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CAPITAL COST BREAKDOWN FOR COMPARATIVE EVALUATION OF ADVANCED CONVERTERS

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Abstract

More detailed breakdowns of reactor plant capital cost estimates discussed in Chapter 6 of the report "A Comparative Evaluation of Advanced Converters" are presented.

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Capital Cost Breakdown for Comparative
Evaluation of Advanced Converters

R. C. Olson and R. E. Hoskins

The capital cost estimates that were summarized and discussed in A Comparative Evaluation of Advanced Converters¹ are shown in more detail in this memo.

Tables 1R and 1A give a summary of costs according to major accounts. These values agree with those given in Tables 6.2 and 6.3 of ORNL-3686, except for corrections made to the SGR accounts which are noted in Tables 2A and 5A. As the result of these corrections, the total cost for the SGR plant was reduced from $\$132.2 \times 10^6$ to $\$131.6 \times 10^6$. This change has negligible effect on the total power costs reported for the SGR.

Tables 2R through 5R give a breakdown of the sponsors' estimates arranged by Sargent and Lundy according to the AEC classification of accounts.² It should be noted that only Westinghouse (PWR) and Atomics International (SGR) followed the AEC system in itemizing their costs. Costs were not reported for the SBR plant; only subaccount totals and prices for major primary equipment items were given by Babcock and Wilcox for the SSCR; and procedures other than those in the AEC system were used by duPont (HWR concepts) and General Atomics (HTGR) in grouping their estimates.

Adjusted direct construction cost estimates adapted by ORNL from normalized estimates prepared by Sargent and Lundy are shown in Tables 2A through 5A. Methods used in arriving at the adjusted direct costs are discussed in Appendix B of ORNL-3686.

When referring to the comparison of adjusted costs, it should be remembered that the values are to be regarded as relative rather than absolute investment costs, since they are sensitive to the accuracy of reference design costs used for cost normalizations. Also, uncertainties associated with the estimates, discussed in Chapter 6 of ORNL-3686, should be taken into consideration in interpreting the comparisons.

¹M. W. Rosenthal et al., "A Comparative Evaluation of Advanced Converters," USAEC Report ORNL-3686 (Draft), Oak Ridge National Laboratory.

²Kaiser Engineers, "Guide to Nuclear Power Cost Evaluation," USAEC Report TID-7025 (Vol. 1).

Table 1R. Summary of Reported Costs
(All costs in \$10⁶)

Reactor Concept	PWR	SSCR	HWF-Th	HWR-U	HTGR	SGR
Account 21 - Structures	12.157	10.674	*	*	*	10.096
22 - Reactor Equipment	54.941	37.568	*	*	*	55.692
23 - Turbines	33.246	29.398	*	*	*	24.597
24 - Electrical Equipment	3.787	3.130	*	*	*	2.700
25 - Miscellaneous	0.609	0.822	*	*	*	0.857
Total Direct Cost	<u>104.740</u>	<u>81.592</u>	<u>108.100</u>	<u>100.700</u>	<u>81.379</u>	<u>93.942</u>
Indirects						
General and administrative	6.494	5.060	*	*	*	5.198
Miscellaneous construction	1.112	1.190	*	*	*	0.991
AE fees	12.358)	11.630	*	*	*)	14.819
NE fees	1.500)		*	*	*)	
Startup	0.600	0.500	*	*	*	0.500
Land	0.360	0.360	*	*	*	0.360
Interest	21.906	10.741	*	*	*	15.542
Contingency	13.017	6.023	*	*	*	11.581
Total indirect cost	<u>60.347</u>	<u>35.454</u>	<u>54.000</u>	<u>50.400</u>	<u>41.861</u>	<u>48.991</u>
Total plant cost	<u>165.084</u>	<u>117.046</u>	<u>162.100</u>	<u>151.100</u>	<u>123.240</u>	<u>142.933</u>

* Reported costs not in accordance with AEC classification of accounts.

