Table 17-14 Semirara Unong Pit
Selective Mining

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
WASTE (BCM)												
SOFT MATERIAL	9,610	9,532	9,446	9,462	9,515	9,449	8,705	5,406	5,406	3,379	2,023	81,931
HARD MATERIAL	2,402	2,383	2,362	2,365	2,379	2,362	2,176	1,351	1,351	845	506	20,483
SUB-TOTAL	12,012	11,915	11,808	11,827	11,894	11,811	10,881	6,757	6,757	4,223	2,529	102,414
WASTE COAL	206	224	244	241	227	243	427	479	479	299	179	3,248
TOTAL WASTE	12,218	12,139	12,052	12,068	12,121	12,054	11,308	7,236	7,236	4,522	2,708	105,662
COAL (TONS)												
PRODUCT COAL	690	748	816	805	760	814	1,428	1,600	1,600	1,000	599	10,859
WASTE COAL	268	291	317	313	296	316	555	622	622	389	233	4,223
TOTAL COAL SEAM	958	1,039	1,133	1,118	1,056	1,130	1,983	2,222	2,222	1,389	832	15,082
PRODUCT COAL BCM	531	575	628	619	585	626	1,098	1,231	1,231	769	461	8,353
TOTAL BCM	12,749	12,714	12,680	12,687	12,706	12,680	12,406	8,466	8,466	5,292	3,169	114,016
STRIP RATIO	17.7	16.2	14.8	15.0	15.9	14.8	7.9	4.5	4.5	4.5	4.5	9.7
EQUIPMENT												
BWE UNIT	4	4	4	4	4	4	4	3.4	3.4	2.1	1.3	

NOTES

OPERATING DAYS	360	HARD MATERIAL BCM/HR		601
CUTTING TIME %	54.8	SOFT MATERIAL BCM/HR		720
HARD MATERIAL%	20.0	COAL	TONS/HR	599

d. Run-of-mine extraction

a) 249 days per year (5 days per week) operation with 49.6% BWE cutting time Table 17-15

b) 301 days per year (6 days per week) operation with 49.6% BWE cutting time Table 17-16

c) 360 days per year (all the year round) operation with 49.6% BWE cutting time Table 17-17

d) 249 days per year (5 days per week) operation with 54.8% BWE cutting time Table 17-18

e) 301 days per year (6 days per week) operation with 54.8% BWE cutting time Table 17-19

f) 360 days per year (all the year round) operation with 54.8% BWE cutting time Table 17-20

Run-of-Mine Extraction

Cutting Time	49.6%
Hard Material	20.0%
Hard Material	601 BCM/hr.
Soft Material	720 BCM/hr.
Coal	748 tons/hr.

Table 17-15 Semirara Unong Pit
Run-of-Mine Extraction

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
WASTE (BCM)																		
SOFT MATERIAL	6,122	6,114	6,008	6,038	6,030	6,044	6,058	6,075	6,031	5,037	3,706	3,706	3,706	3,706	2,647	2,118	1,824	81,931
HARD MATERIAL	1,530	1,529	1,517	1,509	1,507	1,511	1,515	1,519	1,508	1,484	927	927	927	927	662	529	456	20,483
SUB-TOTAL	7,652	7,643	7,585	7,547	7,537	7,555	7,573	7,594	7,539	7,421	4,633	4,633	4,633	4,633	3,309	2,647	2,280	102,414
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL WASTE	7,652	7,643	7,585	7,547	7,537	7,555	7,573	7,594	7,539	7,421	4,633	4,633	4,633	4,633	3,309	2,647	2,280	102,414
COAL (TONS)																		
PRODUCT COAL	606	616	676	716	732	710	689	666	727	855	1,400	1,400	1,400	1,400	1,000	800	689	15,082
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL COAL SEAM	606	616	676	716	732	710	689	666	727	855	1,400	1,400	1,400	1,400	1,000	800	689	15,082
PRODUCT COAL BCM	466	474	520	551	563	546	530	512	559	658	1,077	1,077	1,077	1,077	769	615	530	11,602
TOTAL BCM	8,118	8,117	8,105	8,098	8,100	8,101	8,103	8,106	8,098	8,079	5,710	5,710	5,710	5,710	4,078	3,263	2,810	114,018
STRIP RATIO	12.6	12.4	11.2	10.5	10.3	10.6	11.0	11.4	10.4	8.7	3.3	3.3	3.3	3.3	3.3	3.3	3.3	6.8
EQUIPMENT BWE UNIT	4	4	4	4	4	4	4	4	4	4	2.9	2.9	2.9	2.9	2.1	1.7	1.4	

NOTES

OPERATING DAYS	249	HARD MATERIAL BCM/HR	601
CUTTING TIME %	40.6	SOFT MATERIAL BCM/HR	720
HARD MATERIAL%	20.0	COAL TONS/HR	748

Table 17-16 Semirara Unong Pit
Run-of-Mine Extraction

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	TOTAL
WASTE (BCM)																
SOFT MATERIAL	7,398	7,389	7,301	7,290	7,304	7,329	7,325	7,249	4,447	4,447	4,447	4,447	2,779	1,668	1,112	81,931
HARD MATERIAL	1,850	1,847	1,825	1,823	1,826	1,832	1,831	1,812	1,112	1,112	1,112	1,112	695	417	278	20,483
SUB-TOTAL	9,248	9,236	9,126	9,113	9,130	9,161	9,156	9,061	5,559	5,559	5,559	5,559	3,474	2,085	1,390	102,414
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL WASTE	9,248	9,236	9,126	9,113	9,130	9,161	9,156	9,061	5,559	5,559	5,559	5,559	3,474	2,085	1,390	102,414
COAL (TONS)																
PRODUCT COAL	735	749	861	882	862	826	831	936	1,600	1,600	1,600	1,600	1,000	600	400	15,082
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL COAL SEAM	735	749	861	882	862	826	831	936	1,600	1,600	1,600	1,600	1,000	600	400	15,082
PRODUCT COAL BCM	565	576	662	678	663	635	639	720	1,231	1,231	1,231	1,231	769	462	308	11,602
TOTAL BCM	9,813	9,812	9,788	9,791	9,793	9,796	9,795	9,781	6,789	6,789	6,789	6,789	4,243	2,546	1,697	114,016
STRIP RATIO	12.6	12.3	10.6	10.3	10.6	11.1	11.0	9.7	3.5	3.5	3.5	3.5	3.5	3.5	3.5	6.8
EQUIPMENT																
BWE UNIT	4	4	4	4	4	4	4	4	2.8	2.8	2.8	2.8	1.8	1.1	0.7	

