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ESTIMATED QUANTITIES OF MATERIALS CONTAINED IN A 1000-MW(e) PWR POWER PLANT

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OAK RIDGE NATIONAL LABORATORY
OPERATED BY UNION CARBIDE CORPORATION • FOR THE U.S. ATOMIC ENERGY COMMISSION

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FOREWORD AND ACKNOWLEDGMENTS

The work reported here is part of a study of material resource usage in nuclear power plants supported by the U.S. Atomic Energy Commission Directorate of Regulatory Standards as one of the generic issues involved in meeting the aims set forth by the National Environmental Policy Act of 1969. A report on the entire study is being prepared. The encouragement and guidance of William Ramsay, the project director, and his co-worker, Charles E. Shortt of the Directorate of Licensing, were constructive and essential to completion of the work.

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ABSTRACT

The quantities of materials contained in a typical 1000-MW(e) pressurized-water reactor power plant have been estimated in detail. Reference plant features, methods used in making the estimate, accuracy of the estimates, and accounting system are discussed. Estimated quantities of the composite materials and their constituents are summarized and are also presented in detail for each portion of the power plant.

Key words: materials, nuclear power plant, PWR, quantities, resources

1. INTRODUCTION

A detailed estimate of the quantities of materials contained in a 1000-MW(e) pressurized-water reactor (PWR) power plant, including field construction materials, was prepared as part of a study of material resource use and recovery in nuclear power plants; however, completion of that study was deferred because of funding shortages. Due to the current interest in the materials estimates, that portion of the study is reported separately here.

The general magnitudes of quantities of field materials such as concrete, reinforcing steel, and structural steel required for construction of a given size power plant are well known, since they are purchased as raw materials. These materials also are of general interest because they are major items in the total material list. The amounts of materials contained in the purchased factory-built equipment and machinery are not so well known, because they are purchased as finished items instead of as units of materials and labor.

The composite materials considered in this estimate include the major types of materials contained in factory-built equipment and machinery and the field materials that are consumed in plant construction. The materials quantities are listed by accounts according to systems and locations within the plant. These accounts are defined by terminology consistent with present usage in large power plants. The estimated quantities of the composite materials are then broken down into quantities of their basic constituents.

2. DESCRIPTION OF THE REFERENCE POWER PLANT

The material quantity estimates presented in this report are based on a typical PWR power plant rated at 1000 MW(e) net output with run-of-river cooling. Reference 1 contains a very complete description of a typical 1000-MW(e) PWR power plant, with a detailed accounting of costs of equipment, materials, and labor for construction of the plant at a well-defined site. The plant described in that document was used as the reference plant for preparing this estimate of material quantities.

The reference plant design features related to safety and environmental considerations are based on standards that prevailed in early 1971 and the effects on the materials inventory of adding such things as improved radioactive waste treatment systems and alternate heat sinks are not included.

3. ACCOUNTING SYSTEM

For preparation of an inventory of materials, use of a systematic method of accounting for every important piece of material in the plant was necessary. All of the systems and items of equipment are very well defined by the USAEC accounting system described in ref. 2. That accounting system also was used in ref. 1. The major categories of that accounting system at the two-digit level are:

20 LAND AND LAND RIGHTS

This account is of no significance to this report because no construction materials or equipment are involved.

21 STRUCTURES AND SITE FACILITIES

This account includes all plant buildings and other structures such as stacks, canals, roads, fences, retaining walls, sanitary sewers, and storm sewers.

22 REACTOR PLANT EQUIPMENT

This account includes the reactor and all associated systems contained within the reactor building, auxiliaries, radioactive waste system, and fuel storage systems. The major system in this account is the nuclear steam supply system.

23 TURBINE PLANT EQUIPMENT

The turbine generator and all associated systems including those for condensing the working fluid (steam), rejecting excess heat, and heating the feed water are included in this account. In general, all systems within the turbine building and connected portions which are external, such as tanks and pipe lines, are included.

24 ELECTRIC PLANT EQUIPMENT

All plant electric equipment (except the main generator and pump drives) including associated systems, wiring, and cables are included in this account.

25 MISCELLANEOUS PLANT EQUIPMENT

This account includes plant equipment and facilities that are in common use and associated with equipment or facilities in more than one of the other accounts. It includes such items as cranes, compressed air and potable water supplies, shop and laboratory equipment, and communication facilities.

26 SPECIAL MATERIALS

This account is of no importance to this report since it is for special materials (other than natural water) for use as coolants or as the reactor moderator or reflector.

The two-digit accounts described above are further broken down into individual systems and equipment items. Some accounts defined in ref. 2 were slightly modified and extended to as far as the eight-digit level for identification of specific details. A complete listing of the accounts used in preparing this estimate is included in Appendix A.

4. REFERENCE PLANT FEATURES

The estimates of the materials contained in the reference plant included only those used within the boundaries of the plant site and improvements described below. Usually, the boundaries adopted for this study are the same as those defined for the standard hypothetical plant site in ref. 2. There are wide

variations in plant design and site features which are peculiar to specific plants and sites. These variations have a definite bearing on the amounts of materials required. Some of the features of special interest and the assumptions made about them are:

(1) Highway access. An existing road in good condition connects the plant site with other highways.

(2) Railroad access. A railroad access has to be provided by constructing a spur five miles long.

(3) Cooling water. The reference plant is located 2000 ft from the shoreline of a river that supplies an adequate amount of raw water for makeup and condenser cooling. The temperature is such that the turbine back-pressure is specified as 1.5 in. Hg.

(4) Utilities. Communications, electric power, and water facilities for construction activities exist at the plant site boundary.

(5) Sewage plant. All sewage receives primary and secondary treatment in the plant prior to discharge to the river.

(6) Air and marine transportation facilities. None are required.

(7) Electrical power transmission and switchyard. These items are not included as part of the plant.

(8) Second unit provisions. The plant layout is arranged to accommodate a second power plant; however, all items considered are sized for a single 1000-MW(e) plant.

(9) Shipping casks. No shipping casks are included. These are assumed to be rental items.

(10) Reactor vessel inspection equipment. No major reactor vessel inspection equipment is included. This type of equipment is assumed to be rented or provided by a service group hired to make periodic inspections.

(11) Nuclear fuel element and absorber materials. None of the fuel, cladding, or absorber materials used in fuel elements and control rods were included. These are considered as consumables used during plant operation, rather than construction materials.

(12) Operating materials. None of the materials consumed during power plant operations were included.

Nuclear power plant designs are based on safety and environmental standards that are constantly undergoing changes. Features such as the reactor containment system, radioactive waste disposal systems, and emergency core cooling systems are subject to design changes to comply with current standards. Another very important plant design feature subject to wide variability is the heat rejection system. The reference plant uses run-of-river cooling; however, environmental considerations now make this unacceptable in most locations. Other heat rejection systems using wet or dry cooling towers, holding ponds, sprays, and combinations of these are being used where necessary. Large quantities of materials are involved in some of these alternative systems.

5. METHODS USED FOR ESTIMATING THE MATERIAL QUANTITIES

The estimates of material quantities were made by various methods. In many cases the quantities of materials such as concrete, reinforcing steel, and paint were given directly in ref. 1. Weights of materials contained in equipment and machinery items were estimated by reference to equipment catalogs and technical journals, by personal communications with equipment manufacturers, and by routine calculations. Due to the large number of items involved, there was not sufficient time to explore each of the small items to great lengths. These items were handled by establishing as much data as possible on the composition of similar well-defined equipment and then making projections to each item in question. An example of this is the method used for determining the weights of carbon steel and copper contained in electric motors. Curves were plotted by use of known weights for motors of several horsepower ratings.

These curves were then used for determining the weights of materials in all the electric motors in the reference plant.

In other cases, material quantities had to be estimated from the cost of an item. This was accomplished by comparing the cost of the item with costs of similar items of known material content. Use of this method was limited to smaller systems and items for which costs were given in ref. 1, but which were not well-defined physically.

Preparation of the estimate of material quantities required going through the entire plant accounting system, identifying each item, and determining the amounts of various materials it contained and the amounts of additional materials used in its installation. A nuclear power plant uses many materials; however, the estimates were restricted to those materials used in significant quantities. The materials chosen are: aluminum, babbitt metal, brass, bronze, carbon steel, concrete, copper, galvanized iron, Inconel, insulation, lead, nickel, paint, silver, stainless steel, and Zircaloy. Composite materials were then broken down into major constituents: aluminum, antimony, asbestos, cadmium, chromium, copper, indium, iron, lead, manganese, molybdenum, nickel, silver, tin, titanium, zinc, magnesia, cement, coarse aggregate, and fine aggregate. The estimated quantities of the composite materials and the basic constituents are summarized in Tables 1 and 2, respectively.

Table 1. Estimated quantities of composite materials contained in a typical 1000-MW(e) PWR power plant, including field construction materials consumed

Material	Total estimated quantity
Aluminum, metric tons	18
Babbitt metal, metric tons	<1
Brass, metric tons	10
Bronze, metric tons	25
Carbon steel, metric tons	32, 731
Concrete, yd^3	98,130
Copper, metric tons	694
Galvanized iron, metric tons	1,257
Inconel, metric tons	124
Insulation (thermal), metric tons	922
Lead, metric tons	46
Nickel, metric tons	1
Paint, gal	17,500
Silver, metric tons	<1
Stainless steel, metric tons	2,080
Wood, bd ft	4.8×10^6

6. DISCUSSION OF ACCURACY

The accuracy of the estimates contained in the report for a specific item can generally be related to the amount of description given that item in ref. 1. Generally, the larger items are the best defined and should have a higher degree of accuracy. The degree of accuracy for the estimates involving items that are not as well defined would then be lower. It is not possible to state an exact degree of confidence that should be

Table 2. Quantities of basic constituent materials contained in a typical 1000-MW(e) PWR plant, including field construction materials consumed

Material	Total estimated quantity (metric tons)
Aluminum	18
Antimony	Negligible
Asbestos	138
Chromium	415
Copper	726
Iron	34,662
Lead	47
Manganese	467
Molybdenum	164
Nickel	484
Silver	<1
Tin	2
Titanium	Negligible
Zinc	2
Magnesia	783
Cement	30,133
Aggregate (coarse)	90,361
Aggregate (fine)	45,855

placed on each item of the estimate; however, the following generalizations for each material estimated should be considered:

(1) Carbon steel. All steel items, except stainless steel and galvanized iron, were included in this general classification. No attempt was made to separate the various alloys of steel. The carbon steel classification represents a major construction material and the degree of accuracy of the estimate for this classification is probably one of the best in this report.

(2) Concrete. All concrete was put into this single classification. This material was well defined in ref. 1; therefore, the degree of accuracy of the estimate of the quantity of this material is also believed to be one of the best in this report.

(3) Inconel. All Inconel material was put into this classification. The application of this material was well defined, and therefore the estimated quantity should also be one of the best in this report.

(4) Stainless steel. All stainless steel materials, regardless of type, were put into this classification. The degree of accuracy of the estimated quantity of this material may be slightly lower than that for carbon steel.

(5) Brass and bronze. The applications of these two materials are not well defined. There are many cases in which judgments had to be made concerning whether brass or bronze would be used. The degree of accuracy of each individual estimate is probably well below that for carbon steel; however, the combined quantities estimated for brass and bronze should be somewhat better than their individual estimates.

(6) Galvanized iron. All galvanized steel and iron was put into this classification. Use of this material is not well defined in some areas; therefore, the degree of accuracy of the estimate is believed to be lower than that for carbon steel.

(7) Aluminum. All aluminum and aluminum alloys were put into this classification. The use of this material was not well defined. None was assumed to be used for electrical cables or bus bars. The degree of accuracy of the estimate for this material is probably well below that for carbon steel.

(8) Babbitt metal. This alloy is used for bearing liners in a very limited number of applications. Most motors, pumps, and other rotating equipment use steel ball bearings. The total quantity of this material used in the reference plant appears to be insignificant.

(9) Copper. This material is contained mainly in electric motors, generators, transformers, electrical cable, bus bars, and piping. All electrical cable and bus bars were assumed to be made of copper. The degree of accuracy of this estimate may be lower than that for carbon steel; however, the portions that have been compared with rule-of-thumb methods seem to check out well.