Table 1A. Summary of Adjusted Costs
(All Costs in \$10⁶)

Reactor Concept	PWR	SBR	SSCR	EWR-Th	HWR-U	HTGR	SGR
Account 21 - Structures	12.209	12.209	9.494	11.346	10.867	8.683	9.438*
22 - Reactor Equipment	50.548	54.955	47.116	52.516	45.376	47.479	57.592
23 - Turbines	26.710	26.710	26.710	27.044	27.044	22.758	22.322
24 - Electrical Equipment	3.986	3.986	3.990	4.004	4.004	3.717	3.029*
25 - Miscellaneous	<u>0.800</u>	<u>0.800</u>	<u>0.800</u>	<u>0.800</u>	<u>0.800</u>	<u>0.800</u>	<u>0.800</u>
Total Direct Cost	94.253	98.660	88.110	95.710	88.091	83.437	93.181*
Indirects							
General and Administrative	5.655	5.920	5.287	5.742	5.285	5.006	5.591
Miscellaneous Construction	0.990	1.046	0.934	1.015	0.934	0.884	0.988
AE Fees	5.015	5.281	4.717	5.123	4.716	4.466	4.988
NE Fees	2.119	2.218	1.981	2.152	1.981	1.876	2.095
Startup	0.727	0.727	0.770	0.962	0.920	0.707	0.746
Land	0.360	0.360	0.360	0.360	0.360	0.360	0.360
Contingency	10.916	11.313	10.216	11.106	10.229	9.674	10.795
Interest	<u>12.968</u>	<u>13.439</u>	<u>12.137</u>	<u>13.194</u>	<u>12.152</u>	<u>11.492</u>	<u>12.824</u>
Total Indirect Cost	38.789	40.304	36.402	39.654	36.577	34.465	38.387
Total Plant Cost	133.042	138.964	124.512	135.364	124.668	117.902	131.568*

*See notes on Tables 2A and 6A.

Table 2R. Accounts 20, 211, 212, 218, 219 - Land, Buildings and Stacks, Reported Costs

Reactor Concept	PWR	SBR	SSCR	HWR	HTGR	SGR
Account 20: Land and Land Rights	\$360,000	Not reported	\$360,000	Not reported	Not reported	\$360,000
Account 211: Ground Improvements	866,000	Not reported	874,200	\$550,000	\$513,000	1,471,000
Account 212: Buildings						
Housing for						
Reactor and primary system	See Acct. 219	Not reported	See Acct. 219	See Acct. 219	1,875,000	5,911,000
Reactor auxiliaries	599,000	Not reported	Not reported	Not reported	842,000	Incl. above*
Fuel storage - New	85,000	Not reported	Not reported	) 656,000		) Incl. above*
- Spent	469,000	Not reported	Not reported			
Waste disposal	87,000 (Part in reactor auxiliaries)	Not reported	Not reported	265,000		175,000
Turbine and auxiliaries	1,506,000	Not reported	Not reported	1,600,000	3,532,000	1,960,000
Circulating water screens and pumps	510,000	Not reported	Not reported	Not reported	Incl. in Turb. Bldg.*	Incl. 232.5
Circulating water treatment		Not reported	Not reported	Not reported	Incl. in Turb. Bldg.*	Not reported
Control room	Incl. in Off. Bldg.	Not reported	Not reported	Incl. in Off. Bldg.*	Incl. in Turb. Bldg.*	Incl. in Admin. Bldg.*
General offices and admin.	613,000	Not reported	Not reported	400,000	Incl. in Turb. Bldg.*	374,000
Machine shop and laboratories	Incl. in Off. Bldg.	Not reported	Not reported	Not reported	Incl. in Turb. Bldg.*	Incl. in Admin. Bldg.*
Heating plant	Incl. in Turb. Bldg.*	Not reported	Not reported	Not reported	Incl. in Turb. Bldg.*	Not reported
Warehouse	40,000	Not reported	Not reported	Not reported	Not reported	80,000
Gate house, well pump hse.	11,000	Not reported	Not reported	Not reported	Not reported	20,000
Other	142,000 (Yard Crane)	Not reported	Not reported	Not reported	Not reported	25,000 (Misc. Fans.)
Total Account 212	\$1,062,000	Not reported	\$5,341,500	\$2,921,000	Not reported	\$8,545,000
Account 218 - Stacks	76,000	Not reported	70,900	65,000	76,000	80,000
Account 219 - Containment Bldgs.	\$7,143,000	Not reported	\$4,387,000	\$9,910,000 - Th \$9,220,000 - U.	---	---

*These statements are assumptions based on the drawings submitted.

