

Index

A

Accelerated irradiation, 50–58, 145,
158, 178, 192, 201, 204, 205
Annealing, 61–64, 106, 200, 240
Big Rock Point, 147
PM-2A, 129
SM-1A, 113–120
Yankee, 170
Army package power reactor, 105
ASME code, 21, 26, 248

B

Base plate, 74–79, 248, 251
Beltline flux/fluence
Big Rock Point, 155, 156, 226–230
Dresden, 185–188
Elk River Reactor, 197
Humboldt Bay, 204
SM-1, 122
SM-1A, 109, 114
PM-2A, 125
Table, 140–142
Yankee, 167–170, 174, 230–233
Brittle fracture, 24, 28, 33, 126

C

Charpy V-notch, 21–25, 27, 37, 50–
52, 108, 121, 127, 145, 158,
175, 179, 191, 201, 242, 252
Chemical composition, 31, 49, 67,
72, 74–89, 158, 253
Effects of-
copper, 6, 74–79, 80–89
phosphorus, 6, 80–89
sulfur, 83–89

Reactor steel and welds-

Big Rock Point, 144
Dresden, 175
Elk River reactor, 190
Humboldt Bay, 201
La Crosse, 75
PM-2A, 107
SM-1, 107
SM-1A, 107
Yankee, 157

Computer code (*see* Neutron spec-
trum)

Cross rolling (*see also* Orientation),
50

Cross sections, 210, 212–218, 221,
222, 225–227, 237, 232, 234,
253

Damage, 223, 224

Iron, $^{54}\text{Fe}(n, p)$, 201, 211, 214,
216, 221

Dresden, 183, 185

Libraries, 129, 169, 219

D

Damage model, 223–225

Ductile-brittle transition tempera-
ture (*see* Transition tempera-
ture)

Detector (monitor) flux, 108, 109,
145, 153, 183, 185, 192, 209–
217, 249, 252

Dose (flux) rate, 56–58

Yankee, 165

Drop-weight test, 23–26, 37

Ductile fracture, 21, 33, 37–41

Dynamic tear test, 37–45

E

Embrittlement, 19-23, Chapter 2,
139-142
Neutron in-
Big Rock Point, 145-158
Dresden, 174-183, 188
Elk River, 193-197, 200
Humboldt Bay, 202, 204
PM-2A, 124-134
SM-1, 122-123
SM-1A, 112-120
Yankee, 159-170, 174
Thermal, 183, 189, 246
Through thickness, 128, 134, 170,
172, 173, 179, 188
Embrittlement trend, 52-55, 58, 59,
66, 67, 70-72, 105
Elevated temperature, 52, 53, 55,
58, 59
Reactors-
Big Rock Point, 152, 155
Dresden, 180, 182, 186-188
Elk River, 196-200
Humboldt Bay, 202, 205
PM-2A, 128, 133, 242
SM-1, 123, 241
SM-1A, 110-114, 240
Yankee, 53, 163, 169, 172, 173

F

Failures, 26, 27, 29, 33, 158, 240,
241, 244, 245
Fatigue, 32, 35, 97
Elk River, 198-200
PM-2A, 98, 125
Fission foil (*see* Detector)
Fission spectrum (*see* Neutron spec-
trum)
Flaws, 23-25, 26, 29-30, 32-37, 43
Artificial, 124-126
Forging
Elk River, 189-191

PM-2A, 124, 127, 129, 130, 134
SM-1A, 107, 112, 113, 117, 118,
120
Fracture analysis diagram, 26, 27
Fracture mechanics, 31, 32, 33-37,
131-134, 256
PM-2A, 34, 35, 124-126, 131, 132

H

Heat affected zone, 31, 49, 74, 76,
140, 141, 143, 145, 147-152,
156, 158, 175, 179, 181-184,
201-263, 204, 243-246, 248,
250, 251, 253
Heat treatment
Reactors-
Big Rock Point, 144
Dresden, 175
Elk River, 189-191
Humboldt Bay, 201
PM-2A, 107
SM-1, 107, 121
SM-1A, 107
Yankee, 157
Stress relief annealing, 248, 251,
253
Heavy section steel technology pro-
gram, 30-33
Hydrogen embrittlement, 65-67, 99

I

Industry cooperative program, 30
Industry funded program, 30
Inspection, 29-33
Izod specimens, 121

L

Longitudinal (*see* Orientation)
Low energy tearing, 22, 23, 25, 51,
52, 79, 80, 179

M

Microstructure, 31, 49, 67, 71-74,
79-82, 164, 165
Monitor, flux (*see* Detector)