NOTES

OPERATING DAYS	301	HARD MATERIAL BCM/HR	601
CUTTING TIME %	49.6	SOFT MATERIAL BCM/HR	720
HARD MATERIAL%	20.0	COAL TONS/HR	748

Table 17-17 Semirara Unong Pit
Run-of-Mine Extraction

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	TOTAL
WASTE (BCM)													
SOFT MATERIAL	8,847	8,802	8,726	8,728	8,761	8,754	8,604	5,195	5,195	5,195	3,897	1,226	81,931
HARD MATERIAL	2,212	2,200	2,182	2,182	2,190	2,189	2,151	1,299	1,299	1,299	974	307	20,483
SUB-TOTAL	11,059	11,002	10,908	10,910	10,951	10,943	10,755	6,494	6,494	6,494	4,871	1,533	102,414
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL WASTE	11,059	11,002	10,908	10,910	10,951	10,943	10,755	6,494	6,494	6,494	4,871	1,533	102,414
COAL (TONS)													
PRODUCT COAL	881	940	1,041	1,042	995	1,003	1,208	2,000	2,000	2,000	1,500	472	15,082
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL COAL SEAM	881	940	1,041	1,042	995	1,003	1,208	2,000	2,000	2,000	1,500	472	15,082
PRODUCT COAL BCM	678	723	801	802	765	772	929	1,538	1,538	1,538	1,154	363	11,602
TOTAL BCM	11,737	11,725	11,709	11,712	11,716	11,715	11,684	8,033	8,033	8,033	6,025	1,896	114,016
STRIP RATIO	12.6	11.7	10.5	10.5	11.0	10.9	8.9	3.2	3.2	3.2	3.2	3.2	6.8
EQUIPMENT													
BWE UNIT	4	4	4	4	4	4	4	2.8	2.8	2.8	2.1	0.7	

NOTES

OPERATINNG DAYS	360	HARD MATTERIAL	BCM/HR	601
CUTTING TIME %	49.6	SOFT MATTERIAL	BCM/HR	720
HARD MATTERIAL%	20.0	COAL	TONS/HR	748

Run-of-Mine Extraction

Cutting Time	54.8%
Hard Material	20.0%
Hard Material	601 BCM/hr.
Soft Material	720 BCM/hr.
Coal	748 tons/hr.

Table 17-18 Semirara Unong Pit
Run-of-Mine Extraction

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	TOTAL
WASTE (BCM)																	
SOFT MATERIAL	6,354	6,755	6,686	6,666	6,668	6,682	6,712	6,675	6,577	4,062	4,062	4,062	4,062	2,708	1,625	1,573	81,931
HARD MATERIAL	1,589	1,689	1,671	1,667	1,667	1,671	1,678	1,669	1,644	1,016	1,016	1,016	1,016	677	406	393	20,483
SUB-TOTAL	7,943	8,444	8,357	8,333	8,335	8,353	8,390	8,344	8,221	5,078	5,078	5,078	5,078	3,385	2,031	1,967	102,414
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL WASTE	7,943	8,444	8,357	8,333	8,335	8,353	8,390	8,344	8,221	5,078	5,078	5,078	5,078	3,385	2,031	1,967	102,414
COAL (TONS)																	
PRODUCT COAL	631	681	770	799	799	778	736	786	921	1,500	1,500	1,500	1,500	1,000	600	581	15,082
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL COAL SEAM	631	681	770	799	799	778	736	786	921	1,500	1,500	1,500	1,500	1,000	600	581	15,082
PRODUCT COAL BCM	485	524	592	615	615	598	566	605	708	1,154	1,154	1,154	1,154	769	462	447	11,602
TOTAL BCM	8,428	8,968	8,949	8,948	8,950	8,951	8,956	8,949	8,929	6,232	6,232	6,232	6,232	4,154	2,493	2,414	114,016
STRIP RATIO	12.6	12.4	10.9	10.4	10.4	10.7	11.4	10.6	8.9	3.4	3.4	3.4	3.4	3.4	3.4	3.4	6.8
EQUIPMENT																	
BWE UNIT	4	4	4	4	4	4	4	4	4	2.9	2.9	2.9	2.9	1.9	1.2	1.1	

NOTES

OPERATING DAYS	249	HARD MATERIAL BCM/HR	601
CUTTING TIME %	54.8	SOFT MATERIAL BCM/HR	720
HARD MATERIAL%	20.0	COAL TONS/HR	748

Table 17-19 Semirara Unong Pit
Run-of-Mine Extraction

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
WASTE (BCM)															
SOFT MATERIAL	8,173	8,145	8,064	8,056	8,078	8,114	8,053	7,694	4,373	4,373	3,644	2,429	1,944	792	81,931
HARD MATERIAL	2,043	2,036	2,016	2,014	2,020	2,028	2,013	1,923	1,093	1,093	911	607	486	198	20,483
SUB-TOTAL	10,216	10,181	10,080	10,070	10,098	10,142	10,066	9,617	5,466	5,466	4,555	3,037	2,429	990	102,414
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL WASTE	10,216	10,181	10,080	10,070	10,098	10,142	10,066	9,617	5,466	5,466	4,555	3,037	2,429	990	102,414
COAL (TONS)															
PRODUCT COAL	813	851	956	972	939	890	974	1,461	1,800	1,800	1,500	1,000	800	326	15,082
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL COAL SEAM	813	851	956	972	939	890	974	1,461	1,800	1,800	1,500	1,000	800	326	15,082
PRODUCT COAL BCM	625	655	735	748	722	685	749	1,124	1,385	1,385	1,154	769	615	251	11,602
TOTAL BCM	10,841	10,836	10,815	10,818	10,820	10,827	10,815	10,741	6,851	6,851	5,709	3,806	3,045	1,241	114,016
STRIP RATIO	12.6	12.0	10.5	10.4	10.8	11.4	10.3	6.6	3.0	3.0	3.0	3.0	3.0	3.0	6.8
EQUIPMENT BWE UNIT	4	4	4	4	4	4	4	4	2.6	2.6	2.2	1.4	1.2	0.5	

NOTES

OPERATINNG DAYS	301	HARD MATTERIAL	BCM/HR	601
CUTTING TIME %	54.8	SOFT MATTERIAL	BCM/HR	720
HARD MATTERIAL%	20.0	COAL	TONS/HR	748