Table 3R. Account 22 - Reactor Plant Equipment, Reported Costs

Reactor Concept	PWR	SBR	SSCR	HWR-Th	HWF-U	HTGR	SGR
<u>221 Reactor Equipment</u>							
Reactor vessel	\$10,847,000	N.A.	Not indicated	\$ 7,240,000	\$ 5,900,000	\$ 8,781,000	\$ 2,542,000
Reactor controls	5,286,800	N.A.	Not indicated	3,210,000	2,910,000	3,666,000	4,010,000
Reactor shielding	33,000	N.A.	Not indicated	3,780,000	2,640,000	Not indicated	1,782,000
Reactor auxiliary cooling and heating systems	848,500	N.A.	Not indicated	360,000	360,000	Not indicated	2,822,000
Reactor plant containers (within building)	----	N.A.	Not indicated	----	----	Not indicated	1,458,000
Moderator and reflector (including cladding, if any)	----	N.A.	Not indicated	----	----	1,470,000	3,398,000
Reactor plant cranes and hoists	357,000	N.A.	Not indicated	120,000	120,000	Not indicated	215,000
Equipment foundations	8,000	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Painting	50,000	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Total Account 221	\$17,431,100	N.A.	\$9,213,400	Not indicated	Not indicated	\$14,418,000	\$16,227,000
<u>222 Heat Transfer System</u>							
Reactor coolant system	\$ 8,363,100	N.A.	Not indicated	\$ 5,840,000	\$ 6,330,000	\$ 6,739,000	\$ 2,551,000
Intermediate coolant system	----	----	----	----	----	----	7,510,000
Steam generators	12,055,200	N.A.	Not indicated	10,700,000	10,700,000	Not indicated	11,183,000
Coolant receiving, supply and treatment	2,814,100	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	2,170,000
Moderator auxiliary systems	----	N.A.	Not indicated	1,530,000	810,000	----	----
Total Account 222	\$23,357,400	N.A.	\$19,021,500	Not indicated	Not indicated	\$22,307,000	\$23,514,000
<u>223 Fuel Handling and Storage Equipment</u>							
Cranes and hoists	\$ 387,800	N.A.	Not indicated	\$ 970,000	\$ 970,000	\$ 496,000	\$ 352,000
Special tools and service equipment	602,000	N.A.	Not indicated	5,000,000	1,600,000	1,418,000	500,000
Spent fuel storage cooling	5,000	N.A.	Not indicated	10,000	10,000	----	1,338,000
Shipping casks and cars	----	----	----	564,000	564,000	714,000	----
Total Account 223	\$ 994,800	N.A.	\$ 860,600	Not indicated	Not indicated	\$ 2,628,000	\$ 2,190,000
<u>224 Nuclear Fuel Processing and Fabrication Equipment</u>							
<u>225 Radioactive Waste Treatment and Disposal</u>							
Liquid waste	\$ 196,000	N.A.	Not indicated	Not indicated	Not indicated	\$ 207,000	\$ 186,000
Gaseous waste	59,000	N.A.	Not indicated	Not indicated	Not indicated	198,000	204,000
Solid waste	4,000	N.A.	Not indicated	Not indicated	Not indicated	----	----
Equipment foundations and shield walls	112,000	N.A.	Not indicated	Not indicated	----	----	----
Total Account 225	\$ 371,000	N.A.	\$ 834,000	\$ 730,000 (includes building)	\$ 730,000 (includes building)	\$ 405,000	\$ 390,000

Table 3R. (Contd)

