20

Incentives
for hazardous materials vendors, 69
waste minimization, 27-28
Industrial oil categories, 116
Industrial wastewater treatment plant
sludge, 12
Information-driven waste reduction, 43
Inhibitor kinetic studies, chlorinated
solvents, 99-100
Insurance requirements, small generators,
144
Isopropanol (Isopropyl alcohol IPA)
components, 83
field test criteria, 81
test results, 90-91

## J

Jarosite precipitation, metal recovery programs, 165-166

#### K

K071 brine
proposed sulfide precipitation option, 52
proposed water washing process, 51-52
recycle/reuse, 49-56
K106 waste
recycle/reuse options, 52, 55-56
wastewater treatment sludge, 49-56
Kauri-butanol value (KBV), solvents, 84

#### $\mathbf{L}$

Landfilling limits of, 104-105 solvent wastes, 74-75

### M

Magnesium fluoride (Mg<sub>2</sub>F) generation, 19-20 magnetic separation studies, 177 separation from uranium, 178-183 uranium processing, 27 Magnetic field gradients, slag leach filter cake, 26 Magnetic separation defined, 172-173 DOE site selection, 177-178 equipment and operating procedures, 178 Fernald waste, 188-189 operating principles, 173-175 selection criteria, 176-178 uranium, 172-189 uranium-magnesium fluoride separation, 178-183 uranium-other waste separation, 183-Magnetic susceptibility, selected materials, 173-174 Management programs, see also Consultants waste oil disposal, 117 Material substitution, waste oil disposal, 117-118 Matrix-gradient magnetic separation (MGMS) defined, 172-173 uranium - DOE sites, 183-188 uranium-magnesium fluoride separation, 179-180 Membrane separation processes, waste oil

recovery, 119-120

P Mercury cell chloralkali waste minimization audit, 49-50 Paint stripping, waste minimization audit, wastewater treatment system schematic. 56 - 58Particle size, precoat filter sludge waste. Mercury retorting process, 52–56 192-193 Metal bearing wastes, EPA programs, 163-Pasteurization, waste oil recovery, 120 Metal borohydride Performance evaluation requirements, demetallation results - type A oil, 128 154-155 demetallation results - type B oil, 127 Personnel interviews, waste minimization demetalling reagent, 126-133 audits, 63-64 "Plant-specific" waste minimization, 33-Metal drum reconditioning, 22-24 Metal pallets, 24 34 Metal recovery programs Plant-wide waste minimization operations current practices, 66 bench-scale studies, 166 recommendations, 68-69 EPA programs, 164-167 large-scale tests, 166-167 Plastic pallets, 24 Polyvinylidene chloride (PVDC) recycling, Metal stabilization tests, 98-99 Mobile solvent recovery system (MSR) 190-195 background and technical approach, Potassium borohydride demetallation properties, 129-130, 133 105-106 Precoat filter sludge diagram and schematic, 108-110 background, 190 evaluation, 110-112 filter system - pre-1984, 191-192 hazardous waste generator profile, 107-108 liquid cyclone, 193–195 reform of filter system, 192-193 research objectives, 106–107 schematic, 191-192 Molecular sieving, 111–112 Previsit audit preparations, 63 Motor oil composition, 116 Priorities in waste minimization, 67-68 Municipal solid waste, ash byproduct, Processed refuse fuel (PRF) procedure, 196-197 197-198 Process-oriented waste management N information gathering, 64, 66, 69 minimization programs, 26-27 Neutralized raffinate, 26-27 waste reduction audits, 45-46 Nitrates, uranium processing, 27 Product testing, bottom ash products, 200 Nonspecification fuels, waste oil recovery, 120-121 Q n-way separator efficiency evaluation, 153-154 Quality assurance/quality control, bottom efficiency expressions, 155-158 ash products, 200 O R Oak Ridge National Laboratory cost Radioactive waste streams, 2 Reaction time/temperature, TBMR recovery program conflict resolution, 32-34 reaction studies, 134-136 estimated and actual costs, 31-32 Recycle-reuse option, mercury chloralkali

estimated and actual costs, 31-32
planning and implementation, 30-32
structure, 34-36
Open pile storage, acidic rainfall, 201
Organo clay, adsorption media, 167-168
Overhead charges, generator-charged waste management, 33-34

reaction studies, 134-136
Recycle-reuse option, mercury chloralkali processing, 52-56
Regulatory pressure, waste minimization prioritization, 67-68
Reitma's tenth criterion, 157
Re-refining, waste oil recovery, 120
Research and development, waste reduction audits, 46