Table 17-20 Semirara Unong Pit
Run-of-Mine Extraction

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
WASTE (BCM)												
SOFT MATERIAL	9,774	9,706	9,638	9,652	9,698	9,608	6,186	6,186	5,624	4,218	1,642	81,931
HARD MATERIAL	2,443	2,427	2,409	2,413	2,425	2,402	1,546	1,546	1,406	1,054	411	20,483
SUB-TOTAL	12,217	12,133	12,047	12,065	12,123	12,010	7,732	7,732	7,029	5,272	2,053	102,414
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL WASTE	12,217	12,133	12,047	12,065	12,123	12,010	7,732	7,732	7,029	5,272	2,053	102,414
COAL (TONS)												
PRODUCT COAL	974	1,062	1,157	1,137	1,071	1,197	2,200	2,200	2,000	1,500	584	15,082
WASTE COAL	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL COAL SEAM	974	1,062	1,157	1,137	1,071	1,197	2,200	2,200	2,000	1,500	584	15,082
PRODUCT COAL BCM	749	817	890	875	824	921	1,692	1,692	1,538	1,154	449	11,602
TOTAL BCM	12,966	12,950	12,937	12,940	12,947	12,931	9,425	9,425	8,568	6,426	2,502	114,016
STRIP RATIO	12.5	11.4	10.4	10.6	11.3	10.0	3.5	3.5	3.5	3.5	3.5	6.8
EQUIPMENT BWE UNIT	4	4	4	4	4	4	3.0	3.0	2.7	2.0	0.8	

NOTES

OPERATINNG DAYS	360	HARD MATTERIAL	601
CUTTING TIME %	54.8	SOFT MATTERIAL	720
HARD MATTERIAL%	20.0	COAL	748

Table 17-21 Production Summary (4 BWE's)

CUT TIME % 54.8

		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
RUN-OF-MINE	249 DAYS	631	681	770	799	799	778	736	786	921	1,500	1,500	1,500	1,500	1,000	600	581		15,082
	301 DAYS	813	851	956	972	939	890	974	1,461	1,800	1,800	1,500	1,000	800	326				15,082
	360 DAYS	974	1,062	1,157	1,137	1,071	1,197	2,200	2,200	2,000	1,500	584							15,082
SELECTIVE	249 DAYS	474	482	541	563	566	551	522	548	619	977	1,100	1,100	1,100	1,100	616			10,859
	301 DAYS	575	599	673	688	666	629	680	851	1,300	1,300	1,200	1,000	698					10,859
	360 DAYS	690	748	816	805	760	814	1,428	1,600	1,600	1,000	599							10,860

CUT TIME % 49.6

		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
RUN-OF-MINE	249 DAYS	606	616	676	716	732	710	689	666	727	855	1,400	1,400	1,400	1,400	1,000	800	689	15,082
	301 DAYS	735	749	861	882	862	826	831	936	1,600	1,600	1,600	1,600	1,000	600	400			15,082
	360 DAYS	881	940	1,041	1,042	995	1,003	1,208	2,000	2,000	2,000	1,500	472						15,082
SELECTIVE	249 DAYS	429	436	474	504	516	503	490	471	506	574	875	1,000	1,000	1,000	1,000	600	480	10,858
	301 DAYS	520	527	607	621	610	588	580	631	1,200	1,200	1,200	1,200	1,000	376				10,860
	360 DAYS	624	662	733	737	706	822	1,450	1,450	1,450	1,000	800	426						10,860

e. Considering the current status of the Unong pit in which all production system has been installed and operating, the most economical and realistic way to increase the mine production is to increase the yearly operating days without injecting additional capital cost.

The estimated attainable yearly production varies depending upon annual operating days and mining methods, run-of-mine extraction or selective mining, as summarized in Table 17-21.

Currently, SCC is striving to achieve 60% of cutting time by providing better maintenance services, so that the estimated 54.8% may not be so hard to attain. At this cutting time percentage, approximately 600,000 tons of coal production is expected by operating 301 days per year provided that the geological conditions and coal seam occurrence are same as the mine plan estimated by Austromineral. When the mining area is shifted to the lower stripping ratio area, presumably after 1995, the production scale comes up to 1.3 million tons per year with only 3 BWE units operation.

17-4 Summary

Because of the limited remaining coal reserves in the Unong pit, it is not recommendable to introduce additional mining equipment by injecting additional capital cost.

The production increase could be attained, without changing existing BWE and conveyor systems, by extending annual operating days. The BWE cutting time could be improved as well. It is reported by SCC that current operating days are 233, which is considered 5 days per week operation allowing some holidays. It could be extended to at least 301 days, hopefully as close as to 360 days by increasing manpower. At the same time, BWE cutting time improvement must be pursued by contemplating the ways to minimize the operating delay.

Slight production increase is expected by adding truck and shovel system to the existing BWE system, however, the operating time of the truck and shovel system would be much lower than industrial standard, due to poor trafficability in the wet season.

18. Discussions

18-1 Slope Stability

18-2 Seawater Incursions and Mine Dewatering

18-3 Coal Reserves in the Unong Pit

18-4 Coal Quality Control and Mine Plan

18. Discussions

18-1 Slope Stability

The final wall angle in the Unong pit was determined based on the data obtained through the various soil mechanical tests performed on drilling core samples.

Major factors, which are internal friction angle and cohesion, are summarized as follows:

Location	Internal Friction Angle (°C)	Cohesion ($mN \times m^{-2}$)	
Northeastern Wall	18.5	0.068	Parallel to the bedding planes
West/Southwestern Walls	26.8	0.045	Vertical
South/Southeastern Walls	25.4	0.050	Average of vertical and diagonal
Northwestern Wall	25.4	0.050	Average of vertical and diagonal

For the northeastern wall, 50% of the cohesion value of the shearing in parallel to the bedding planes was used and 67% of the indicated values were applied to the rest of the walls.

In accordance with those basic factors and assumptions, the angles of the pit walls are currently maintained at approximately as follows:

Northeastern wall	1 : 3.5	16°
West/Southwestern Wall	1 : 2.0	27°
South/Southeastern Wall	1 : 3.0	18°
Northwestern Wall	1 : 4.5	12°

On the northeastern wall, a slope slide has been experienced as seen in the pictures attached. (Photo No. 11) It was interpreted by some consultant that the slide was caused due to the water pressure of the seawater intrusion. Currently, deep well pumping has been extensively practiced around the brim of the pit to reduce the incursion of both seawater and groundwater into the pit, especially after the occurrence of the slope slide, it has been reinforced by adding deep wells above the northeast wall.