N

Nil ductility transition temperature
(NDT), 22-27, 32-34, 39,
42-44, 127, 128, 139, 140-
143, 145, 172, 173, 179, 197
Neutrons
Thermal, 211, 214-217, 224
Fast, 109, 183, 214
Neutron dosimetry (flux monitor-
ing), Chapter 5, 28, 120-122,
124, 139, 143, 153, 154, 163,
168, 172, 173, 183-188, 192,
201, 239, 249, 252
Neutron fluence (*see also* Beltline
flux/fluence), 49-55, 124,
139-145, 155, 156, 167-169,
180-188, 194-197, 204, 249
Neutron flux (*see also* Beltline
flux/fluence), 56-58, 109,
155, 172, 173, 249, 252
Neutron spectrum, Chapter 5, 53,
105, 109, 133, 153-156, 167-
170, 183
Calculations, 109, 125, 133, 167,
168, 217, 232, 241
Computer codes, 125, 167, 168,
217, 232, 241
Fission spectrum, 133, 134, 154,
217, 232
Graphic representations, 220-223
Big Rock Point, 153, 154
SM-1A, 110, 113, 219, 220
PM-2A, 128
Yankee, 167, 168
Watt fission, 153, 167, 214, 215,
219, 220
Nozzle cutout, 189

O

Orientation, 21, 50, 51, 204
of specimens and V-notch, 21, 50,
124, 146-151, 175, 202, 204,
242, 243, 246, 248, 252
Primary rolling direction, 21

P

Pressure vessel, pressure vessel steel,
140-142
Big Rock Point, 144, 145
Dresden, 175
Elk River, 189-191
Humboldt Bay, 201
PM-2A, 107, 122, 123
SM-1, 107, 241
SM-1A, 107, 112, 113, 117, 240
Yankee, 157, 158
Pressure vessel research committee,
29, 30

R

Reference steel, 51, 251
ASTM A212-B, 57, 189-191
ASTM A302-B, 51, 52, 54, 58, 59,
63, 70, 73, 78, 139-143, 160-
174, 245
General Electric, 140, 141, 204,
242, 243
Rolling direction (*see* Orientation),
50

S

Saturation, embrittlement, 52, 54,
194
Sensitivity, embrittlement, 49, 55,
67-69, 70-89, 99, 106, 120,
155-158, 163-165
Shear energy absorption, 21-25, 37-
39, 50-52, 74-77, 182, 183,
202
Shelf (*see* Shear energy absorption)
Shell course, 175, 200, 201, 248, 251

Shift (*see* NDT Increase and Transition temperature increase)

Spectrum (*see* Neutron spectrum)

Stresses, 23, 25–27, 31, 32, 34–37, 124–127, 131–134

Experimental irradiation, 65

Stress corrosion cracking, 35, 36, 125

Surveillance capsules, 143, 249, 250, 252, 255

Big Rock Point, 145, 146

Dresden, 175, 176

Elk River, 191, 192

Humboldt Bay, 201

SM-1A, 108, 115, 240

Yankee, 158, 159, 244, 245

Surveillance programs, 19, 20, 105, 106, 139–145, 239

Reactors-

Big Rock Point, 145, 242

Dresden, 175, 246

Elk River, 189, 246

Humboldt Bay, 200, 247

PM-2A, 123, 241

SM-1, 120, 241

SM-1A, 107, 239

Yankee, 158, 243

Guidelines, 254–258

Recommendations, 139, 247–253

T

Temperature, irradiation, 49, 57–61, 99, 106, 156, 165, 166, 174, 194, 197, 249, 250, 252, 253

Temperature monitor, 143, 145, 174, 201, 244, 246, 250, 252, 253

Tensile properties, 56, 57, 90–96, 127–131, 183, 197, 203, 252, 253, 255

Thermal control, 179, 183, 201, 246, 249, 253

Thickness effects, 42–45

Transition temperature (*see* Transition temperature increase)

Curve (illustrative), 21, 22, 50, 51

Transition temperature increase (*see also* Embrittlement trend), 21, 22, 50, 51

Service limit projection, 139–145

Big Rock Point, 153–156

Dresden, 183, 187, 188

Elk River Reactor, 196, 197

Humboldt Bay, 204, 205

PM-2A, 125, 128, 129

SM-1, 122, 123

SM-1A, 113, 114, 119

Yankee, 167–170

Transverse (*see* Orientation)

W

Weld metal, 29, 74, 77–80, 88–91, 145–149, 152, 155, 156, 175, 179, 181, 182, 184, 188, 201–203, 246, 248, 250, 251, 253

Submerged arc, 78, 248

Electroslag, 78, 79, 248

Field weld, 192