(10) Lead. This material includes mainly items for shielding which were not too well defined. The degree of accuracy is believed to be much lower than that of carbon steel.

(11) Silver. This metal was used mainly in electrical switchgear contactors, plated bus-bar connections, and other electrical apparatus. The applications of this material were not defined, and the estimates were based on judgments made for each item involved. The degree of precision of this estimate is well below that for carbon steel.

(12) Insulation. This included all thermal insulation material used on pipes and other equipment items. Reflective insulation used on the reactor vessel is not included because it is stainless steel and is included in that category of material. The accuracy of this estimate is believed to be lower than that of carbon steel.

(13) Paint. All paint used in field construction was well defined and was put into this single classification. Paint applied to equipment at the factory was not included, and for that reason the total quantity of paint estimated is believed to be low.

(14) Wood. All wood consumed in construction of the plant is included. Skids, crates, and boxes prepared offsite for shipping equipment were omitted. The use of this material was not defined in ref. 1. Some uses of wood could be estimated reasonably well; however, many had to be estimated by using arbitrary allocations of portions of the field materials' costs. For this reason the degree of accuracy of the estimated wood consumption is relatively low.

Beyond the matter of estimating accuracy, the choice of some materials is not well defined even for a plant of a specific type. Therefore, discretionary substitution could shift quantities from one material type to another under the pressures of availability and cost.

A computer printout of the composite materials estimates are shown at the three-digit account level in Appendix B. Typical basic constituents of these materials are as shown in Appendix C. A computer printout of the quantities of basic constituents of the composite materials at the three-digit account level is shown in Appendix D.

REFERENCES

1. United Engineers and Constructors Inc., "Pressurized Water Reactor Plant," *1000-MWe Central Station Power Plants Investment Cost Study, Vol. I,* USAEC Report WASH-1230 (Vol. I), June 1972.

2. NUS Corporation, *Guide for Economic Evaluation of Nuclear Reactor Plant Designs,* Report NUS-531, January 1969.

Appendix A

This appendix lists the accounts described in ref. 2, with certain modifications and extensions included

Account number	Account title and description of items included
21	STRUCTURES AND SITE FACILITIES
211	Site improvements and facilities
	.1 General yard improvements
	.11 Grading, general excavation and/or fill, and landscaping
	.12 Roads, sidewalks, and parking areas
	.13 Retaining walls
	.14 Fences, railings, and gateways
	.15 Sanitary sewer system:
	Connection to existing system
	Septic tank
	Distribution box
	Tile field (drainage)
	Piping, conduits, and manholes
	.16 Yard drainage and storm sewer system:
	Connection to existing system
	Manholes, catch basins, inlets, etc.
	Outfall structure
	Piping, conduits, open ditches
	.17 Roadway and general yard lighting (includes lighting for security fences, roadways, parking areas, walkways, tanks, yard, etc.)
	.18 Cathodic protection
	.2 Waterfront improvements
	.21 Revetments
	.22 Levees
	.23 Breakwaters
	.3 Highway access
	Roads constructed to connect the project site with public roads, when title to such roads and responsibility for maintenance remains with the plant owner after completion of the project
	.31 Grading
	.32 Surfacing
	.33 Culverts
	.34 Bridges, trestles, and causeways
	.35 Guards and signs
	.36 Lighting
	.4 Railway access
	Railroads constructed to permanently connect the site with public carriers
	.41 Grading
	.42 Bridges, culverts, and trestles
	.43 Ballast, ties, rails, and accessories
	.44 Signals and interlocks
	.45 Switches, crossovers, and bumpers

Account number	Account title and description of items included
211	.5 Waterway access facilities
	.51 Dredging
	.52 Piers, barge docks, or similar structures
	.6 Air access facilities
212	Reactor building
	All materials related to the structure in which the nuclear reactor is placed, except equipment foundations which are separable from structure and are associated with individual equipment items
	.1 Basic building structures (excludes structures associated with primary reactor containment systems)
	.11 Excavation and backfill (includes sheeting, shoring, and dewatering)
	.12 Bearing piles and caissons
	.13 Substructure concrete
	.131 Forms
	.132 Reinforcing
	.133 Concrete (includes concrete shielding, either ordinary or high-density, which is incorporated into building structure)
	.134 Embedded items
	.135 Miscellaneous items; finishes, patching, etc.
	.136 Waterproofing and damp-proofing (includes porous fill and vapor barrier)
	.137 Leakage control liner
	.138 Non-concrete shielding incorporated into building structure
	.139 Tensioning cable and associated hardware (for prestressed concrete designs)
	.14 Superstructure
	.141 Concrete (use same breakdown as for account 212.13)
	.142 Structural steel and miscellaneous metal:
	Structural steel
	Stairways and ladders
	Walkways, handrails, gratings, and checkered plate
	.143 Exterior walls (includes caulking and insulation; type of wall is optional):
	Concrete (poured, precast)
	Masonry (brick, block, tile)
	Siding (asbestos, aluminum, steel, sandwich panels; includes supports, attachments, louvers, etc.)
	.144 Roof decks (type is optional):
	Precast or poured slabs (concrete, gypsum) Metal deck (steel, aluminum)
	.145 Roofing and flashing (includes insulation):
	Roof covering (type is optional)
	Flashing (includes gravel stops and facia)
	Gutters and downspouts
	.146 Interior walls and partitions (includes shielding incorporated into building structure and insulation; type is optional):
	Concrete
	Masonry
	Metal
	Plaster and plasterboard
	Removable types

Account number	Account title and description of items included
212	.147 Doors and windows (excluding containment air locks): Vehicle doors Personnel doors Windows (includes glazing) Curtains, shades, and blinds .148 Wall, floor, and ceiling finishes (type of covering is optional): Walls (tile, drywall, plaster and stucco, paneling) Floors (wood; tile: ceramic, stone, asphalt, terrazzo, vinyl, vinyl asbestos, rubber) Ceilings (acoustical, plaster, metal, translucent; includes suspension system and insulation) .149 Painting (includes special protective coatings for decontamination) .15 Special shielding (Note: shielding that is isolated from the building structure and that is associated with a particular item of equipment is listed with the equipment accounts) High-density concrete Ordinary concrete Lead sheets or plates Steel sheets or plates Sand or earth Water tanks Removable blocks or plugs (lead, steel, concrete, etc.) .16 Stacks integral with building (use applicable items from account 219 for breakdown) .2 Building services (includes systems and components servicing containment) .21 Plumbing and drainage systems .211 Floor drainage (includes sump pumps) .212 Roof drainage .213 Plumbing fixutres (sinks, toilets, etc.) .214 Piping, valves, and fittings .22 Heating, ventilating and air conditioning systems (includes pumping systems associated with double-barrier containment schemes, but excludes radioactive-gas treatment equipment and systems that are covered in account 224.2 and containment-inerting systems that are covered in account 226.1) .221 Boiler or connection to central heating source .222 Convectors and/or unit heaters .223 Fans, blowers, and drives .224 Air cooling equipment and heat exchangers* .225 Pipe or duct connection to gaseous waste and off-gas system (account 224.2) or to stack (account 219) .226 Ventilation-duct isolation valves .227 Ductwork (includes registers, grilles, dampers, louvers, filters**) .228 Piping, valves, fittings; and insulation; miscellaneous pumps and tanks .229 Instrumentation and controls

*For heat rejection, this equipment may be connected to equipment in one or more of the following accounts: 226.7, 232.23, or 235.3.

**Special filtering systems that remove airborne contaminants from the off-gas stream are excluded and covered in account 224.2, but such filters that are a part of in-plant air circulating, cooling, and clean-up systems are included in this account.

Account number	Account title and description of items included
212	.23 Fire protection systems (excludes systems serving specific items of equipment, which are included with the equipment accounts, and fire pumps, which are included in account 252.2)
	.231 Sprinklers
	.232 Piping
	.233 Hose reels and cabinets
	.234 Alarm systems (portion within building)
	.24 Lighting and service power
	.241 Fixtures, panels, outlets, and switches
	.242 Conduit and wiring
	.25 Elevators
	.3 Containment structures
	.31 Excavation and backfill (includes sheeting, shoring, and dewatering)*
	.32 Bearing piles and caissons*
	.33 Substructure concrete (use same breakdown as for account 212.13)*
	.34 Superstructure (use same breakdown as for account 212.14)*
	.35 Special shielding (use same breakdown as for account 212.15)*
	.36 Stacks integral with containment (use applicable items from account 219 for breakdown)*
	.37 Steel containment structures and components
	.371 Steel shell and connecting ducts
	.372 Air locks
	.373 Penetrations
	.374 Flow distribution pipes, ducts, and baffles (includes downcomers in pressure-suppression type)
	.375 Protective coatings, insulation, expansion spacers, and painting
213	Turbine building Structure that houses turbine-generator units and related equipment (includes control room if building design places this within structure; otherwise assign control room to building with which it is most clearly associated). Expand subdivisions as in account 212.
214	Intake and discharge structures This account consists of: (a) structures that house equipment required to bring cooling water into plant; (b) discharge weir or seal box and related structures that form the transition between the closed (pressurized) portion of the circulating water system and the open (unpressurized) portion; and (c) conduits (e.g., open canals, pipes, or tunnels) that provide paths for cooling water to flow (i) to the intake structure from the source of cooling water (e.g., river, sea, or lake), and (ii) away from the discharge weir to return to the river, sea, or lake. Includes any special structures constructed to minimize re-circulation of discharged cooling water back to the plant. Where applicable, expand the subdivisions under accounts 214.1 and 214.2 similar to the subdivisions in account 212. .1 Intake structure (pump house) .2 Discharge structure

*Included here only if portion for containment is separate from reactor building; otherwise item is included in account 212.1.

Account number	Account title and description of items included
214	.3 Unpressurized intake and discharge conduits .31 Excavation includes sheeting, shoring, dewatering, backfill, and grading .32 Dredging .33 Revetments and other forms of bank protection .34 Tunnels and/or pipes .341 Metal pipe .342 Concrete, pipe or poured (includes forms and reinforcing) .35 Skimmer wall (if separate from intake structure)
215	Reactor auxiliaries building Structure that houses auxiliary systems associated with the reactor, except radioactive waste handling systems and fuel processing systems if separate buildings are provided. Expand subdivisions as in account 212.
216	Radioactive waste building This account is used when a separate structure (or well-defined wing of another building) is provided to house the equipment that processes radioactive waste materials. If a separate structure or wing is not provided, the equipment is housed in the reactor auxiliaries building and this account is not used. Expand subdivisions as in account 212.
217	Fuel storage building This account is used when a separate structure (or well-defined wing of another building) is provided at the plant site to store and examine either new or spent fuel assemblies. If a separate building or wing is not provided, this account is not used. Expand subdivisions as in account 212.
218	Miscellaneous buildings Present a separate account for each individual building considered (administration building or administration wing, gatehouse, warehouse, firehouse, etc.); designate as 218A, 218B, etc. Expand subdivisions as in account 212.
219	Stacks (when separable from buildings) Ventilation exhaust, off-gas, and flue stacks. Present a separate account for each individual stack; designate as 219A, 219B, etc. .1 Excavation and backfill .2 Foundation (includes bearing piles and caissons) .3 Stack structure (concrete, brick, steel, etc.; also guy lines if used) .4 Linings, painting, and protective coatings .5 Accessory items (includes ladders and walkways, lightning protection, aircraft warning lighting, and general lighting)
22	REACTOR PLANT EQUIPMENT
221	Reactor equipment .1 Reactor vessel and accessories (type and materials are optional and include pressure vessel and pressure-tube types using steel, prestressed concrete, zirconium, etc.) .11 Vessel supports and foundations .111 Concrete (use same breakdown as shown for account 212.13) .112 Structural steel