Reactor Concept	PWR	SBR	SECR	HWR-Th	HWR-U	HTGR	SGR
<u>226 Instrumentation and Control</u>							
Reactor control incl. in core instrumentation	\$ 1,903,900	N.A.	Not indicated	\$ 1,800,000	\$ 1,500,000	Not indicated	\$ 1,575,000
Heat transfer system incl. reactor plant auxiliary systems	429,500	N.A.	Not indicated	600,000	600,000	Not indicated	3,050,000
Control panels	16,000	N.A.	Not indicated	----	----	Not indicated	76,000
Secondary plant	286,000	N.A.	Not indicated	----	----	Not indicated	1,000,000
Radiation monitoring	86,800	N.A.	Not indicated	----	----	\$ 783,000	663,000
Steam generator controls	216,600	N.A.	Not indicated	700,000	700,000	Not indicated	
C and I piping, tubing and wiring	<u>215,300</u>	<u>N.A.</u>	<u>Not indicated</u>			<u>Not indicated</u>	
Total Account 225	\$ 3,154,100	N.A.	\$ 1,314,500	Not indicated	Not indicated	Not indicated	\$ 6,364,000
<u>227 Feedwater Supply and Treatment</u>							
Raw water supply system	----	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Make-up water supply	\$ 4,000	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Steam generator feedwater purification and treatment system	43,000	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Feedwater heaters	4,684,700	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Feedwater pumps and drives	<u>562,000</u>	<u>N.A.</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>
Total Account 227	\$ 5,293,700	N.A.	\$ 2,377,300	Not indicated	Not indicated	Not indicated	\$ 3,770,000
<u>228 Steam, Condensate and Feedwater Piping</u>							
Main steam piping	Not indicated	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Auxiliary steam	Not indicated	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Condensate piping	Not indicated	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Feedwater piping	Not indicated	N.A.	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Drains and vents	<u>Not indicated</u>	<u>N.A.</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>
Total Account 228	\$ 3,846,000	N.A.	\$ 3,687,000	Not indicated	Not indicated	Not indicated	\$ 2,550,000
<u>229 Other Reactor Plant Equipment</u>	\$ 383,600	N.A.	\$ 260,000	----	----	\$ 737,000	\$ 687,000

Table 4R. Account 23 -- Turbine Generator Units, Reported Costs

Reactor Concept	PWR	SBR	SSCR	HWR	HTGR	SGR
<u>231 Turbine Generator Units</u>						
Foundations	\$ 435,000	N.A.	Not indicated	Not indicated	Not indicated	\$ 336,000
Turbine generators	27,287,000	N.A.	Not indicated	Not indicated	Not indicated	18,547,000
Stand-by exciter	<u>4,000</u>	<u>N.A.</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>547,000</u>
Total Account 231	\$27,726,000	N.A.	\$25,692,000	Not indicated	\$19,621,000	\$19,430,000
<u>232 Circulating Water System</u>						
Pumping and regulating equipment	\$ 1,193,000	N.A.	Not indicated	Not indicated	Not indicated	\$ 723,000
Circulating water lines	555,000	N.A.	Not indicated	Not indicated	Not indicated	631,000
Intake and discharge structures	40,000	N.A.	Not indicated	Not indicated	Not indicated	894,000
Fouling, corrosion control and water treatment	<u>22,000</u>	<u>N.A.</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>40,000</u>
Total Account 232	\$ 1,820,000	N.A.	\$ 707,500	Not indicated	\$ 3,387,000	\$ 2,288,000
<u>233 Condensers and Auxiliaries</u>						
Condensers	Not indicated	N.A.	Not indicated	Not indicated	Not indicated	Not indicated
Foundations						
Condensate pumps	Not indicated	N.A.	Not indicated	Not indicated	Not indicated	Not indicated
Air removal equipment	<u>Not indicated</u>	<u>N.A.</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>	<u>Not indicated</u>
Total Account 233	\$ 3,140,000	N.A.	\$ 2,803,000	Not indicated	Not indicated	\$ 1,340,000
<u>234 Central Lubricating System</u>	None	N.A.	\$ 33,200	Not indicated	Not indicated	\$ 60,000
<u>235 Turbine Plant Boards, Instruments and Controls</u>	\$ 25,000	N.A.	\$ 162,500	Not indicated	Not indicated	\$ 700,000
<u>236 Turbine Plant Piping</u>	\$ 372,000	N.A.	Not indicated	Not indicated	Not indicated	\$ 713,000
<u>237 Auxiliary Equipment for Generators</u>	Included in 236	N.A.	Not indicated	Not indicated	\$ 74,000	\$ 66,000
<u>238 Other Turbine Plant Equipment</u>	\$ 113,000	N.A.	Not indicated	Not indicated	Not indicated	Not indicated
<u>239 Miscellaneous</u>	\$ 50,000	N.A.	Not indicated	Not indicated	Not indicated	Not indicated
Total Account 23	\$33,246,000	N.A.	\$29,398,200	Not indicated	\$23,082,000	\$24,579,000