As a result, the slide of the slope is maintaining the present condition without showing further movement which has been monitored regularly by SCC geologists.

It has been also reported that the deep well above the northeast wall are all dried.

The slope stability is one of the most important factors affecting the pit design in terms of safety as well as to decide mineable coal reserves.

If the said northeast slope angle has to be regraded, the mineable coal reserve in the proposed pit area will be reduced. It could not be quantified, unfortunately, due to insufficient data and information.

A detailed slope stability study must be implemented to assess the future aspect of the pit and to verify the coal supply to NAPOCOR in accordance with the coal supply agreement.

18-2 Seawater Incursion and Mine Dewatering

In order to cope with the seawater and other ground water incursion as well as surface water, sumps with pumping system are provided in the pit and deep well pumping systems are along the immediate outside of the pit brim.

At present, considerable seawater, it can not be quantified though, is flowing into the pit, especially from the northeastern wall of the pit. As the pit deepened, the seawater incursion is expected to increase.

The modification and/or up-grading of the current dewatering system must be studied as well as the construction of barriers to minimize the seawater incursion. The barriers could be constructed by utilizing waste material from the pit operation with minimum expenditure. The detail must be studied further.

18-3 Coal Reserves in the Unong Pit

As previously mentioned, the mineable coal reserves could be much lower than the originally estimated 17,220,000 tons, judging from the given information which is very limited, though.

Consequently, higher mining cost is expected due to the increased stripping ratio. In addition to that, the life of the pit becomes shorter than that of originally expected, resulting in premature termination of the coal supply to NAPOCOR.

In order to secure the contracted coal supply to NAPOCOR, the development of alternative pit, possibly Himalian or Panian, is an imminent subject to be determined, since the pit development requires considerably long leading time including feasibility study, fund seeking, detail study, construction, etc.

18-4 Coal Quality Control and Mine Plan

It has been learned through the mine site survey and coal sample analysis results, the characteristics of the coal vary depending upon the location in the pit. Consequently, precise operational mine plan must be established to know what quality coal is available in what quantity at what location. Based on such precise mine plan, coal blending program should be scheduled to yield as consistent quality coal as possible at either the Semirara coal stockpile area or Calaca plant of NAPOCOR or at the both locations.

At present, there is neither detail long term mining plan nor coal quality forecast available. Such mining plan is indispensable to estimate coal specifications to be supplied from Semirara coal mine.

19. Coal Quality Control

19. Coal Quality Control

19-1 Outline

In July 1984, SCC commenced regular coal delivery to NAPOCOR Calaca Coal-fired Thermal Power Plant, Batangas, Luzon in compliance with the Coal Supply Agreement signed in December 1980 between SCC and NAPOCOR.

The coal delivery continued until the end of October 1984 when NAPOCOR refused taking coal from SCC due to its inferior quality containing too much moisture and clay which clogs up the plant equipment.

During this period, the coal supplied by SCC was extracted by a "whole seam recovery" including all mudstone partings, it is called "run-of-mine". In order to solve the problem, SCC modified its mining method from the originally scheduled "run-of-mine" to "selective-mining" which extract virtually only coal plies segregating from mudstone partings. Then, in February 1985 NAPOCOR resumed to take coal from SCC.

However, even with the coal mined by selective mining, the power plant has been unable to use 100% of Semirara coal, despite the fact that the power plant was originally designed to operate on 100% of Semirara coal.

Accoridngly, NAPOCOR has been blending Semirara coal with imported higher-grade coal, primarily Australian coal, to up-grade the quality of coal fed into the power plant. In line with the energy policy of the government of the Philippines, NAPOCOR has been striving to increase the consumption of domestic coal to save valuable foreign currency by curbing the importation of coal.

The extensive study has been conducted to find the optimum measures to up-grade the quality of Semirara coal to a level acceptable to the power plant.

19-2 Contracted Specifications

Quality of coal delivered to NAPOCOR is specified in the "Coal Supply Agreement" as follows:

a. Proximate Analysis (Air-dried basis as per ASTM)

Ash:	16–22%
Fixed Carbon:	24–30%

	Volatile Combustible Matter:	38–44%
	Sulfur:	0.4–1.3%
	Moisture:	11–15%
b.	*Calorific Value (Air-dried basis):*	8,300–9,300 Btu/lb
c.	Hardgrove Grindability Index:	40–50
d.	Ash Fusion	
	Hemisphere Temperature:	1,350°C
	Flow Temperature:	1,410°C
e.	Grain Size:	200 mm maximum

The coal quality must be determined by implementing analyses in accordance with ASTM standard on the samples taken as specified in the "Coal Supply Agreement".

19-3 Delivered Coal Quality

1) "Run-of-Mine" Coal

Tables 19-1 and 19-2 show the results of coal analysis done by SCC and NAPOCOR respectively on the "run-of-mine" coal delivered to NAPOCOR.

There are some differences observed in the results between those, despite the fact that the both were done based on the same ASTM standard.

In order to make a fair comparison between those done by SCC and NAPOCOR, ash content and heating value have been converted to a completely moisture free base, since ASTM standard does not specify the moisture content under air dry condition, so that moisture content is not always consistent. Tables 19-6 and 19-7 show the comparison which indicate considerable differences.

2) Selective Mining Semirara Coal (SSC)

The coal analysis data of Selective Mining Semirara Coal (SSC) are shown in Tables 19-3 and 19-4. And the comparison of the coal data analyzed by SCC and NAPOCOR are also shown in Tables 19-6 and 19-7. Table 19-5 shows a summary of those analyses by SCC and NAPOCOR.