Account number	Account title and description of items included
221	.12 Vessel structure
	.121 Body and attachments
	.122 Closure and attachments
	.123 Studs, fasteners, seals, and gaskets
	.124 Calandria tubes and fittings
	.125 Pressure tubes and fittings
	.126 Insulation
	.13 Vessel internals (excludes fuel, reflector, moderator, and reactivity control components)
	.131 Core tank or container (for fluid-fuel systems)
	.132 Core support structures
	.133 Core shroud
	.134 Reactor coolant flow baffles, fuel assembly shrouds, distributors, orifices, and strainers
	.135 Feedwater distributor, core spray distributor, liquid poison distributor
	.136 Steam separators, driers, and baffles
	.137 Internal insulation
	.138 Internal thermal shields
	.139 Guides, shrouds, holders, housings, etc. for instrumentation and irradiation samples
	.14 Shipping equipment (includes covers, skids, and lifting beams)
	.2 Reactor control devices, both primary and emergency (type is optional)
	.21 Absorber-fuel positioning devices
	.211 Control-element assemblies (type is optional; includes absorber or special fueled sections):
	Control rods or blades (linear motion; includes followers, extension rods, and connection pieces)
	.212 Control-element drive mechanisms (type is optional; includes motors, pumps, tanks, coolers, housings, guide tubes, shrouds, supports, seals, position transmitters, and electrical devices):
	Hydraulic
	Magnetic-jack
	Rack-and-pinion
	Geared motor drum
	Drum or reel
	Pneumatic
	Other
	.22 Moderator-characteristic-varying devices (specific type is optional; includes injection pumps, "fuse" systems, tanks, reconcentrator systems, heaters, piping, supports, hangers, etc.):
	Neutron-capture-varying devices (e.g., boric acid in H_2O); may be used in conjunction with account 223.3
	Moderating-ratio-varying (e.g., H_2O in D_2O)
	.23 Moderator/reflector-level varying devices (includes only equipment associated with control function; remaining equipment included in account 221.3)
	.24 Reactor-coolant recirculation-flow varying control devices (includes only equipment associated with control function; remaining equipment included in account 222.1)
	.25 Neutron source

Account number	Account title and description of items included
221	.3 Moderator/reflector systems* (excludes cost of initial supply of moderator/reflector materials, which are included in account 26, but includes all costs associated with transportation and installation of the initial supply)
	.31 Circulating pumps, drives, and controls
	.32 Tanks (storage, dump, head, etc.)
	.33 Heat exchangers
	.34 Piping, valves, fittings (includes calandria and other relief valves)
	.35 Insulation
	.36 Purification, chemical treatment, and recovery systems
	.361 Ion-exchange systems
	.362 D_2O upgrading column and accessories
	.363 Chemical treatment systems
	.364 Atmospheric and drain recovery systems
	.365 Piping, valves, fittings, and insulation
	.37 Transportation and handling systems
	.371 Transportation charges (initial supply)
	.372 Receiving and storage charges (initial supply)
	.373 Pumps, compressors, drives, and controls (including charge and transfer pumps)
	.374 Piping, valves, and fittings
	.375 Insulation
	.38 Foundations, supports, bases, hangers, inserts, and screens
	.4 Reactor shielding
	.41 External thermal and neutron shielding (excludes shielding that also serves as a structural material and materials to shield other components in addition to the reactor, which are included in account 212.1):
	Neutron-shield tank system (includes tanks, pumps, cleanup system)
	Ordinary or heavy concrete
	Graphite, borated graphite, etc.
	Metallic shields
	.42 Shield-cooling system (includes a separate gas system or embedded or submerged cooling coils)
	.43 Blast or missile shields
222	Main heat transfer and transport systems
	.1 Reactor core coolant system (portions external to reactor vessel)
	.11 Fluid-circulating driving systems
	.111 Main pumps (primary coolant pumps)
	.1111 Casing, impeller, and pump shaft
	.1112 Motor, drive gear
	.1113 Electrical power controls
	.1114 Instrumentation on pump, motors, etc.
	.112 Auxiliary pumps
	.113 Insulation
	.114 Foundations, supports, etc.

*Included only when the moderator/reflector is separate from reactor coolant.

Account number	Account title and description of items included
222	.12 Piping system
	.121 Piping
	.122 Valves and fittings (includes loop and plant isolation valves, if present)
	.123 Insulation
	.124 Hangers, supports, bases, inserts, and screens
	.13 Heat exchange equipment
	.131 Steam generator
	.1311 Shell
	.1312 Tubes
	.132 Steam drums and/or external steam separators (if present)
	.133 Steam (or other vapor) lines interconnecting heat exchange equipment or drums and connecting to final plant isolation valves, if present, or to turbine-generator unit if isolation valves are not present
	.134 Other piping, valves, and fittings for heat-exchange equipment (includes feed piping connection to loop or plant isolation valves, if present, or to feed-heating equipment if isolation valves are not present)
	.135 Insulation
	.136 Steam generator foundation and support
	.137 Missile shield
	.14 Pressurizing system
	.141 Pressurizer
	.1411 Shell and nozzles
	.1412 Heaters
	.1413 Instrumentation and controls
	.1414 Pressurizer support
	.1415 Pressurizer missile shield
	.142 Pumping system
	.1421 Pumps
	.1422 Motors
	.1423 Electrical power and controls
	.1424 Accessories (including electric heaters and power supply, spray nozzles, relief valves, foundations, supports, inserts, etc.)
	.143 Pressurizer relief tank
	.1431 Pressurizer relief tank
	.1432 Pressurizer relief tank support
	.1433 Pressurizer relief tank missile shield
223	Safeguards cooling system
	.1 Residual heat removal system
	.11 Residual heat removal pump
	.111 Impeller, casing, and pump shaft
	.112 Motor and drive gear
	.113 Electrical power controls
	.114 Instrumentation on pump and motor
	.115 Foundations and supports
	.12 Heat exchangers
	.121 Shell
	.122 Tubes
	.123 Insulation
	.2 Emergency shutdown or core-isolation cooling system

Account number	Account title and description of items included
223	.3 Safety injection system
	.31 Pumps
	.311 Safety injection pumps
	.3111 Impeller, casing, and pump shaft
	.3112 Motor
	.3113 Electric power and controls
	.32 Heat exchangers
	.33 Tanks, including accumulators
	.331 Accumulator tanks
	.332 Boron tank
	.34 Piping valves and fittings
	.4 Containment heat absorption/rejection system
	.41 Pumps, fans, or compressors
	.411 Casing, impeller, and shaft
	.412 Motor and controls
	.42 Heat exchangers
	.43 Tanks
	.44 Piping, valves, and fittings
	.45 Insulation
	.46 Foundations, supports, etc.
	.47 Chemical storage and injection systems
	.471 Spray pumps
	.4711 Casing, impeller, and shaft
	.4712 Motor
	.472 Heat exchangers, including condensers and boilers
	.473 Spray additive tank
	.474 Piping, valves, and fittings
224	Radioactive waste treatment and disposal
	.1 Liquid waste processing equipment
	.11 Storage tanks
	.111 Waste holdup
	.112 Spent resin storage
	.113 Reactor coolant drain
	.114 Chemical drain
	.115 Sump tank
	.116 Caustic mix regenerant
	.117 Waste condensate
	.12 Pumps and compressors
	.121 Waste condensate
	.1211 Waste condensate pump
	.1212 Motor
	.1213 Electric power and controls
	.1214 Supports
	.122 Reactor coolant
	.1221 Reactor coolant drain pump
	.1222 Motor
	.1223 Electric power and controls
	.1224 Supports

Account number	Account title and description of items included
224	.123 Containment pump
	.1231 Containment sump pump
	.1232 Motor
	.1233 Electric power and controls
	.1234 Supports
	.124 Sump tank
	.1241 Sump pump
	.1242 Motor
	.1243 Electric power and controls
	.1244 Supports
	.125 Chemical drain
	.1251 Chemical drain pump
	.1252 Motor
	.1253 Electric power and controls
	.1254 Supports
	.126 Regenerant pump
	.1261 Regenerant pump
	.1262 Motor
	.1263 Electric power and controls
	.1264 Supports
	.13 Heaters and heat exchangers
	.14 Evaporator systems
	.15 Ion exchange systems (includes regeneration equipment)
	.16 Filters, traps, and separators (includes centrifuges)
	.17 Piping, valves, and fittings
	.18 Insulation
	.2 Gaseous waste process equipment
	.21 Gas decay tanks
	.22 Process columns and towers:
	Absorbers
	Scrubbers
	Degasifiers
	.23 Filters, separators, and dehumidifiers
	.24 Heat exchangers and gas coolers
	.25 Compressors, blowers, and pumps
	.251 Compressors, blowers, and pumps
	.252 Motors
	.253 Electric power and controls
	.254 Supports
	.26 Gas analyzer
	.27 Duct to stack
	.28 Piping, valves, and fittings
	.3 Solid waste processing equipment
	.31 Storage tanks
	.32 Filters, centrifuges, and separators
	.33 Pumps and compressors
	.331 Pumps and compressors
	.332 Motors
	.333 Electric power and controls

Account number	Account title and description of items included
224	.34 Incinerator .35 Baler .351 Hydraulic baler .352 Motor .353 Electric power and controls .354 Supports .36 Cement mixing and handling equipment .37 Drumming station .371 Drumming station equipment .372 Motors .374 Electric power and controls .375 Supports
225	Nuclear fuel handling and storage system .1 Fuel handling tools and equipment .11 Cranes and hoists (including fuel cask crane; excluding those that are integral with service platforms, which are in account 225.13) .111 Overhead crane .12 Fuel handling tools .13 Fuel transfer system .131 Conveyer and tracks .132 Upending frame and winch .14 Refueling machines and accessories .15 Facilities for preshipment encapsulation of spent fuel .2 Remote viewing equipment .21 Electronic system (television) .22 Optical system .23 Special lighting equipment .3 Service platforms, including integral manipulator cranes and hoists, rails, and controls .31 Reactor cavity equipment .32 Spent fuel pit equipment .4 Fuel storage cleaning and inspection .41 New fuel storage rack .42 Spent fuel storage rack .43 Spent fuel storage pool cooling and cleaning system .431 Pumps .4311 Spent fuel pit pump .43111 Pumps and parts .43112 Pump motor .43113 Power controls and instrumentation .43114 Supports .4312 Spent fuel pit skimmer pump .43121 Pump and parts .43122 Pump motor .43123 Power controls and instrumentation .43124 Supports

Account number	Account title and description of items included
225	.432 Heat exchangers
	.4321 Spent fuel pit heat exchanger
	.43211 Shell
	.43212 Tube
	.43213 Insulation
	.43214 Supports
	.433 Demineralizers
	.4331 Spent fuel pit demineralizer
	.434 Filters
	.4341 Spent fuel pit filter and strainer
	.4342 Spent fuel pit skimmer filter and strainer
	.4343 Spent fuel pit skimmer
	.435 Precoat filter system
	.436 Piping, valves, and fittings
	.437 Refueling water storage and cleanup
	.4371 Refueling water storage tank
	.4372 Refueling water purification pump
	.43721 Pump and parts
	.43722 Pump motor
	.43723 Controls and instrumentation
	.43724 Supports
	.44 Spent fuel cleaning equipment
	.441 Cleanup cells
	.442 Storage tanks
	.443 Purification equipment
	.444 Pumps and drives
	.45 Inspection equipment
	.5 Fuel shipping containers
226	Other reactor plant equipment
	.1 Inert gas systems
	.11 Common gas supply and storage facilities (this account used only when there is a common facility to serve two or more of the following accounts)
	.111 Pumps and compressors, drives and controls
	.112 Gas supply and/or storage systems (includes tanks, onsite generating plant, etc.)
	.113 Gas purification systems
	.114 Heat exchangers
	.115 Piping, valves, and fittings
	.116 Insulation
	.117 Foundations, supports, bases, hangers, inserts, and screens
	.12 Reactor core coolant cover gas system (if present; use same breakdown as for account 226.11)
	.13 Reactor blanket coolant cover gas system (this account used only when separate system is provided; when present use same breakdown as for account 226.11)
	.14 Intermediate loop coolant cover gas system (this account used only when separate system is provided; when present use same breakdown as for account 226.11)