Resource recovery, ash products, 204	reclamation, 100–102
Reverse osmosis	volume profile for mobile solvent
membrane processes, 168–170	recovery, 107–108 Stabilization (solidification fly seb. 203
waste oil recovery, 119–120	Stabilization/solidification, fly ash, 203–204
Robust performance, efficiency evaluation, 157–158	Steam injection distillation unit (SIDU)
Rosin-Raimmler equation, 158–160	evaluation program, 76–79
Rotogravure printing plant sludge, 111	mass balance summaries, 78-79
Rotogravure printing plant studge, 111	mobile solvent recovery system (MSR),
S	108–110
B	overview, 73–79
Scrap metal elimination and	sampling locations, 77
minimization, 24–26	solvent wastes, 75–79
Segregation of waste	Still bottom disposal, mobile solvent
Army segregation programs, 10–11	recovery system (MSR), 110
fuel blending, 120	Stoddard solvent (SS)
prioritization, 68–69	components, 82
separation techniques, 3–4	field test criteria, 81
Self-audit check list, 43	generation statistics, 83
Slag leach filter cake, 26	HAZMIN recycling program, 11
Sludge production	reclamation of, 100-101
Army segregation programs, 10–11	test method sensitivity and consistency,
magnetic separation studies, 177	90–92
metal borohydride demetallation, 127-	test results, 85-86
128	Storage practices see Treatment, storage
reaction temperature, 129	and disposal (TSD) facilities
Small-quantity generators, waste oil	Synthetic oil, waste oil disposal, 117-
management, 143-149	118
Smectite clay	
adsorption media, 167-168	T
pillared/delaminated structure, 168	
Solid low-level radioactive waste (SLLW),	Temperature, solvent properties, 94–95
34–36	Tetrachloroethylene (Perchloroethylene,
Solid-waste samples, magnetic separation	PERC)
studies, 177	additives/impurities, 95
Solvents see also Spent solvents	components, 83
capital costs of treatment, 75	consumption statistics, 83
chlorinated inhibitors, 95–99	field test criteria, 81
classification, 81	inhibitor concentrations, 100–101
inhibitor kinetic studies, 99–100	inhibitor variation with usage time, 97
land disposal, 74	test method sensitivity and consistency, 92-94
monitoring methods, 84	test results, 87–89
RCRA amendments for, 104–105	Thin film evaporation
recovery overview, 2-3 recycling, 73-79	development, 73–79
	evaluation program, 76–79
specific gravity, 84 test method sensitivity and consistency,	mass balance summaries, 77
90–95	mobile solvent recovery system (MSR),
Source identification (waste), 65–66	108
Source reduction, mercury chloralkali	sampling locations, 76
processing, 52–56	solvent waste treatment, 74–75
Specification fuels, waste oil recovery,	
SECTION OF THE PROPERTY OF THE	Toxic Characteristic Leaching Procedure
	Toxic Characteristic Leaching Procedure,
120–121	Toxic Characteristic Leaching Procedure, 201–203
	Toxic Characteristic Leaching Procedure,

Transport of waste solvents, mobile solvent recovery unit, 105-106	Used oil recovery, overview, 3 Utilization practices, 3-4
Transuranic Waste Program, 31 Treatment, storage and disposal (TSD)	v
facilities minimization, 20–21	Vapor degreasers, characteristics, 82
mobile solvent recovery system (MSR),	vapor degredatis, enaracteristics, e2
107–108	$\mathbf{W}$
onsite information gathering, 64	
plant-wide minimization procedures, 69	Waste categories
present methods and associated costs, 66	acceptance criteria, 34–36
1,1,1-Trichloroethane (Methyl chloroform, MC)	Army characterization, 10 minimization option identification, 66–
additives/impurities, 95	67
components, 83	Oak Ridge National Laboratory, 34-36
consumption statistics, 83	prioritization of minimization
field test criteria, 81	operations, 67–68
inhibitor concentrations, 100–101	waste generation inventories, 64-65
inhibitor variation with usage time, 97	Waste minimization audits
mobile solvent recovery system (MSR),	Army HAZMIN program, 10
110-111	audit-dependent waste reduction, 43-46
test results, 90	background, 2, 48–49
Trichloroethylene (TCE)	baseline generation, 66
additives/impurities, 94 components, 82	common sense waste reduction, 42-43 defined, 41
consumption statistics, 83	electroplating operations, 58–61
field test criteria, 81	examples of waste oil recovery, 121-
inhibitor concentrations, 100–101	122
inhibitor variation with usage time, 96	generator charges, 29-37, 41-42
smectite clay, 167-168	information-driven waste reduction, 43
test method sensitivity and consistency,	limits of, 69–70
92	mercury cell chloralkali plant, 49–56
test results, 85–88	onsite information gathering, 63–66
Trichlorotrifluoroethane (Freon-113)	past/present minimization efforts and
components, 83 field test criteria, 81	costs, 66 paint stripping facility, 56-58
test results, 90–91	personnel interviews, 63–64
Tubing bomb microreactor (TBMR)	phases, 42–46
diammonium phosphate (DAP)	plant-wide observations, 66, 68-69
demetallation, 134-142	previsit preparation, 63
reaction conditions, 126-127	prioritization for specific wastes, 67-68
time/temperature reactions, 134-136	research and development, 46
used oil demetallation, 124–125	specific waste operations, 66–67
<b>T</b> T	strategy and methodology, 49, 62-70
${f U}$	TSD methods and associated costs, 66 waste categorization, 65-66
Ultrafiltration, waste oil recovery, 119	waste generation inventory, 64-65
Underground storage tanks (USTs),	Waste minimization techniques
leakage regulations, 144–145	cost and storage problems, 17-18
Uranium	waste oil disposal, 117-121
magnesium fluoride separation, 178-183	Waste oil
magnetic separation of, 172-189	analysis, 124–125
process wastes, 26-27	demetallation, 123-142
production process, 18–19	diammonium phosphate reagent, 133-
Uranyl nitrate (UNH) extraction, 18–19	134

Waste oil (cont.)
disposal, 117–118
energy/material recovery, 118-121
equipment, 124–125
management program, 117
materials, 124
metal borohydride reagent, 126-133
minimization examples, 121
minimization techniques, 117-121
separation and concentration, 118
small quantity generator, 143-149
TMBR reaction studies, 134-142
types and characteristics, 115-116
Waste reduction audit (WRA) see Waste
minimization audit
Waste separation and concentration, 118
Waste stream tracking system, 36
Wastewater
metal and organic contaminants, 12, 34-
35

slightly radioactive, 34-35 treatment plant sludges, 11 Water diammonium phosphate (DAP) demetallation, 139-140 distillation flask demetallation, 137 metal borohydride demetallation, 131-133 Wooden pallet minimization, 24 Worrell efficiency, zigzag air classifier, 156-157

Z

Zigzag air classifier, efficiency evaluation, 156-157