Table 19-1 ROM Coal Analysis by SCC, Delivered in 1984

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
2	840728	5472	31.88	19.10	12.67	35.64	32.59	8549	0.55	15.81
3	840728	5763	27.08	16.91	17.60	35.88	29.61	8136	0.49	12.22
4	840803	5016	25.53	17.86	18.71	35.06	28.37	7792	0.65	9.34
5	840804	5003	24.81	17.51	21.35	32.65	28.49	7520	0.67	8.85
6	840806	5091	30.51	17.86	9.37	36.52	36.25	9009	0.58	15.39
7	840809	5292	29.15	17.11	13.79	35.17	33.93	8521	0.58	14.53
8	840813	5132	26.97	17.79	17.61	33.33	31.27	7876	0.65	11.17
9	840814	5621	31.49	17.92	13.07	35.30	33.71	8438	0.57	16.53
10	840822	5142	27.10	17.86	10.55	35.95	35.64	8881	0.56	11.25
11	840823	5190	24.79	17.72	9.14	36.31	36.83	8652	0.51	8.59
12	840825	5179	28.29	16.61	15.72	34.22	33.45	8261	0.56	14.01
13	840827	5567	26.08	14.97	19.17	34.04	31.82	8074	0.54	13.07
14	840828	5112	25.62	14.31	18.81	35.23	31.65	8143	0.54	13.20
15	840901	5260	26.80	14.85	20.53	33.96	30.66	7961	0.59	14.03
16	840917	5100	23.43	15.01	15.92	35.81	33.26	8464	0.67	9.91
17	840922	5963	27.29	17.57	13.97	35.38	33.08	8445	0.51	11.79
18	840926	5335	27.41	16.97	15.79	34.60	32.64	8322	0.50	12.57
19	841002	5481	25.73	15.32	19.91	34.09	30.68	7905	0.51	12.29
20	841005	5411	25.26	18.77	14.68	34.29	32.26	8190	0.64	7.99
21	841007	5160	28.36	17.60	17.22	35.93	29.25	7948	0.55	13.06
22	841008	5373	27.18	18.15	18.36	34.39	29.10	7777	0.54	11.03
23	841011	4914	24.73	17.68	17.54	34.48	30.30	7960	0.61	8.56
24	841012	5462	25.62	17.17	16.72	35.62	30.49	8081	0.54	10.18
25	841016	4900	27.59	16.11	17.49	35.27	31.13	8206	0.53	13.65
26	841017	5893	25.64	17.58	13.66	36.20	32.56	8493	0.48	9.78
27	841019	4522	25.32	19.22	14.92	34.25	31.63	8031	0.61	7.55
28	841021	5555	24.66	17.64	20.24	34.33	27.79	7542	0.55	8.52
29	841028	5470	24.40	16.19	21.84	32.95	29.02	7554	0.48	9.80
	Average	[148379]	26.740	17.120	16.298	34.888	31.695	8169	0.563	11.595
	STDev		2.101	1.279	3.413	1.014	2.347	380	0.056	2.521

(note) [number] : total tonnage of the period

Table 19-2 ROM Coal Analysis by NAPOCOR, Delivered in 1984

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
2	7-29-84	5173	28.78	16.66	13.85	36.32	33.17	8679	0.61	14.55
3	7-29-84	5435	25.87	16.48	18.65	33.66	31.21	7961	0.51	13.31
4	7-29-84	5016	25.53	18.32	20.17	32.78	28.73	7783	0.50	8.82
5	8-05-84	5003	24.70	18.37	22.24	31.24	28.15	7232	0.61	7.76
6	9-12-84	5091	29.98	18.35	9.91	37.59	34.15	9091	0.56	14.15
7	9-24-84	5295	27.47	17.49	13.40	35.96	33.15	8128	0.61	12.12
8	8-14-84	5132	29.17	18.77	17.20	33.74	30.29	7836	0.70	12.82
9	8-15-84	5621	30.87	16.87	14.70	36.53	31.90	8466	0.64	16.75
10	8-19-84	5142	26.96	19.54	11.59	35.85	33.02	8453	0.65	9.21
11	8-21-84	5190	27.74	20.64	9.62	35.45	34.29	8697	0.65	8.95
12	8-23-84	5179	n/a	16.20	17.14	35.02	31.63	8006	0.64	n/a
13	8-25-84	5567	n/a	16.58	20.04	32.98	30.40	7820	0.64	n/a
14	8-26-84	5122	n/a	16.43	18.97	33.20	31.41	7850	0.64	n/a
15	9-14-84	5260	22.34	14.85	22.32	33.53	29.30	7580	0.68	8.80
16	9-21-84	5100	22.77	16.98	16.96	33.89	32.17	8116	0.72	6.42
17	9-23-84	5963	26.11	16.22	15.94	34.06	33.78	8243	0.70	11.78
18	9-27-84	5335	23.93	16.23	22.29	32.87	28.61	7625	0.60	9.20
19	10-02-84	5481	24.68	14.20	24.84	32.48	28.48	7392	0.65	12.22
20	10-06-84	4816	27.51	15.37	21.12	33.23	30.27	7838	0.67	14.33
21	10-08-84	5160	25.93	14.67	25.20	31.57	28.55	7248	0.76	13.19
22	10-10-84	5373	25.23	13.35	26.72	32.06	27.87	7107	0.72	13.71
23	10-12-84	5045	25.03	15.55	23.26	31.76	29.42	7504	0.71	11.23
24	10-13-84	5880	25.44	16.05	22.12	31.74	30.08	7662	0.65	11.20
25	10-17-84	4900	26.33	15.80	24.43	31.62	28.15	7374	0.78	12.49
26	10-19-84	5577	24.19	15.89	21.38	32.80	29.92	7742	0.78	9.87
27	10-21-84	4522	22.75	15.38	23.76	31.84	29.02	7413	0.75	6.90
28	10-24-84	5555	21.70	13.44	29.67	31.30	25.58	6803	0.68	9.56
29	10-30-84	5470	24.51	15.32	29.24	29.47	25.96	6849	0.62	10.83
	Average	[147403]	25.821	16.429	19.883	33.376	30.309	7804	0.658	11.207
	STDev		2.356	1.719	5.362	1.914	2.342	554	0.070	2.613