Account number	Account title and description of items included
226	.15 Moderator cover gas system (this account used only when separate system is provided; when present use same breakdown as for subaccount 226.11)
	.16 Containment inerting system (if present; use same breakdown as for subaccount 226.11)
	.2 Special heating systems (includes those for heating and/or preheating plant components and also for producing steam as an emergency or auxiliary power source driving either pumps in this account or a generator in account 242.3; type is optional)
	.21 Electrical heating elements and power supply
	.22 Steam or hot water chases
	.23 Heat exchanger, piping, valves, and fittings
	.24 Closed gas loop
	.25 Heater or boiler and accessories (if separate from building heating boiler)
	.3 Coolant receiving, storage, and makeup systems
	.4 Coolant charge, volume control, relief, drain, and recovery systems
	.41 Common facilities (this account used only when there is a common facility to serve two or more of the following accounts)
	.411 Tanks (storage, dump, or head)
	.412 Charging pumps, drives and controls (if not superseded by pumps in accounts 222.142 or 223)
	.413 Piping, valves, fittings (includes relief valves, rupture disks, and special atmospheric and drain systems)
	.414 Insulation
	.415 Foundations, supports, bases, hangers, inserts, and screens
	.42 System for reactor core coolant (use same breakdown as for account 226.41)
	.421 Tanks including volume control tank
	.422 Charging pumps
	.4221 Pump and parts
	.4222 Pump motor
	.4223 Power controls and instrumentation
	.4224 Support
	.423 Piping, valves, fittings (includes relief valves rupture disks, and special atmospheric drain systems)
	.424 Insulation
	.425 Foundations, supports, bases, hangers, inserts, and screens
	.43 System for reactor blanket coolant (if present; use same breakdown as for subaccount 226.41)
	.44 System for intermediate loop coolant (if present; use same breakdown as for subaccount 226.41)
	.5 Coolant purification and chemical treatment
	.51 Common facilities (this account used only when there is a common facility to serve two or more of the following accounts)
	.511 Pumps, fans, compressors; drives and controls
	.512 Miscellaneous tanks (mixing, surge, head, resin, coolant, chemical storage, etc.), piping, valves, fittings, and insulation
	.513 Heat exchangers, including both regenerative and non-regenerative types
	.514 Ion-exchange systems
	.515 Filter systems (including cold and freeze traps)

Account number	Account title and description of items included
226	.516 Chemical treatment and degasifier systems
	.517 Fractionating tower and catalytic hydro-cracker
	.518 Sampling and blowdown systems
	.519 Foundations, supports, bases, hangers, inserts, and screens
	.52 System for reactor core coolant
	.521 Pumps, fans, compressors, drives and controls
	.5211 Gas stripper feed pump
	.52111 Pump and parts
	.52112 Pump motor
	.52113 Electric power controls and instrumentation
	.52114 Supports
	.5212 Monitor tank pumps
	.52121 Pump and parts
	.52122 Pump motor
	.52123 Electric power controls and instrumentation
	.52124 Supports
	.5213 Hold-up tank recirculating pump
	.52131 Pump and parts
	.52132 Pump motor
	.52133 Electric power, controls and instrumentation
	.52134 Supports
	.5214 Concentrate holding tank transfer pump
	.52141 Pump and parts
	.52142 Pump motor
	.52143 Electric power, controls and instrumentation
	.52144 Supports
	.5215 Boric acid pumps
	.52151 Pump and parts
	.52152 Pump motor
	.52153 Electric power controls and instrumentation
	.52154 Supports
	.5216 Sump pumps
	.52161 Pumps and parts
	.52162 Pump motor
	.52163 Electric power controls and instrumentation
	.52164 Supports
	.522 Miscellaneous tanks (mixing, surge, head, resin, coolant, chemical storage, etc.) piping fittings and insulation
	.5221 Boric acid tanks
	.52211 Tank
	.52212 Heaters
	.5222 Boric acid batch tank
	.5223 Chemical mixing tank
	.5224 Resin fill tank
	.5225 Hold-up tanks
	.5226 Monitor tanks
	.5227 Concrete holding tank
	.52271 Tank
	.52272 Heater

Account number	Account title and description of items included
226	.5228 Primary water storage tank
	.52281 Tank
	.52282 Heater
	.5229 Piping, valves, fittings, and insulation
	.523 Heat exchangers
	.5231 Regenerative heat exchangers
	.52311 Shell
	.52312 Tube
	.52313 Insulation
	.52314 Support
	.5232 Non-regenerative heat exchanger
	.52321 Shell
	.52322 Tube
	.52323 Insulation
	.52324 Supports
	.5233 Excess letdown heat exchanger
	.52331 Shell
	.52332 Tube
	.52333 Insulation
	.52334 Support
	.524 Ion-exchange systems
	.5241 Mixed-bed demineralizer
	.5242 Deborating demineralizer
	.5243 Base-removal ion exchanger
	.5244 Cation-removal ion exchanger
	.5245 Evaporator condensate demineralizer
	.525 Filter systems (including cold and freeze traps)
	.5251 Condensate filter
	.5252 Reactor coolant filter
	.5253 Concentrate filter
	.5254 Seal water filter
	.5255 Boric acid filter
	.526 Chemical treatment and degasifier systems
	.527 Boric acid evaporator package
	.528 Sampling and blowdown system
	.5281 Sample heat exchanger
	.52811 Shell
	.52812 Tube
	.52813 Insulation
	.5282 Sample vessels
	.5283 Sample sink and hood
	.529 Foundations, supports, bases, hangers, inserts, and screens
	.53 System for reactor blanket coolant (if present; use same breakdown as for subaccount 226.51)
	.54 System for intermediate loop coolant (if present; use same breakdown as for subaccount 226.51)
	.6 Fluid leak detection systems (type is optional, and includes systems for detecting leakage at components, such as reactor vessel closure, and in the vicinity of pipes and equipment)
	.61 Moderator

Account number	Account title and description of items included
226	.62 Reactor core coolant .63 Reactor blanket coolant .64 Intermediate loop coolant .65 Cover gas .66 Steam or other vapor .67 Other
	.7 Auxiliary cooling systems for reactor plant components and systems Circuits for cooling various reactor plant components and systems. These are *intermediate coolant* circuits which serve to isolate the reactor plant from the heat rejection circuit (such as the auxiliary cooling water circuit of account 232.23) to which they transfer heat. Heat exchangers at the components being cooled are included in the accounts for the cooled components, but other components handling the intermediate coolant, including the heat exchangers to the receiving system, are in this auxiliary cooling system account. Typical reactor plant components cooled by auxiliary cooling systems are: pumps (main coolant, emergency core cooling, safety injection, charging, containment spray); heat exchangers (primary coolant or waste letdown, containment ventilation, seal water); waste evaporators, condensers, and compressors; shielding; moderator; reactor vessel supports; and spent fuel storage pool. .71 Pumps, drives, and controls .711 Pump and parts .712 Pump motor .713 Electric power controls and instrumentation .714 Supports .72 Storage, surge, and head tanks .73 Piping, valves, and fittings .74 Insulation .75 Foundations, supports, bases, hangers, inserts, and screens .76 Heat exchangers (to transfer heat *from* this intermediate circuit) .761 Shell .762 Tubes .763 Insulation .764 Supports
	.8 Maintenance equipment (except for items in accounts 226.84 and 226.85, excludes equipment for refueling which is covered in account 225) .81 Remotely controlled tools .82 Radioactive maintenance facilities .83 Portable shielding .84 Tools and equipment for reactor vessel .841 Closure stud tensioners, elongation measuring devices, stud handling tool, nut wrench, and head guide studs .842 Seal weld cutting and welding machine .843 Lifting fixtures .844 Other .85 Tools and fixtures for reactor core .851 Lifting devices and fixtures .852 Special equipment for removing pressure tubes/calandria tubes .853 Other .86 Decontamination equipment

Account number	Account title and description of items included
226	.87 Equipment inspection tools and devices, including optical, electronic, and ultrasonic equipment
227	Instrumentation and control
	.1 Reactor and process instrumentation and control equipment
	.11 Operator bench and control boards in control room (includes instruments, indicators, alarms, recorders, and controls thereon)
	.12 Local control boards (includes instruments, indicators, alarms, recorders, and controls thereon)
	.13 Reactor power control system (includes associated cabinets and power supplies): Interlock logic Analog computation devices and function generators Actuators and controllers (excludes control mechanisms and drives, which are included in account 221.2)
	.14 Reactor radiation detection equipment: Electronic systems (in-core and/or out-of-core) Passive flux integrating systems (e.g., flux wire)
	.15 Reactor coolant property sensing equipment (includes sensors and transmitters): Temperature Pressure Flow rate Density (or void)
	.16 Other sensing systems associated with reactor control: Control element position Moderator level Moderator composition
	.17 Control systems for all other process and auxiliary systems in account 22 (includes specifically boiler feed flow controller and generally all other controls and regulators for level, flow, temperature, etc.; excludes systems that perform monitoring/alarm function only, which are included in subaccount 227.3) .171 Moderator/reflector systems (Reference: account 221.3) .172 Main heat transfer and transport systems (Reference: account 222) .173 Safeguards cooling systems (Reference: account 223) .174 Radioactive waste treatment and disposal (Reference: account 224) .175 Nuclear fuel handling and storage systems (Reference: account 225) .176 Miscellaneous reactor plant equipment systems (Reference: accounts 221.4 and 226) .177 Fossil-fueled boiler superheater systems (Reference: account 228) .178 Irradiation facilities systems (Reference: account 229)
	.2 Automatic monitoring and computation equipment (for equipment and systems in account 22 and in other portions of the power plant if the monitoring/control equipment is common; similar devices for use in turbine plant or elsewhere, if separable, are included in account 236) .21 Automatic scanning systems .22 Print-out, plotting, and data-logging equipment .23 Analog and/or digital equipment for data processing and/or computation
	.3 Monitoring systems (excludes equipment associated with monitoring reactor radiation levels, which is included in subaccount 227.1, and also excludes equipment for monitoring radiation levels in the plant environment, which is included in account 254.5)

Account number	Account title and description of items included
227	.31 Heat transport/transfer system and other process systems radiation monitors (includes those for coolants, steam, off-gas, and liquid waste discharges)
	.32 Personnel and area radiation monitors within buildings and portable survey instruments
	.33 Primary system integrity monitors (includes strain sensing systems and acoustic sensing systems)
	.34 Equipment operational surveillance systems (includes vibration/acoustic, temperature, and pressure monitors)
	.35 In-core fuel and/or core structure monitors (includes temperature, strain, and vibration monitors)
	.36 Valve position sensors
	.37 Failed fuel element detection equipment
	.38 Containment leakage monitoring systems
	.39 Containment closure position sensors (includes valves and access door position sensors)
	.4 Isolated indicating and recording gauges, meters, and instruments
	.5 Control and instrument piping, tubing, and wiring
231	Turbine Plant
	.1 Turbine generator
	.11 Turbine
	.111 Turbine
	.112 Insulation
	.12 Generator
	.2 Foundations
	.21 Concrete
	.22 Structural steel
	.3 Standby exciters
	.4 Lubrication system
	.41 Purification system
	.411 Transfer pumps
	.412 Motors
	.413 Electric power and controls
	.414 Supports
	.42 Storage tanks
	.421 Tanks
	.422 Interconnecting piping
	.43 Fire protection equipment
	.5 Gas systems
	.51 Hydrogen system
	.52 CO_2 system
	.6 Reheaters and moisture separators
	.61 Shell
	.62 Tubes
	.63 Supports
	.64 Insulation

Account number	Account title and description of items included
232	Heat rejection systems
	.1 Water intake common facilities
	.11 Traveling screens, drives, and controls
	.12 Screen wash pumps, drives, and controls
	.121 Pumps
	.122 Motors
	.123 Electric power and controls
	.124 Supports
	.13 Trash rack (bar screen) and trash rake, including drives and controls
	.14 Piping, valves, and fittings (includes lines for flow recirculation, deicing, dewatering or draining, makeup, and screen washing)
	.15 Water treatment systems
	.151 Chlorine injection system (includes storage tanks)
	.152 Water treatment other than chlorination
	.16 Gates and stop logs
	.17 Dewatering, makeup, deicing, or primary pumps, drives, and controls
	.171 Pumps
	.172 Motors
	.173 Electric power and controls
	.174 Supports
	.2 Circulating water systems (pressurized portions to and from heat exchanger equipment; unpressurized portion is included in account 214.3)
	.21 Condenser cooling water supply circuit
	.211 Pumps, drive and controls
	.2111 Pump and parts
	.2112 Pump motor
	.2113 Electric power controls and instrumentation
	.2114 Supports
	.212 Valves, fittings, and expansion units
	.213 Lines:
	Metal pipe
	Concrete (pipe or tunnel)
	Excavation and back-fill
	.22 Condenser cooling water discharge circuit
	.221 Valves, fittings, and expansion units
	.222 Lines:
	Metal pipe
	Concrete (pipe or tunnel)
	Excavation and back-fill
	.23 Auxiliary cooling water circuit. This is the circuit that circulates raw water to the intermediate cooling circuits in the reactor plant (account 226.7). A part of the circuit also circulates raw water directly to other plant equipment: to air cooling equipment in the reactor building and containment (account 212.224); to emergency and auxiliary generators (account 242.32); to turbine and generator auxiliaries and coolers (accounts 235.2, 235.6, 231.1, 231.4, and 231.5); to air conditioning, ventilation, and compressed air systems (accounts 213 to 218 and 252.1); and to provide backup for some emergency cooling loads (such as containment spray and spent fuel storage pool). Note that account 235.3 may be