Table 2R. Account 24 - Electrical Systems, Reported Costs

Reactor Concept	PWR	SBR	SSCR	HWR	HTGR	SGR
Account 24 - Accessory Electrical Equipment		No Costs Reported	No Breakdown Reported	Breakdown not in accordance with AEC accounts	Breakdown not in accordance with AEC accounts	
241 Switchgear						
Generator main and neutral	----					\$ 973,000
Station service	\$ 1,247,000					----
Unit substations	19,000					
242 Switchboards						245,000
Main control board	411,000					66,000
Auxiliary power, battery and signal boards	9,400					79,000
Motor control centers	63,000					100,000
243 Protective Equipment	55,900					52,000
244 Electrical Structures	153,000					118,000
245 Conduit	423,000					289,000
246 Power and Control Wiring	943,800					395,000
Generator main leads	Not indicated					Not indicated
Control, auxiliary power and excitation wiring	Not indicated					Not indicated
247 Station Service Equipment	444,800					628,000
Station service transformers	Not indicated					Not indicated
Batteries, etc.	Not indicated					Not indicated
Insulating oil storage and treatment	Not indicated					Not indicated
Emergency generators	Not indicated					Not indicated
Total Account 24	\$ 3,786,900		\$ 3,130,000	\$ 5,072,400	\$ 2,304,383	\$ 2,700,000

Table 2A. Accounts 20 and 21 - Land, Building and Structures,
Adjusted Costs (Costs in \$10³)

	PWR	SPR	SSCR	HWR-Th	HWR-U	HTGR	SGR
Account 20							
Land and land rights	360	360	360	360	360	360	360
Account 21							
211 - Ground improvements	866	866	866	866	866	866	866
212 - Buildings and structures							
Reactor building ^a (including containment)	7,715	7,715	5,000	6,852	6,373	4,275	5,911
Reactor auxiliaries	599	599	599	599	599	(b)	(b)
Fuel handling and storage and waste disposal	783	783	783	783	783	842	175
Offices, shops and laboratories	613	613	613	613	613	613	374
Turbine and auxiliaries	1,506	1,506	1,506	1,506	1,506	1,960	1,960
Warehouse	40	40	40	40	40	40	40
Stacks	76	76	76	76	76	76	76
Miscellaneous	11	11	11	11	11	11	36
Sub Total 212	11,343	11,343	8,628	10,480	10,001	7,817	8,572
Total Account 21	12,209	12,209	9,494	11,346	10,867	8,683	9,438 ^c

^aAll reactor concepts except the SGR utilize a steel-lined reinforced-concrete containment vessel.

^bThe reactor buildings for the SGR and HTGR are designed to include portions of the reactor auxiliaries, fuel handling and storage, waste disposal, offices, shops and laboratory facilities.

^cThe total of account 21 for the SGR has been increased 316 thousand dollars over that reported in ORNL-3686 to correct for an error in addition.

Table 3A. Account 22 - Reactor Plant Equipment, Adjusted Costs
(Costs in \$10⁵).

	PWR	SBR	SSCR	HWR-Th	HWR-U	HTGR	SGR
221 Reactor Equipment							
Reactor vessel ^a	8,200	10,500	6,336	7,160	5,830	10,352	2,542
Reactor controls	5,287	6,200	1,723	3,210	2,910	3,530	4,010
Reactor shields	33	33	33	3,780	2,640	(b)	1,782
Reactor auxiliary heating and cooling systems	849	849	849	849	849	398	2,822
Moderator and reflector	--	--	--	--	--	1,470	3,398
Reactor plant cranes and hoists	357	357	215	120	120	(c)	215
Sub Total 221	14,726	17,939	9,155	15,119	12,349	15,750	14,769
222 Heat Transfer Systems							
Reactor coolant system	6,363	7,552	6,300	6,300	6,300	5,451 ^d	2,551
Intermediate coolant system	--	--	--	--	--	--	7,610
Steam generators ^e	12,055	12,055	12,000	12,000	12,000	8,476	11,183
Reactor coolant receiving supply and treatment	2,814	2,814	5,462	2,140	2,170	1,962	3,628
Reactor moderator auxiliary system	--	--	--	1,530	840	--	--
Sub Total 222	21,232	22,421	23,762	21,970	21,310	15,889	24,972
223 Nuclear Fuel Handling and Storage Equipment	995	1,000	861	5,980	2,580	1,914	2,190
225 Radioactive Waste Treatment and Disposal	400	400	830	400	400	400	400
226 Instrumentation and Control							
Reactor control including in-core instrumentation	1,904	1,904	1,500	1,800	1,500	1,429	1,575
Reactor heat transfer, auxiliary systems secondary plant and etc.	1,585	1,585	1,585	1,550	1,550	2,821	3,789
Sub Total 226	3,489	3,489	3,085	3,350	3,050	4,250	5,364
227 Feed Water Supply and Treatment							
Make-up water supply	4	4	4	4	4	4	4
Feed-water purification and treatment systems	43	43	43	43	43	466	466
Feed-water heaters	1,451	1,451	1,451	1,325	1,325	1,356	1,440
Feed-water pumps and drives	562	562	562	636	636	487	1,800
Reheaters-moisture separators	3,234	3,234	3,234	--	--	(e)	(e)
Sub Total 227	5,294	5,294	5,294	2,008	2,008	2,313	3,710
228 Steam, Condensate and Feed-Water Piping	3,846	3,846	3,687	3,650	3,650	6,641	5,500
229 Other Reactor Plant Equipment and Miscellaneous Equipment	566	566	442	30	29	322	687
Total Account 22	50,548	54,955	47,116	52,516	45,376	47,479	57,592