(Note) n/a : data not available
[number] : total tonnage of the period

Table 19-3 Selective Mining Coal Analysis by SCC, Delivered from 1985 to 1987

Table 19-3 (1) Selective Mining Coal Analysis by SCC, Delivered in 1985

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
30	850206	5026	27.52	19.83	6.17	36.73	37.27	9216	0.57	9.59
31	850213	5022	24.51	17.96	8.93	37.41	35.70	9045	0.56	7.99
32	850216	8027	25.16	18.81	7.49	36.69	37.01	9147	0.52	7.82
33	850222	5024	24.15	18.11	6.85	37.70	37.34	9325	0.47	7.38
34	850223	7791	24.29	19.04	5.65	37.32	37.99	9362	0.49	6.47
35	850303	5008	26.95	15.06	7.90	38.32	38.72	9577	0.67	14.00
36	850306	8143	26.24	15.00	8.87	37.86	38.27	9366	0.53	13.14
37	850307	5014	26.44	16.59	10.64	36.12	36.65	8922	0.51	11.79
38	850313	5021	26.10	16.70	10.52	36.77	36.01	8946	0.50	11.26
39	850321	8309	24.10	17.16	8.03	37.55	37.26	9328	0.52	8.28
40	850327	5047	23.55	15.81	9.58	37.56	37.05	9236	0.51	9.19
41	850330	8359	23.01	14.28	12.21	37.45	36.06	8993	0.53	10.18
42	850330	5012	20.43	13.09	15.68	36.70	34.53	8639	0.63	8.44
43	850402	5006	24.60	13.09	12.60	37.44	36.87	9070	0.69	13.24
44	850408	8315	22.68	15.22	14.69	35.79	34.30	8496	0.51	8.80
45	850410	5035	23.08	14.96	7.51	38.90	38.63	9613	0.64	9.55
46	850413	5018	25.33	18.44	8.95	36.49	36.12	9078	0.63	8.45
47	850416	5021	24.29	14.82	10.48	38.36	36.34	9166	0.56	11.12
48	850522	5021	23.49	11.23	8.99	41.03	38.75	9628	0.75	13.81
49	850523	7739	23.68	14.95	6.33	39.60	39.12	9722	0.70	10.26
50	850524	5015	24.73	13.50	9.82	39.44	37.24	9280	0.66	12.98
51	850527	7007	24.48	14.50	7.67	38.38	39.45	9628	0.51	11.67
52	850527	5022	25.07	17.10	6.49	38.51	37.90	9506	0.60	9.61
53	850530	6295	22.49	13.02	6.84	39.84	40.30	9807	0.42	10.89
54	850602	7568	23.26	13.77	8.43	39.14	38.66	9398	0.53	11.01
55	850605	7433	24.62	17.28	7.35	37.91	37.46	9303	0.52	8.87
56	850625	8195	26.27	15.19	9.05	38.90	36.86	9411	0.59	13.06
1st Half	Average	[168493]	24.464	15.723	9.027	37.923	37.328	9267	0.567	10.328
	STDev		1.541	2.155	2.495	1.237	1.416	312	0.080	2.119

(note) [number] : total tonnage of the period

Table 19-3 (2) Selective Mining Coal Analysis by SCC, Delivered in 1985 Cont'd.

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
57	850704	7985	27.06	15.22	12.62	37.76	34.40	8892	0.67	13.96
58	850708	5021	27.43	14.79	13.80	37.63	33.78	8920	0.76	14.83
59	850709	7651	27.00	14.55	13.62	38.06	33.77	8802	0.67	14.57
60	850719	7607	25.69	15.22	10.64	37.93	36.21	8925	0.43	12.35
61	850722	7758	23.15	13.53	10.31	39.40	36.76	9082	0.50	11.13
62	850723	5014	26.08	14.54	9.15	39.01	37.30	9463	0.54	13.50
63	850817	5008	26.41	14.12	13.37	37.12	35.39	9009	0.66	14.31
64	850824	8094	25.92	15.75	10.81	36.70	36.74	9062	0.41	12.07
65	850827	7805	25.04	14.49	12.49	36.14	36.88	8993	0.39	12.34
66	850901	8191	25.59	14.98	15.75	36.71	32.56	8541	0.39	12.48
67	850926	8288	24.98	15.58	12.31	37.10	35.01	8964	0.46	11.14
68	850930	7993	26.85	16.01	13.02	36.87	34.10	8785	0.48	12.91
69	851004	7583	32.97	15.17	12.42	37.60	34.81	9012	0.49	20.98
70	851008	7772	29.36	17.32	9.00	38.29	35.39	9145	0.52	14.56
71	851104	7875	26.57	15.30	8.72	38.72	37.26	9366	0.50	13.10
72	851120	4860	26.35	13.98	10.93	38.71	36.38	9229	0.67	14.38
73	851123	4992	29.11	13.47	10.15	39.40	36.98	9494	0.70	18.07
74	851125	5028	27.16	13.25	9.45	39.60	37.70	9640	0.83	16.03
75	851127	5024	28.62	13.67	9.01	39.17	38.15	9695	0.77	17.31
76	851215	5009	25.21	13.64	8.76	38.86	38.74	9600	0.66	13.40
77	851219	5005	23.61	11.54	12.78	38.68	37.00	9393	0.54	13.65
78	851219	5014	24.66	11.72	11.34	38.88	38.06	9623	0.44	14.66
79	851223	5010	24.89	13.94	10.47	38.69	36.90	9352	0.43	12.72
80	851223	5005	24.67	14.62	9.84	38.38	37.16	9346	0.44	11.77
81	851227	5034	23.74	15.22	11.09	37.84	35.85	9104	0.53	10.05
82	851228	5010	23.72	13.27	10.45	38.68	37.60	9471	0.46	12.04
83	851230	5041	24.23	14.18	9.40	38.52	37.90	9513	0.44	11.71
2nd Half	Average	[169675]	26.151	14.410	11.174	38.165	36.251	9201	0.547	13.704
	STDev		2.127	1.233	1.838	0.933	1.572	307	0.128	2.337
Full Year	Average	[338169]	25.307	15.066	10.100	38.044	36.790	9234	0.557	12.016
	STDev		2.027	1.861	2.426	1.092	1.579	308	0.106	2.790