Account number	Account title and description of items included
232	redundant to portions of this account. Note also that heat exchangers are always included in the account for the component or system being cooled. In plants using cooling towers for ultimate heat rejection, the coolant circulated in this circuit may be that circulated through the cooling towers rather than raw water.
	.231 Pumps, drives, and controls
	.2311 Pumps and parts
	.2312 Pump motor
	.2313 Electric power controls and instrumentation
	.2314 Supports
	.232 Valves, fittings, and expansion units
	.233 Lines (supply and discharge):
	.2331 Metal pipe
	.2332 Concrete (pipe or tunnel)
	.2333 Excavation and back-fill
	.3 Cooling towers (includes both dry and evaporative types)
	.31 Foundations and basin
	.32 Piping, valves, and fittings (other than those included in previous subaccounts)
	.33 Heat exchangers
	.34 Tower superstructure
	.35 Fans, drives, and controls
	.4 Other systems that reject heat to the atmosphere (includes those using air to supplement, or to replace, circulating water system)
	.41 Fans, drives, and controls
	.42 Ducts
	.43 Foundations, supports, and inserts
233	Condensing system
	.1 Condensers
	.11 Condenser shells and associated components (includes flexible connection to turbine exhausts, protective coatings, and internals to be compatible with turbine-bypass system in account 233.4)
	.12 Tubing
	.13 Special duct connections to turbine exhaust
	.14 Special exhaust valves or other turbine-isolating means
	.15 Insulation
	.16 Foundations, supports, bases, inserts, and screens
	.2 Condensate system
	.21 Pumps, drives and controls
	.211 Main condensate
	.2111 Pump
	.2112 Motor
	.2113 Electrical power supply and controls
	.212 Condensate booster
	.2121 Pump
	.2122 Motor
	.2123 Electrical power supply and controls

Account number	Account title and description of items included
233	.213 Condensate transfer
	.2131 Pump
	.2132 Motor
	.2133 Electrical power supply and controls
	.22 Condensate storage tanks (includes protective coatings and fittings)
	.23 Piping, valves, and fittings (main condensate piping segments between condenser hotwell and final feedwater pump and drain and vent piping for equipment in account 233)
	.24 Insulation
	.25 Foundations, supports, hangers, bases, inserts, and screens
	.3 Gas removal system (this account may be associated with the gaseous wastes and off-gas processing system, account 224.2)
	.31 Steam-jet ejectors, with inter- and after-condensers
	.32 Priming ejectors
	.33 Vacuum pumps, drives and controls
	.331 Pumps
	.332 Motors
	.333 Electric power and controls
	.34 Piping, valves, and fittings
	.35 Insulation
	.36 Foundations, supports, hangers, bases, inserts, and screens
	.4 Turbine-bypass system
	.41 Actuating valves
	.42 Pressure-reducing assemblies
	.43 Piping, manifolds, and fittings
	.44 Desuperheating system
	.45 Insulation
	.46 Hangers, foundations, supports, bases, inserts, and screens
234	Feed-heating system
	.1 Regenerative heat exchangers
	.11 Closed heaters
	.12 Open heaters (includes deaerating type)
	.13 Insulation
	.14 Foundations, supports, bases, inserts, and screens
	.2 Pumps
	.21 Main feed pumps, drives, and controls
	.211 Pumps
	.212 Drives
	.213 Controls
	.22 Auxiliary (startup, emergency, and reserve) feed pumps, drives, and controls
	.221 Pumps
	.222 Drives
	.223 Electrical power and controls
	.23 Drains, pumps, drives, and controls
	.231 Pumps
	.232 Drives
	.233 Electrical power and controls

Account number	Account title and description of items included
234	.24 Insulation
	.25 Foundations, supports, bases, inserts, and screens
	.26 Lubrication oil purification equipment
	.3 Piping and tanks
	.31 Feed piping (segments between feedwater pump and steam generator)
	.32 Drain coolers
	.33 Drains and flash tanks
	.34 Extraction, drain, and vent piping; valves and fittings (for components in account 234 only; includes flow control valves)
	.35 Insulation
	.36 Hangers, supports, and inserts
235	Other turbine plant equipment
	.1 Main steam (or other vapor) piping
	.11 Main steam piping (between reactor, steam generator, boiler, containment or plant isolation valves, and turbine stop valves)
	.12 Reheat and separator piping, valves and fittings (includes steam piping, relief valves, and drain control valves)
	.13 Insulation
	.14 Hangers, supports, foundations, bases, inserts, and screens
	.2 Turbine auxiliaries
	.21 Drain coolers
	.22 Drains and flash tanks
	.23 Gland steam condensers
	.24 Gland seal water system
	.25 Drip, drains, and vent piping, valves, and fittings (for components in accounts 231.1, 235.1, and 235.2)
	.26 Insulation
	.27 Hangers, supports, foundations, bases, inserts and screens
	.3 Auxiliary cooling systems
	Circuits for cooling various turbine plant and electric plant components and high-voltage ac systems in all structures except reactor containment. Such components typically include turbine-generator unit lubrication oil, generator hydrogen and stator cooling systems, air compressors, feed pumps, etc. (This account may be redundant with account 232.23 for some cooling circuits, in which case use of account 232.23 is preferable.
	.31 Pumps, drives, and controls
	.311 Pump and parts
	.312 Pump motor
	.313 Electric power controls and instrumentation
	.314 Supports
	.32 Storage, surge, and head tanks
	.33 Piping, valves, and fittings (includes drain and vent piping for all components in account 235.3)
	.34 Insulation
	.35 Hangers, supports, foundations, inserts, and screens
	.36 Heat exchangers

Account number	Account title and description of items included
235	.4 Makeup treatment systems
	.41 Evaporator system
	.42 Ion-exchange system
	.43 Filter and separator systems
	.44 Pumps, drives, and controls
	.441 Pump and parts
	.442 Pump motor
	.443 Electric power controls and instrumentation
	.444 Supports
	.45 Piping, valves, and fittings
	.46 Storage tanks (includes protective coatings and fittings)
	.47 Hangers, foundations, supports, bases, inserts, and screens
	.48 Heaters
	.5 Chemical treatment and condensate purification systems
	.51 Chemical storage and addition equipment (for boiler treatment)
	.52 Condensate demineralizer and filter system
	.53 Condensate and demineralized stored water treatment system
	.54 Resin storage, regeneration, and addition systems
	.55 Boiler and steam generator blowdown and fluid sampling systems
	.56 Pumps, drives, and controls
	.561 Pump and parts
	.562 Pump motor
	.563 Electric power controls and instrumentation
	.564 Supports
	.57 Piping, valves, and fittings
	.58 Insulation
	.59 Hangers, foundations, supports, bases, inserts, and screens
	.6 Central lubrication service system
	Central system which stores, transfers, purifies, and cools lubricating oil for more than one equipment item, such as a system that serves various plant auxiliary turbine drives (and perhaps also the main turbine-generator units). Lubrication systems that serve single equipment items exclusively are included with that equipment (e.g., account 231.4). Use same breakdown as shown for account 231.4.
236	Instrumentation and control
	Turbine plant control systems (includes panel-mounted supervisory instruments and controls located in the control room or locally, control boards, isolated controllers, and isolated recording gages, meters, and instruments; excludes items normally furnished with turbine-generator unit, which are included in account 231.1)
	.1 Process instrumentation and control equipment
	.11 Operator bench and control boards in control room (includes instruments, indicators, alarms, recorders, and controls thereon)
	.12 Local control boards (includes instruments, recorders, indicators, alarms, and controls thereon)
	.13 Control systems for process and auxiliary systems in account 23 (includes controllers, transmitters, and sensors; excludes boiler feed flow controllers, which are included in account 227)

Account number	Account title and description of items included
236	.2 Automatic monitoring and control equipment (for equipment and systems in account 23 if separable from similar devices for use in reactor plant; all data-processing equipment is included in account 227)
	.21 Automatic scanning systems
	.22 Printout and data-logging equipment
	.23 Analog and digital equipment for plant or system control
	.3 Isolated indicating and recording gages, meters, and instruments
	.4 Control and instrument piping, tubing, and wiring
24	ELECTRIC PLANT EQUIPMENT
	Electric motor drives are included with the equipment and devices being driven. Separate control panels and individually mounted local control devices for motors are included in the same account as the motor and driven equipment.
241	Switchgear
	.1 Generator circuits
	.11 Generator switchgear (includes circuit breakers, disconnecting switches, operating mechanisms and interlocks, integral metering and protective equipment, and accessories and enclosure for this equipment)
	.12 Generator neutral grounding equipment
	.13 Generator current and potential transformers (includes housings)
	.14 Generator surge arresters or other protective equipment (includes housings)
	.15 Excitation switchgear for main generators (includes voltage regulators, rheostats, discharge resistors, instruments, control devices, and housings)
	.16 Special screens, bases, foundations, inserts, or supports for above-listed equipment
	.2 Station service
	.21 Station switchgear for all types of service and all voltage classes (includes circuit breakers, disconnecting switches, operating mechanisms and interlocks, integral metering and protective equipment, current limiting reactors, current and potential transformers, voltage regulators, compensators, fault ground buses, and accessories and enclosures for this equipment)
	.22 Station motor control centers (centrally located, locally mounted, isolated motor-control units are included with the motor being controlled)
	.23 System neutral grounding devices
	.24 Separately mounted station service devices, such as instrument transformers and surge arresters
	.25 Special screens, bases, foundations, inserts, or supports for above-listed equipment
242	Station service equipment
	Voltage conversion equipment for station service power and lighting and emergency power sources (includes auxiliary generators and batteries and charging equipment)
	.1 Station service and startup transformers
	.11 Station service transformers
	.12 Station startup transformers
	.13 Foundations, walls, and related structures
	.14 Voltage regulation equipment
	.15 Insulating oil storage and treating equipment (excludes such equipment serving only the transmission plant substation equipment)

Account number	Account title and description of items included
242	.2 Low voltage unit substations and lighting transformers
	.21 Unit substations and transformers
	.22 Special screens, bases, foundations, inserts, or supports
	.3 Auxiliary power sources
	.31 Battery systems
	.311 Batteries
	.312 Chargers
	.32 Auxiliary generators (type is optional)
	.321 Diesel-engine/generator units (includes fuel, cooling, starting, and exhaust systems)
	.322 Gas-turbine/generator units (includes fuel cooling, starting and exhaust systems)
	.323 Steam-turbine/generator units (excludes boiler and accessories that are included in account 226.2)
	.33 Motor-generator sets
243	Switchboards
	Bench, relay, and recording and indicating instrument and supervisory control boards installed in the control room, (includes devices mounted on the boards; auxiliary power, battery, and signal system boards)
	.1 Main control board for electric systems (includes main generators)
	.11 Operator's benchboard and control board
	.12 Protective relay panels
	.13 Recording and indicating instrument panels
	.14 Special screens, bases, inserts, or supports
	.2 Auxiliary power and signal boards
	.21 Power distribution panels
	.22 Battery control and DC distribution panels
	.23 Separately mounted annunciator panels
	.24 Diesel or gas-turbine auxiliary generator control panels
	.25 Motor-generator set control panels
	.26 Special screens, bases, inserts, or supports
244	Protective equipment
	.1 General station grounding system
	.11 Ground conductors and connectors for equipment, piping, and structural members
	.12 Ground wells, mats, and rods (includes excavation and backfill)
	.2 Fire protection systems
	Special fire-extinguishing systems exclusively for electrical equipment, including generator (e.g., CO_2 systems)
245	Electrical structures and wiring containers
	.1 Concrete cable tunnels, trenches, and envelopes
	Tunnels and/or trenches for main generator circuit extending into the switchyard or for station service circuits between buildings. (When tunnels are part of a building or serve a dual purpose, electrical and non-electrical, they are to be included under the appropriate building account in account 21.)