^aIncludes cost of reactor vessel, vessel supports internal shields, internal structures, ducts and thermal insulation for the PWR, SBR, SSCR, HTGR and SGR, or the equivalent equipment for the pressure tube heavy water reactors.

^bShielding cost is included in cost of the prestressed concrete pressure vessel.

^cA large overhead crane is not required for this concept; hoisting equipment for reactor maintenance is included in account 223.

^dCost of gas circulators, drives and accessories only, cost of ducting included in vessel cost.

^eCost of live-steam reheaters for the PWR, SBR, SSCR are included in account 227. The cost of superheaters, and reheaters for the HTGR and SGR are included in the steam generator costs.

Table 4A. Account 23 - Turbine Generator Units, Adjusted Costs
(Costs in \$10³)

	FWR	SBR	SSCR	WHR-Th	HWR-U	HTGR	SGR
231 Turbine-Generator Units							
Foundations	345	345	345	345	345	370	370
Turbine-generators	21,288	21,288	21,288	21,288	21,288	18,797	18,305
Sub Total 231	21,633	21,633	21,633	21,633	21,633	19,167	18,675
232 Circulating Water System							
Pumping and regulating equipment	873	873	873	960	960	596	596
Circulating water lines	225	225	225	225	225	175	175
Intake and discharge structures	531	531	531	531	531	422	422
Fouling, corrosion control and water treatment systems	58	58	58	58	58	50	50
Sub Total 232	1,687	1,687	1,687	1,774	1,774	1,243	1,243
233 Condensers and Auxiliaries							
Condensers and air removal equipment	2,640	2,640	2,640	2,910	2,910	1,384	1,440
Condensate pumps	190	190	190	167	167	100	100
Sub Total 233	2,830	2,830	2,830	3,077	3,077	1,484	1,540
234 Central Lubricating System	(a)	(a)	(a)	(a)	(a)	60	60
235 Turbine Plant Boards - Instrument and Controls	25	25	25	25	25	25	25
236 Turbine Plant Piping	372	372	372	372	372	713	713
237 Auxiliary Equipment for Generators	(a)	(a)	(a)	(a)	(a)	66	66
238 Other Turbine Plant Equipment	113	113	113	113	113	--	--
239 Miscellaneous	50	50	50	50	50	--	--
Total Account 23	26,710	26,710	26,710	27,044	27,044	22,758	22,322

^aCost of this equipment is not applicable to tandem compound units in this study.

Table 5A. Account 24 - Electrical Systems, Adjusted Costs
(Costs in \$10³)

Gen. Main. and Neutral Circuit Switchgear	335	336	336	336	336	336	336
Station Service Switchgear	532	532	522	527	527	306	346
Main Control Switchboards	65	65	65	65	65	65	65
Motor Control Switchboards	63	63	63	63	63	63	63
Station Service Transformers	453	453	467	476	476	147	169
Auxiliary Generator	37	37	37	37	37	800	50
Other Equipment (Distributed Items)	2,500	2,500	2,500	2,500	2,500	2,000	2,000
Total Account 24	3,986	3,986	3,990	4,004	4,004	3,717	3,029 ^a

^aThe total of account 24 for the SGR was reduced 750 thousand dollars from that shown in ORNL-3636 due to reduction in auxiliary generator requirements.

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