(note) [number] : total tonnage of the period

Table 19-3 (3) Selective Mining Coal Analysis by SCC, Delivered in 1986

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
84	851230	5004	24.92	13.08	10.11	38.67	38.14	9552	0.58	13.62
85	860101	5017	25.27	12.23	10.40	38.74	38.63	9592	0.53	14.86
86	860226	5082	24.44	12.28	12.04	38.84	36.84	9370	0.54	13.88
87	860228	5022	23.36	14.61	12.99	37.30	35.10	8928	0.46	10.25
88	860228	5030	23.28	14.67	12.74	37.51	35.08	8952	0.49	10.08
89	860303	5030	23.63	13.01	9.63	39.17	38.19	9536	0.54	12.18
90	860308	5020	23.55	16.34	9.36	37.35	36.95	9243	0.64	8.62
91	860323	5063	23.26	13.83	11.79	37.80	36.58	9268	0.60	10.94
92	860325	5056	23.24	14.99	13.24	36.53	35.24	9001	0.52	9.81
93	860329	5065	22.14	13.64	13.31	37.05	36.00	9069	0.50	9.84
94	860401	5060	22.50	14.21	12.04	38.09	35.66	9051	0.47	9.67
95	860404	5027	24.03	15.84	9.67	37.45	37.04	9244	0.39	9.72
96	860407	5059	23.58	17.93	9.14	36.28	36.65	9007	0.35	6.89
97	860409	5045	22.15	17.34	8.41	36.54	37.71	9235	0.41	5.83
98	860411	5040	22.05	14.87	9.58	37.36	38.19	9409	0.55	8.43
99	860420	5060	19.56	12.98	8.66	37.08	41.28	9735	0.57	7.59
100	860422	5055	22.19	15.19	8.88	37.47	38.46	9399	0.43	8.27
101	860425	5065	22.03	15.50	8.50	37.26	38.74	9483	0.68	8.69
102	860427	5047	22.88	13.85	8.61	38.19	39.35	9711	0.48	10.49
103	860512	5009	24.02	17.08	8.36	37.81	36.75	9352	0.45	8.37
104	860515	5053	23.58	15.08	10.21	37.34	37.37	9250	0.40	10.00
105	860518	5056	24.52	13.95	11.62	35.22	39.21	9234	0.46	12.30
106	860527	4999	24.88	14.61	10.81	37.34	37.24	9242	0.46	12.02
107	860530	5009	24.95	16.49	9.30	36.91	37.30	9465	0.44	10.11
108	860602	5047	23.73	15.43	10.51	38.05	36.01	9147	0.52	9.81
109	860604	5070	26.08	15.76	7.59	37.94	38.71	9460	0.38	12.22
110	860606	5023	24.05	16.96	6.73	37.76	38.55	9413	0.58	8.54
111	860607	5068	24.79	15.75	8.05	37.79	38.41	9449	0.59	10.73
112	860609	5025	23.93	17.96	9.88	36.75	35.41	9119	0.61	7.27
113	860610	5071	23.63	16.54	12.92	35.86	34.68	8919	0.65	8.49
1st Half	Average	[151277]	23.541	15.067	10.169	37.448	37.316	9295	0.509	9.984
	STDev		1.276	1.587	1.816	0.867	1.534	226	0.085	2.112

(note) [number] : total tonnage of the period

Table 19-3 (4) Selective Mining Coal Analysis by SCC, Delivered in 1986 Cont'd.

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
114	860709	5010	25.83	17.30	7.50	38.82	36.38	9331	0.48	10.32
115	860712	5007	25.08	19.42	7.29	37.46	35.83	9138	0.39	7.03
116	860715	5029	28.42	17.36	12.88	35.74	34.02	8554	0.59	13.38
117	860718	5016	27.27	14.41	12.22	37.56	35.81	9045	0.59	15.00
118	860721	5035	26.79	15.31	10.09	37.68	36.92	9184	0.60	13.55
119	860722	5029	23.65	16.03	9.51	37.79	36.67	9022	0.47	9.07
120	860725	5021	25.32	16.90	7.26	38.48	37.36	9254	0.54	10.14
121	860819	4960	31.52	16.44	9.27	37.82	36.47	9133	0.58	18.05
122	860821	5034	26.84	17.67	8.86	37.15	36.32	9007	0.56	11.13
123	860823	5066	28.15	16.76	7.69	38.61	36.94	9262	0.48	13.68
124	860825	5056	27.03	17.99	8.02	38.69	35.30	9163	0.45	11.01
125	860826	5050	27.37	17.88	8.48	37.67	35.97	9091	0.44	11.55
126	860909	5035	27.15	16.97	7.98	38.27	36.78	9267	0.46	12.25
127	860912	5049	28.46	16.35	8.81	37.56	37.28	9341	0.59	14.45
128	860912	5014	27.34	15.98	9.10	38.83	36.09	9298	0.61	13.51
129	860914	5065	25.29	13.92	14.57	37.15	34.36	8825	0.58	13.20
130	860928	5052	25.78	16.02	10.78	38.62	34.58	9030	0.55	11.60
131	860930	5038	25.40	17.41	10.76	36.62	35.21	8825	0.54	9.66
132	861002	5061	27.21	17.94	8.38	36.35	37.33	9165	0.56	11.29
133	861004	5036	28.60	17.53	8.69	36.04	37.74	9154	0.53	13.42
134	861006	5055	28.15	17.16	7.75	36.71	38.38	9255	0.45	13.24
135	861007	5035	27.97	18.31	7.68	36.37	37.64	9131	0.40	11.83
136	861008	5041	26.54	17.91	7.58	36.93	37.58	9163	0.44	10.51
137	861009	5058	26.15	16.23	8.41	37.25	38.11	9396	0.43	11.83
138	861011	5056	24.90	15.31	12.41	36.70	35.58	8861	0.55	11.32
139	861013	5054	28.11	16.87	10.10	35.90	37.13	9056	0.50	13.49
140	861015	5048	26.77	16.32	11.59	35.34	36.75	8869	0.53	12.23
141	861016	5056	26.37	17.55	9.57	36.46	36.42	9013	0.48	10.67
142	861017	5064	26.11	18.36	10.37	35.76	35.51	8763	0.55	9.48
143	861021	5055	26.68	16.38	11.28	36.63	35.71	8931	0.55	12.30
144	861023	5064	26.45	16.18	13.68	36.02	34.12	8562	0.55	12.23
145	861119	5055	25.98	16.13	13.80	35.93	34.14	8615	0.53	11.72
146	861121	5037	26.98	17.25	8.09	37.45	37.21	9150	0.58	11.73
147	861123	5059	27.76	17.81	7.54	37.57	37.08	9246	0.79	12.09

Table 19-3 (5) Selective Mining Coal Analysis by SCC, Delivered in 1986 Cont'd.