Account number	Account title and description of items included
245	.11 Excavation and backfill .12 Forms, reinforcing, and concrete .13 Hangers, cable racks, etc. .14 Tunnel lighting, ventilation, and location markers .15 Manholes
	.2 Cable trays and supports
	.3 Conduit
	.4 Other structures Pipe and steel frames and supports, barriers, compartments, and structures for housing and supporting cable, bus, and electrical equipment, other than that already specified
246	Power and control wiring
	.1 Generator circuits wiring Bus (and enclosure) or cable between generator and switching equipment, between switching equipment and terminals (at generator voltage) of transmission system equipment or station servicing equipment, and between generator and generator neutral grounding equipment
	.2 Station service power wiring All power cables and bus to and from station service equipment, switchgear, and switchboards .21 High-voltage cable and bus (1 kV and above) .22 Low-voltage cable and bus (below 1 kV)
	.3 Control wiring All control cables for accessory electric equipment, motor control circuits, and associated protective and monitoring devices (excludes reactor plant and turbine plant control/instrumentation systems, which are included in accounts 22 and 23, respectively)
	.4 Containment penetrations
25	MISCELLANEOUS PLANT EQUIPMENT
251	Transportation and lifting equipment
	.1 Cranes, hoists, monorails, and conveyors (includes equipment for general station use, except fuel handling cranes in account 225, conveyor for the solid waste drumming station in account 224.3, and coal and ash handling equipment in account 228, and any similar equipment in account 229) .11 Turbine building crane .111 Bridge and trolley .112 Crane rails and special supports .113 Trolley conductors or trail cable and all supporting hardware .114 Electrical connections from extremity of feeder circuit (includes any special junction boxes) .12 Main reactor building crane (use breakdown shown for account 251.11) .13 Other cranes, hoists, monorails, and conveyors (list a separate account subdivision for each major item, but combine minor items into a single subdivision; where applicable, use breakdown shown for account 251.11)

Account number	Account title and description of items included
251	.2 Railway equipment
	.21 Locomotives
	.22 Rolling stock
	.3 Roadway equipment
	.31 Trucks
	.32 Cranes
	.33 Fork-lift trucks and pallet trucks
	.34 Tractors
	.35 Trailers
	.36 Automobiles
	.4 Watercraft
	.41 Motorized boats
	.42 Barges and other unpowered craft
	.5 Fuel storage and vehicle maintenance equipment
252	Air and water service systems
	.1 Air systems
	Compressed air and vacuum cleaning systems for general station use (includes service air and instrument air; compressed air systems exclusively serving substation switchgear breakers are included in the transmission plant)
	.11 Compressed air
	.111 Compressors and drives, dryers, filters, receivers, and other compressed air system accessories
	.112 Piping and fittings
	.12 Subatmospheric-pressure air
	.121 Vacuum cleaning blowers, dust catchers, and other vacuum cleaning system accessories
	.122 Piping and fittings
	.2 Water systems
	Service, domestic, and fire protection water systems (excludes makeup water treatment/purification facilities specifically for either reactor coolant or turbine working fluid, since these systems are included in accounts 226.3 and 235.4, respectively)
	.21 Water supply pumps, including drives and controls (type is optional and may include river, lake, or sea water pumps; or deep wells and pumps)
	.22 Fire pumps, drives, and accessories
	.221 Main system
	.222 Auxiliary or jockey system
	.23 Water conditioning system (includes filter bed, coagulator, etc.)
	.24 Storage tanks and/or reservoirs
	.241 Raw water
	.242 Treated water
	.243 Domestic water
	.25 Station service pumps, drives, and accessories
	.26 Domestic water treating equipment
	.27 Domestic water pumps, drives and accessories
	.28 Water heating equipment
	.29 Water distribution systems, indoor and outdoor (includes fire hydrants; all piping, valves, and fittings; and connection to an existing system, if made)
	.3 Auxiliary heating system

Account number	Account title and description of items included
253	Communications equipment
	.1 Local communication systems
	.11 General purpose telephone system (includes connection to commercial system)
	.12 Special telephone circuits (includes sound-powered systems)
	.13 Wireless facilities (microwave and radio)
	.14 Telegraph and telex facilities
	.15 Public address systems and inter-communication systems
	.2 Signal systems
	.21 Fire alarm system (except for indoor portions included in building accounts)
	.22 Security alarm and watchman tour systems
	.23 Evacuation alarm system
	.24 Coded-type call systems
	.25 Other signal systems
254	Furnishings and fixtures
	.1 Safety equipment
	.11 Fire trucks and accessories
	.12 Portable fire extinguishers
	.13 Respirators and other rescue equipment
	.14 First aid stations
	.15 Hospital or infirmary equipment
	.2 Shop, laboratory, and test equipment
	.21 Mechanical
	.211 Portable and hand tools
	.212 Machine shop
	.213 Welding shop
	.214 Pipe shop
	.215 Sheet metal shop
	.22 Electrical
	.221 Electrical shop
	.222 Instrument shop
	.223 Portable and hand tools
	.23 Chemical laboratory
	.3 Office equipment and furnishings
	.4 Change room equipment
	.41 Lockers, shelves, benches, etc.
	.42 Laundry facilities
	.5 Environmental monitoring equipment
	.51 Radiological: Airborne or direct-transmitted Waterborne
	.52 Meteorological
	.53 Other (includes thermal and/or biological pollution of groundwater)
	.6 Dining facilities (if present)
	.61 Kitchen equipment
	.62 Dining room furnishings

Account number	Account title and description of items included
254	.7 Cleaning equipment
	.71 Cleaners, mops, polishers, etc.
	.72 Janitorial supplies

APPENDIX B

COMPILATION OF COMPOSITE MATERIALS OF CONSTRUCTION FOR A TYPICAL 1000-MWe PWR

ACCOUNT	SYSTEM[a]	QUANTITIES				
		ALUMINUM (METRIC TONS)	BABBITT METAL (METRIC TONS)	BRASS (METRIC TONS)	BRONZE (METRIC TONS)	CARBON STEEL (METRIC TONS)
	ENTIRE PLANT	18.14	0.42	10.10	25.14	32731.27
21	STRUCTURES AND SITE	1.19	0.0	2.93	0.21	16519.30
211	SITE IMPROVEMENTS	0.05	0.0	0.0	0.0	1692.94
212	REACTOR BUILDING	0.14	0.0	0.34	0.02	7264.23
213	TURBINE BUILDING	0.82	0.0	1.43	0.07	3641.16
214	INTAKE AND DISCHARGE	0.0	0.0	0.02	0.00	333.66
215	REACTOR AUXILIARIES	0.05	0.0	0.15	0.01	1358.73
217	FUEL STORAGE	0.06	0.0	0.10	0.00	364.60
218	MISCELLANEOUS BUILDINGS	0.08	0.0	0.88	0.10	1863.99
22	REACTOR PLANT EQUIPMENT	5.22	0.0	0.0	0.54	3444.93
221	REACTOR EQUIPMENT	0.0	0.0	0.0	0.0	429.99
222	MAIN HEAT TRANSFER SYSTE	0.0	0.0	0.0	0.04	1686.54
223	SAFEGUARDS COOLING SYSTE	0.0	0.0	0.0	0.13	274.15
224	RADWASTE SYSTEM	0.0	0.0	0.0	0.02	35.20
225	FUEL HANDLING SYSTEMS	0.0	0.0	0.0	0.01	81.98
226	OTHER REACTOR EQUIPMENT	0.0	0.0	0.0	0.35	823.53
227	INSTRUMENTATION AND CONT	5.22	0.0	0.0	0.0	113.53
23	TURBINE PLANT EQUIPMENT	1.17	0.28	6.89	21.48	10958.35
231	TURBINE-GENERATORS	0.0	0.27	0.0	19.74	4138.66
232	HEAT REJECTION SYSTEMS	0.0	0.0	0.36	0.72	2501.06
233	CONDENSING SYSTEMS	0.0	0.0	1.50	0.24	1359.80
234	FEED-HEATING SYSTEM	0.0	0.00	3.89	0.32	1367.76
235	OTHER EQUIPMENT	0.0	0.00	1.13	0.45	1541.28
236	INSTRUMENTATION AND CONT	1.17	0.0	0.0	0.0	49.80
24	ELECTRIC PLANT EQUIPMENT	4.10	0.14	0.0	2.48	965.46
241	SWITCHGEAR	0.0	0.0	0.0	0.74	30.40
242	STATION SERVICE EQUIPMEN	0.02	0.14	0.0	0.72	654.12
243	SWITCHBOARDS	4.08	0.0	0.0	0.05	86.98
244	PROTECTIVE EQUIPMENT	0.0	0.0	0.0	0.45	5.90
245	STRUCTURES AND ENCLOSURE	0.0	0.0	0.0	0.0	112.49
246	POWER AND CONTROL WIRING	0.0	0.0	0.0	0.51	75.57
25	MISCELLANEOUS EQUIPMENT	6.46	0.0	0.29	0.43	843.23
251	TRANSPORTATION AND LIFTI	0.0	0.0	0.0	0.0	529.34
252	AIR AND WATER SERVICE SY	0.0	0.0	0.29	0.0	232.56
253	COMMUNICATIONS EQUIPMENT	0.34	0.0	0.0	0.0	4.67
254	FURNISHINGS AND FIXTURES	6.12	0.0	0.0	0.43	76.66

[a]THE LAST WORD IN SOME TITLES IS TRUNCATED BECAUSE OF SPACE LIMITATIONS.

APPENDIX B (CONTINUED)

ACCOUNT	SYSTEM[a]	QUANTITIES				
		CONCRETE (METRIC TONS)	COPPER (METRIC TONS)	GALVANIZED IRON (METRIC TONS)	INCONEL (METRIC TONS)	INSULATION (METRIC TONS)
	ENTIRE PLANT	179681.06	694.06	1257.46	124.24	921.63
21	STRUCTURES AND SITE	146472.19	33.11	814.23	0.0	21.22
211	SITE IMPROVEMENTS	4887.23	1.53	17.89	0.0	0.0
212	REACTOR BUILDING	54328.98	9.29	301.27	0.0	15.92
213	TURBINE BUILDING	15930.64	1.57	196.41	0.0	5.31
214	INTAKE AND DISCHARGE	13215.10	0.23	3.63	0.0	0.0
215	REACTOR AUXILIARIES	33875.50	0.77	109.77	0.0	0.0
217	FUEL STORAGE	7163.29	0.32	43.36	0.0	0.0
218	MISCELLANEOUS BUILDINGS	17071.41	19.41	141.91	0.0	0.0
22	REACTOR PLANT EQUIPMENT	981.47	50.43	5.51	124.24	194.12
221	REACTOR EQUIPMENT	135.50	6.80	0.0	0.09	0.0
222	MAIN HEAT TRANSFER SYSTE	732.44	9.80	1.63	124.15	30.42
223	SAFEGUARDS COOLING SYSTE	0.0	2.87	1.09	0.0	11.25
224	RADWASTE SYSTEM	0.0	0.23	0.82	0.0	106.12
225	FUEL HANDLING SYSTEMS	12.82	0.18	0.24	0.0	0.38
226	OTHER REACTOR EQUIPMENT	100.71	1.50	1.73	0.0	45.94
227	INSTRUMENTATION AND CONT	0.0	29.04	0.0	0.0	0.0
23	TURBINE PLANT EQUIPMENT	30506.26	51.37	4.67	0.0	706.29
231	TURBINE-GENERATORS	11352.87	35.18	0.48	0.0	106.41
232	HEAT REJECTION SYSTEMS	15143.26	3.04	2.18	0.0	0.0
233	CONDENSING SYSTEMS	1281.78	1.27	0.61	0.0	307.13
234	FEED-HEATING SYSTEM	109.87	1.20	0.54	0.0	165.99
235	OTHER EQUIPMENT	2618.48	0.70	0.86	0.0	126.75
236	INSTRUMENTATION AND CONT	0.0	9.98	0.0	0.0	0.0
24	ELECTRIC PLANT EQUIPMENT	1263.46	556.53	431.05	0.0	0.0
241	SWITCHGEAR	0.0	2.78	1.36	0.0	0.0
242	STATION SERVICE EQUIPMEN	128.18	19.06	8.57	0.0	0.0
243	SWITCHBOARDS	0.0	13.47	0.0	0.0	0.0
244	PROTECTIVE EQUIPMENT	0.0	39.01	0.0	0.0	0.0
245	STRUCTURES AND ENCLOSURE	1135.29	0.0	421.11	0.0	0.0
246	POWER AND CONTROL WIRING	0.0	482.21	0.0	0.0	0.0
25	MISCELLANEOUS EQUIPMENT	457.78	2.61	2.00	0.0	0.0
251	TRANSPORTATION AND LIFTI	0.0	0.47	0.0	0.0	0.0
252	AIR AND WATER SERVICE SY	457.78	1.17	0.0	0.0	0.0
253	COMMUNICATIONS EQUIPMENT	0.0	0.98	0.64	0.0	0.0
254	FURNISHINGS AND FIXTURES	0.0	0.0	1.36	0.0	0.0

[a]THE LAST WORD IN SOME TITLES IS TRUNCATED BECAUSE OF SPACE LIMITATIONS.

APPENDIX B (CONTINUED)

ACCOUNT	SYSTEM[a]	QUANTITIES				
		LEAD (METRIC TONS)	NICKEL (METRIC TONS)	PAINT (CUBIC METERS)	SILVER (METRIC TONS)	STAINLESS STEEL (METRIC TONS)
	ENTIRE PLANT	46.40	0.69	17418.00	0.53	2080.09
21	STRUCTURES AND SITE	33.07	0.07	17210.00	0.05	28.59
211	SITE IMPROVEMENTS	0.68	0.0	0.0	0.0	0.0
212	REACTOR BUILDING	0.0	0.0	5000.00	0.01	5.72
213	TURBINE BUILDING	0.0	0.0	4000.00	0.01	0.0
214	INTAKE AND DISCHARGE	0.0	0.0	0.0	0.00	0.0
215	REACTOR AUXILIARIES	0.0	0.01	1430.00	0.00	0.0
217	FUEL STORAGE	0.0	0.0	480.00	0.00	21.06
218	MISCELLANEOUS BUILDINGS	32.39	0.07	6300.00	0.03	1.81
22	REACTOR PLANT EQUIPMENT	4.54	0.0	8.00	0.04	1154.60
221	REACTOR EQUIPMENT	0.0	0.0	0.0	0.0	275.10
222	MAIN HEAT TRANSFER SYSTE	0.0	0.0	8.00	0.01	202.48
223	SAFEGUARDS COOLING SYSTE	0.0	0.0	0.0	0.01	199.08
224	RADWASTE SYSTEM	0.0	0.0	0.0	0.01	31.91
225	FUEL HANDLING SYSTEMS	0.0	0.0	0.0	0.00	66.96
226	OTHER REACTOR EQUIPMENT	4.54	0.0	0.0	0.01	230.34
227	INSTRUMENTATION AND CONT	0.0	0.0	0.0	0.0	148.73
23	TURBINE PLANT EQUIPMENT	0.0	0.0	0.0	0.04	883.16
231	TURBINE-GENERATORS	0.0	0.0	0.0	0.00	129.90
232	HEAT REJECTION SYSTEMS	0.0	0.0	0.0	0.02	9.07
233	CONDENSING SYSTEMS	0.0	0.0	0.0	0.00	392.32
234	FEED-HEATING SYSTEM	0.0	0.0	0.0	0.01	221.23
235	OTHER EQUIPMENT	0.0	0.0	0.0	0.01	89.36
236	INSTRUMENTATION AND CONT	0.0	0.0	0.0	0.0	41.28
24	ELECTRIC PLANT EQUIPMENT	6.80	0.61	0.0	0.40	0.35
241	SWITCHGEAR	0.0	0.0	0.0	0.25	0.05
242	STATION SERVICE EQUIPMEN	6.80	0.0	0.0	0.13	0.0
243	SWITCHBOARDS	0.0	0.0	0.0	0.02	0.0
244	PROTECTIVE EQUIPMENT	0.0	0.0	0.0	0.0	0.0
245	STRUCTURES AND ENCLOSURE	0.0	0.0	0.0	0.0	0.0
246	POWER AND CONTROL WIRING	0.0	0.61	0.0	0.01	0.0
25	MISCELLANEOUS EQUIPMENT	2.00	0.0	200.00	0.0	13.70
251	TRANSPORTATION AND LIFTI	0.0	0.0	0.0	0.0	0.0
252	AIR AND WATER SERVICE SY	0.0	0.0	200.00	0.0	6.03
253	COMMUNICATIONS EQUIPMENT	0.0	0.0	0.0	0.0	0.0
254	FURNISHINGS AND FIXTURES	2.00	0.0	0.0	0.0	7.67

[a]THE LAST WORD IN SOME TITLES IS TRUNCATED BECAUSE OF SPACE LIMITATIONS.

ACCOUNT	SYSTEM[a]	QUANTITIES			
		SILVER, INDIUM, AND CADMIUM (METRIC TONS)	WOOD (FOOT BOARD MEASURE)	GROSS WEIGHT (METRIC TONS)	COST ($1000)
	ENTIRE PLANT	3.27	6956215.00	36988.10	40976.23
21	STRUCTURES AND SITE	0.0	6106210.00	17432.30	10088.39
211	SITE IMPROVEMENTS	0.0	830400.00	1713.08	860.00
212	REACTOR BUILDING	0.0	1139250.00	7581.00	3878.10
213	TURBINE BUILDING	0.0	412700.00	3841.46	1969.80
214	INTAKE AND DISCHARGE	0.0	461250.00	337.55	295.00
215	REACTOR AUXILIARIES	0.0	1391190.00	1469.50	989.10
217	FUEL STORAGE	0.0	221200.00	429.50	444.00
218	MISCELLANEOUS BUILDINGS	0.0	1650220.00	2060.21	1652.40
22	REACTOR PLANT EQUIPMENT	3.27	190055.00	4790.04	12080.19
221	REACTOR EQUIPMENT	3.27	12090.00	711.98	77.50
222	MAIN HEAT TRANSFER SYSTE	0.0	55020.00	2024.65	2829.00
223	SAFEGUARDS COOLING SYSTE	0.0	15460.00	477.33	1462.00
224	RADWASTE SYSTEM	0.0	10410.00	68.18	470.10
225	FUEL HANDLING SYSTEMS	0.0	3322.00	149.38	529.35
226	OTHER REACTOR EQUIPMENT	0.0	93753.00	1062.01	2484.55
227	INSTRUMENTATION AND CONT	0.0	0.0	296.53	4227.70
23	TURBINE PLANT EQUIPMENT	0.0	540290.00	11927.48	9308.46
231	TURBINE-GENERATORS	0.0	159310.00	4324.23	1299.70
232	HEAT REJECTION SYSTEMS	0.0	211700.00	2516.46	1174.70
233	CONDENSING SYSTEMS	0.0	26360.00	1755.81	1363.56
234	FEED-HEATING SYSTEM	0.0	57220.00	1594.97	4059.50
235	OTHER EQUIPMENT	0.0	85700.00	1633.80	436.00
236	INSTRUMENTATION AND CONT	0.0	0.0	102.23	975.00
24	ELECTRIC PLANT EQUIPMENT	0.0	32210.00	1967.61	7978.20
241	SWITCHGEAR	0.0	0.0	35.58	770.20
242	STATION SERVICE EQUIPMEN	0.0	12210.00	689.56	3819.50
243	SWITCHBOARDS	0.0	0.0	104.60	470.00
244	PROTECTIVE EQUIPMENT	0.0	0.0	45.36	102.00
245	STRUCTURES AND ENCLOSURE	0.0	20000.00	533.61	385.50
246	POWER AND CONTROL WIRING	0.0	0.0	558.91	2431.00
25	MISCELLANEOUS EQUIPMENT	0.0	87450.00	870.72	1521.00
251	TRANSPORTATION AND LIFTI	0.0	49000.00	529.82	545.00
252	AIR AND WATER SERVICE SY	0.0	31300.00	240.05	690.50
253	COMMUNICATIONS EQUIPMENT	0.0	0.0	6.62	50.00
254	FURNISHINGS AND FIXTURES	0.0	7150.00	94.23	235.50

[a]THE LAST WORD IN SOME TITLES IS TRUNCATED BECAUSE OF SPACE LIMITATIONS.

Appendix C

ASSUMED CONSTITUENTS OF COMPOSITE MATERIALS

Composite material	Constituents (wt %)
Aluminum	Al 99.6, Fe 0.35, Ti 0.03, Mn 0.03, Cu 0.05, Zn 0.05
Babbitt metal	Sb 4.5, Sn 91.0, Cu 4.5
Brass	Cu 95.0, Zn 5.0
Bronze	Ni 5.0, Sn 5.0, Pb 1.0, Cu 87.0
Carbon steel	Ni 0.55, Fe 97.65, Mn 0.13, Mo 0.50
Concrete	Cement 16.77, coarse aggregate 50.29, fine aggregate 25.52
Copper	Cu 100.0
Galvanized iron	Fe 99.88, Zn 0.12
Inconel	Ni 76.0, Fe 7.2, Cr 15.8, Mn 0.2, Cu 0.1
Insulation	Magnesia 85.0, asbestos 15.0
Lead	Pb 100.0
Nickel	Ni 99.5, Fe 0.15, Co 0.25
Platinum	Pt 100.0
Silver	Ag 95.0, Cu 5.0
Stainless steel	Ni 10.0, Fe 69.0, Cr 19.0, Mn 2.0

APPENDIX D
COMPILATION OF BASIC RESOURCE MATERIALS USED IN CONSTRUCTION OF A TYPICAL 1000-MWe PWR

ACCOUNT	SYSTEM[a]	QUANTITIES (METRIC TONS)				
		ALUMINUM	ANTIMONY	CADMIUM	CHROMIUM	COPPER
	ENTIRE PLANT	18.07	0.02	0.16	414.85	725.71
21	STRUCTURES AND SITE	1.18	0.0	0.0	5.43	36.08
211	SITE IMPROVEMENTS	0.05	0.0	0.0	0.0	1.53
212	REACTOR BUILDING	0.14	0.0	0.0	1.09	9.63
213	TURBINE BUILDING	0.81	0.0	0.0	0.0	2.99
214	INTAKE AND DISCHARGE	0.0	0.0	0.0	0.0	0.25
215	REACTOR AUXILIARIES	0.05	0.0	0.0	0.0	0.93
217	FUEL STORAGE	0.06	0.0	0.0	4.00	0.42
218	MISCELLANEOUS BUILDINGS	0.08	0.0	0.0	0.34	20.34
22	REACTOR PLANT EQUIPMENT	5.20	0.0	0.16	239.00	51.03
221	REACTOR EQUIPMENT	0.0	0.0	0.16	52.28	6.80
222	MAIN HEAT TRANSFER SYSTE	0.0	0.0	0.0	58.09	9.95
223	SAFEGUARDS COOLING SYSTE	0.0	0.0	0.0	37.83	2.98
224	RADWASTE SYSTEM	0.0	0.0	0.0	6.06	0.25
225	FUEL HANDLING SYSTEMS	0.0	0.0	0.0	12.72	0.19
226	OTHER REACTOR EQUIPMENT	0.0	0.0	0.0	43.76	1.81
227	INSTRUMENTATION AND CONT	5.20	0.0	0.0	28.26	29.04
23	TURBINE PLANT EQUIPMENT	1.16	0.01	0.0	167.80	76.62
231	TURBINE-GENERATORS	0.0	0.01	0.0	24.68	52.37
232	HEAT REJECTION SYSTEMS	0.0	0.0	0.0	1.72	4.02
233	CONDENSING SYSTEMS	0.0	0.0	0.0	74.54	2.90
234	FEED-HEATING SYSTEM	0.0	0.00	0.0	42.03	5.18
235	OTHER EQUIPMENT	0.0	0.00	0.0	16.98	2.17
236	INSTRUMENTATION AND CONT	1.16	0.0	0.0	7.84	9.98
24	ELECTRIC PLANT EQUIPMENT	4.08	0.01	0.0	0.01	558.72
241	SWITCHGEAR	0.0	0.0	0.0	0.01	3.44
242	STATION SERVICE EQUIPMEN	0.02	0.01	0.0	0.0	19.70
243	SWITCHBOARDS	4.07	0.0	0.0	0.0	13.52
244	PROTECTIVE EQUIPMENT	0.0	0.0	0.0	0.0	39.40
245	STRUCTURES AND ENCLOSURE	0.0	0.0	0.0	0.0	0.0
246	POWER AND CONTROL WIRING	0.0	0.0	0.0	0.0	482.66
25	MISCELLANEOUS EQUIPMENT	6.44	0.0	0.0	2.60	3.26
251	TRANSPORTATION AND LIFTI	0.0	0.0	0.0	0.0	0.47
252	AIR AND WATER SERVICE SY	0.0	0.0	0.0	1.15	1.44
253	COMMUNICATIONS EQUIPMENT	0.34	0.0	0.0	0.0	0.98
254	FURNISHINGS AND FIXTURES	6.10	0.0	0.0	1.46	0.38

[a]THE LAST WORD IN SOME TITLES IS TRUNCATED BECAUSE OF SPACE LIMITATIONS.

APPENDIX D (CONTINUED)

ACCOUNT	SYSTEM[a]	QUANTITIES (METRIC TONS)				
		INDIUM	IRON	LEAD	MANGANESE	MOLYBDENUM
	ENTIRE PLANT	0.49	34662.29	46.65	467.36	163.66
21	STRUCTURES AND SITE	0.0	16964.07	33.07	215.32	82.60
211	SITE IMPROVEMENTS	0.0	1671.02	0.68	22.01	8.46
212	REACTOR BUILDING	0.0	7398.36	0.00	94.55	36.32
213	TURBINE BUILDING	0.0	3751.77	0.00	47.34	18.21
214	INTAKE AND DISCHARGE	0.0	329.45	0.00	4.34	1.67
215	REACTOR AUXILIARIES	0.0	1436.44	0.00	17.66	6.79
217	FUEL STORAGE	0.0	413.87	0.00	5.16	1.82
218	MISCELLANEOUS BUILDINGS	0.0	1963.18	32.39	24.27	9.32
22	REACTOR PLANT EQUIPMENT	0.49	4175.12	4.54	68.13	17.22
221	REACTOR EQUIPMENT	0.49	609.70	0.0	11.09	2.15
222	MAIN HEAT TRANSFER SYSTE	0.0	1797.19	0.00	26.22	8.43
223	SAFEGUARDS COOLING SYSTE	0.0	406.16	0.00	7.55	1.37
224	RADWASTE SYSTEM	0.0	57.21	0.00	1.10	0.18
225	FUEL HANDLING SYSTEMS	0.0	126.50	0.00	2.40	0.41
226	OTHER REACTOR EQUIPMENT	0.0	964.84	4.54	15.31	4.12
227	INSTRUMENTATION AND CONT	0.0	213.51	0.0	4.45	0.57
23	TURBINE PLANT EQUIPMENT	0.0	11314.87	0.21	160.12	54.79
231	TURBINE-GENERATORS	0.0	4131.50	0.20	56.40	20.69
232	HEAT REJECTION SYSTEMS	0.0	2450.72	0.01	32.70	12.51
233	CONDENSING SYSTEMS	0.0	1599.16	0.00	25.52	6.80
234	FEED-HEATING SYSTEM	0.0	1488.81	0.00	22.21	6.84
235	OTHER EQUIPMENT	0.0	1567.58	0.00	21.82	7.71
236	INSTRUMENTATION AND CONT	0.0	77.12	0.0	1.47	0.25
24	ELECTRIC PLANT EQUIPMENT	0.0	1373.35	6.83	12.55	4.83
241	SWITCHGEAR	0.0	31.08	0.01	0.40	0.15
242	STATION SERVICE EQUIPMEN	0.0	647.31	6.81	8.50	3.27
243	SWITCHBOARDS	0.0	84.95	0.00	1.13	0.43
244	PROTECTIVE EQUIPMENT	0.0	5.76	0.00	0.08	0.03
245	STRUCTURES AND ENCLOSURE	0.0	530.46	0.0	1.46	0.56
246	POWER AND CONTROL WIRING	0.0	73.79	0.01	0.98	0.38
25	MISCELLANEOUS EQUIPMENT	0.0	834.89	2.00	11.24	4.22
251	TRANSPORTATION AND LIFTI	0.0	516.90	0.0	6.88	2.65
252	AIR AND WATER SERVICE SY	0.0	231.26	0.0	3.14	1.16
253	COMMUNICATIONS EQUIPMENT	0.0	5.20	0.0	0.06	0.02
254	FURNISHINGS AND FIXTURES	0.0	81.53	2.00	1.15	0.38

[a]THE LAST WORD IN SOME TITLES IS TRUNCATED BECAUSE OF SPACE LIMITATIONS.

APPENDIX D (CONTINUED)

ACCOUNT	SYSTEM[a]	QUANTITIES (METRIC TONS)				
		NICKEL	SILVER	TIN	TITANIUM	ZINC
	ENTIRE PLANT	484.39	3.12	1.64	0.01	2.02
21	STRUCTURES AND SITE	93.80	0.05	0.01	0.00	1.12
211	SITE IMPROVEMENTS	9.31	0.0	0.0	0.00	0.02
212	REACTOR BUILDING	40.53	0.01	0.00	0.00	0.38
213	TURBINE BUILDING	20.33	0.01	0.00	0.00	0.31
214	INTAKE AND DISCHARGE	1.84	0.00	0.00	0.0	0.01
215	REACTOR AUXILIARIES	7.48	0.00	0.00	0.00	0.14
217	FUEL STORAGE	4.11	0.00	0.00	0.00	0.06
218	MISCELLANEOUS BUILDINGS	10.51	0.03	0.01	0.00	0.21
22	REACTOR PLANT EQUIPMENT	228.85	2.65	0.03	0.00	0.01
221	REACTOR EQUIPMENT	29.94	2.62	0.0	0.0	0.0
222	MAIN HEAT TRANSFER SYSTE	123.88	0.01	0.00	0.0	0.00
223	SAFEGUARDS COOLING SYSTE	21.42	0.01	0.01	0.0	0.00
224	RADWASTE SYSTEM	3.39	0.01	0.00	0.0	0.00
225	FUEL HANDLING SYSTEMS	7.15	0.00	0.00	0.0	0.00
226	OTHER REACTOR EQUIPMENT	27.58	0.01	0.02	0.0	0.00
227	INSTRUMENTATION AND CONT	15.53	0.0	0.0	0.00	0.00
23	TURBINE PLANT EQUIPMENT	149.66	0.04	1.33	0.00	0.35
231	TURBINE-GENERATORS	36.74	0.00	1.23	0.0	0.00
232	HEAT REJECTION SYSTEMS	14.70	0.02	0.04	0.0	0.02
233	CONDENSING SYSTEMS	46.72	0.00	0.01	0.0	0.08
234	FEED-HEATING SYSTEM	29.66	0.01	0.02	0.0	0.20
235	OTHER EQUIPMENT	17.44	0.01	0.03	0.0	0.06
236	INSTRUMENTATION AND CONT	4.40	0.0	0.0	0.00	0.00
24	ELECTRIC PLANT EQUIPMENT	6.05	0.38	0.25	0.00	0.52
241	SWITCHGEAR	0.21	0.24	0.04	0.0	0.00
242	STATION SERVICE EQUIPMEN	3.63	0.12	0.16	0.00	0.01
243	SWITCHBOARDS	0.48	0.02	0.00	0.00	0.00
244	PROTECTIVE EQUIPMENT	0.06	0.0	0.02	0.0	0.0
245	STRUCTURES AND ENCLOSURE	0.62	0.0	0.0	0.0	0.51
246	POWER AND CONTROL WIRING	1.05	0.01	0.03	0.0	0.0
25	MISCELLANEOUS EQUIPMENT	6.03	0.0	0.02	0.00	0.02
251	TRANSPORTATION AND LIFTI	2.91	0.0	0.0	0.0	0.0
252	AIR AND WATER SERVICE SY	1.88	0.0	0.0	0.0	0.01
253	COMMUNICATIONS EQUIPMENT	0.03	0.0	0.0	0.00	0.00
254	FURNISHINGS AND FIXTURES	1.21	0.0	0.02	0.00	0.00

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APPENDIX D (CONTINUED)

ACCOUNT	SYSTEM[a]	QUANTITIES (METRIC TONS)				
		MAGNESIA	PORTLAND CEMENT	COARSE AGGREGATE	FINE AGGREGATE	ASBESTOS
	ENTIRE PLANT	783.38	30132.51	90361.56	45854.60	138.24
21	STRUCTURES AND SITE	18.04	24563.38	73660.81	37379.70	3.18
211	SITE IMPROVEMENTS	0.0	819.59	2457.79	1247.22	0.0
212	REACTOR BUILDING	13.53	9110.97	27322.04	13864.75	2.39
213	TURBINE BUILDING	4.51	2671.57	8011.52	4065.50	0.80
214	INTAKE AND DISCHARGE	0.0	2216.17	6645.87	3372.49	0.0
215	REACTOR AUXILIARIES	0.0	5680.92	17035.98	8645.02	0.0
217	FUEL STORAGE	0.0	1201.28	3602.42	1828.07	0.0
218	MISCELLANEOUS BUILDINGS	0.0	2862.88	8585.21	4356.62	0.0
22	REACTOR PLANT EQUIPMENT	165.00	164.59	493.58	250.47	29.12
221	REACTOR EQUIPMENT	0.0	22.72	68.14	34.58	0.0
222	MAIN HEAT TRANSFER SYSTE	25.86	122.83	368.35	186.92	4.56
223	SAFEGUARDS COOLING SYSTE	9.57	0.0	0.0	0.0	1.69
224	RADWASTE SYSTEM	90.20	0.0	0.0	0.0	15.92
225	FUEL HANDLING SYSTEMS	0.33	2.15	6.45	3.27	0.06
226	OTHER REACTOR EQUIPMENT	39.05	16.89	50.65	25.70	6.89
227	INSTRUMENTATION AND CONT	0.0	0.0	0.0	0.0	0.0
230	TURBINE PLANT EQUIPMENT	600.34	5115.90	15341.59	7785.20	105.94
231	TURBINE-GENERATORS	90.45	1903.88	5709.36	2897.25	15.96
232	HEAT REJECTION SYSTEMS	0.0	2539.52	7615.54	3864.56	0.0
233	CONDENSING SYSTEMS	261.06	214.95	644.60	327.11	46.07
234	FEED-HEATING SYSTEM	141.09	18.42	55.25	28.04	24.90
235	OTHER EQUIPMENT	107.74	439.12	1316.84	668.24	19.01
236	INSTRUMENTATION AND CONT	0.0	0.0	0.0	0.0	0.0
24	ELECTRIC PLANT EQUIPMENT	0.0	211.88	635.40	322.44	0.0
241	SWITCHGEAR	0.0	0.0	0.0	0.0	0.0
242	STATION SERVICE EQUIPMEN	0.0	21.50	64.46	32.71	0.0
243	SWITCHBOARDS	0.0	0.0	0.0	0.0	0.0
244	PROTECTIVE EQUIPMENT	0.0	0.0	0.0	0.0	0.0
245	STRUCTURES AND ENCLOSURE	0.0	190.39	570.94	289.73	0.0
246	POWER AND CONTROL WIRING	0.0	0.0	0.0	0.0	0.0
25	MISCELLANEOUS EQUIPMENT	0.0	76.77	230.22	116.82	0.0
251	TRANSPORTATION AND LIFTI	0.0	0.0	0.0	0.0	0.0
252	AIR AND WATER SERVICE SY	0.0	76.77	230.22	116.82	0.0
253	COMMUNICATIONS EQUIPMENT	0.0	0.0	0.0	0.0	0.0
254	FURNISHINGS AND FIXTURES	0.0	0.0	0.0	0.0	0.0

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