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
148	861126	5050	27.13	20.44	7.54	36.22	35.80	8960	0.74	8.40
149	861129	5050	26.32	17.04	12.51	35.91	34.54	8695	0.65	11.19
150	861214	5052	24.18	16.89	11.83	35.95	35.33	8625	0.50	8.75
151	861217	5053	25.11	16.21	13.04	36.01	34.74	8685	0.50	10.61
152	861226	5055	25.42	15.73	10.00	36.99	37.28	9161	0.53	11.49
153	861228	5061	25.68	17.13	9.38	36.02	37.47	9070	0.57	10.28
2nd Half	Average	[201721]	26.682	16.920	9.807	37.026	36.247	9032	0.535	11.717
	STDev		1.426	1.214	2.096	0.996	1.181	229	0.081	1.982
Full Year	Average	[352998]	25.335	16.126	9.962	37.207	36.705	9145	0.524	10.974
	STDev		2.070	1.657	1.975	0.960	1.436	261	0.083	2.200

(note) [number] : total tonnage of the period

Table 19-3 (6) Selective Mining Coal Analysis by SCC, Delivered in 1987

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
154	870124	5053	24.60	12.40	9.05	38.08	40.47	9682	0.53	13.92
155	870127	5043	25.14	13.40	7.35	37.40	41.85	9813	0.53	13.55
156	870127	5062	25.46	14.75	9.48	38.77	37.00	9385	0.64	15.56
157	870128	5069	25.97	13.92	8.27	38.16	39.65	9625	0.47	13.40
158	870129	5062	24.31	14.38	8.89	38.09	38.64	9573	0.47	11.60
159	870130	5048	25.45	13.41	10.37	38.02	38.20	9340	0.47	13.90
160	870201	5049	23.01	11.46	13.09	36.82	38.63	9301	0.55	13.05
161	870214	5058	22.93	12.80	11.11	38.23	37.86	9408	0.62	11.62
162	870217	5047	23.38	13.15	10.54	37.95	38.36	9425	0.58	11.77
163	870219	5062	25.10	14.61	9.96	38.38	37.05	9304	0.55	12.27
164	870222	5052	22.83	15.46	13.83	36.81	33.90	8717	0.54	8.69
165	870225	5083	23.87	15.20	11.98	36.71	36.11	9010	0.61	10.20
166	870228	5064	24.01	12.75	12.61	36.64	38.00	9278	0.74	12.87
167	870303	5052	23.48	14.65	12.23	36.70	36.42	9084	0.67	10.34
168	870311	5050	23.44	15.36	11.76	37.38	35.50	8913	0.76	9.54
169	870314	5059	23.08	14.42	12.18	37.39	36.01	8973	0.62	10.12
170	870316	5067	24.60	15.21	10.85	37.47	36.47	9060	0.52	11.06
171	870326	5047	24.05	15.96	11.01	36.68	36.35	8972	0.57	9.60
172	870329	5067	24.47	15.02	13.72	36.32	34.94	8906	0.60	11.11
173	870331	5057	23.78	13.36	13.63	37.12	35.89	8980	0.94	12.02
174	870401	5077	24.99	17.00	11.77	35.59	35.64	8827	0.83	9.61
175	870404	5063	24.80	15.86	12.46	36.36	35.32	8811	0.64	10.60
176	870406	5058	24.42	15.13	14.17	35.56	35.14	8765	0.55	10.94
177	870410	5060	22.19	15.38	15.64	35.63	33.35	8480	0.68	8.05
178	870413	5065	23.11	13.49	13.98	36.85	35.68	9005	0.95	11.11
179	870415	5057	22.48	14.44	14.85	35.53	35.18	8732	0.91	9.39
180	870415	5050	23.52	14.63	14.21	36.15	35.01	8716	0.92	10.41
181	870417	5055	23.42	14.93	16.16	34.34	34.57	8426	0.75	9.98
182	870419	5057	23.09	13.69	16.86	35.71	33.74	8491	0.91	10.88
183	870423	5058	22.02	13.45	14.29	37.37	34.89	8892	0.66	9.89
184	870424	5051	24.36	11.96	16.27	35.25	36.52	8735	0.69	14.07
185	870425	5060	24.61	13.30	15.99	35.76	34.95	8536	0.64	13.01
186	870427	5049	24.93	13.52	11.60	37.18	37.70	9178	0.60	13.19
187	870428	5032	24.06	14.41	10.10	38.27	37.22	9336	0.79	11.27

Table 19-3 (7) Selective Mining Coal Analysis by SCC, Delivered in 1987 Cont'd.

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
188	870429	5016	23.96	16.65	9.74	37.09	36.52	9102	0.83	8.77
189	870514	5045	22.97	15.08	10.86	37.34	36.72	9178	0.38	9.28
190	870516	5056	22.99	14.26	12.18	37.55	36.01	9137	0.85	10.19
191	870519	5048	22.39	14.19	10.94	37.94	36.93	9289	0.88	9.56
192	870521	5043	23.16	16.06	11.35	37.19	35.40	8937	0.74	8.46
193	870523	5062	21.66	14.58	13.19	36.36	35.87	8763	0.62	8.30
194	870601	5029	22.52	15.12	14.99	33.95	35.94	8538	0.46	8.71
195	870603	5033	22.99	16.02	10.15	35.61	38.22	9067	0.48	8.30
196	870605	5051	22.50	14.91	11.12	36.08	37.89	9178	0.71	8.93
197	870608	5045	20.15	13.72	13.12	35.44	37.72	9097	0.99	7.48
198	870609	5017	21.81	15.82	10.22	36.07	37.89	9150	0.71	7.13
199	870610	5058	22.05	15.95	10.75	36.22	37.08	9084	0.71	7.26
200	870612	5046	28.16	15.88	10.26	36.48	37.38	9152	0.59	14.58
201	870614	5059	26.85	17.55	6.68	37.31	38.46	9395	0.57	11.22
202	870615	5068	29.35	15.00	14.66	35.42	34.92	8608	0.80	16.90
203	870615	5050	29.05	15.38	10.25	38.23	36.14	9168	0.89	16.13
204	870625	5044	30.18	15.00	10.72	37.29	36.99	9181	0.79	17.85
205	870628	5072	26.86	14.52	10.58	38.19	36.71	9303	0.83	14.43
206	870628	5052	27.73	14.83	11.55	37.21	36.41	9087	0.80	15.14
1st Half	Average	[267837]	24.194	14.592	11.954	36.823	36.630	9058	0.682	11.268
	STDev		2.007	1.231	2.304	1.076	1.640	316	0.151	2.542

(note) [number] : total tonnage of the period

Table 19-3 (8) Selective Mining Coal Analysis by SCC, Delivered in 1987 Cont'd.

Ship No.	Shipping Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
207	870701	5070	28.18	15.05	9.53	37.47	37.95	9361	0.76	15.46
208	870802	5059	26.85	15.00	11.46	37.58	35.96	9139	1.00	13.93
209	870804	5024	26.17	14.30	13.96	35.96	35.78	8809	0.83	13.85
210	870706	5039	27.02	15.74	13.48	36.72	34.06	8732	0.66	13.39
211	870709	5039	27.37	15.14	14.86	35.75	34.25	8615	0.57	14.39
212	870824	4841	27.21	15.06	12.07	36.79	36.08	9056	0.78	14.30
213	870728	5052	25.88	15.38	15.29	35.52	33.81	8572	0.73	12.40
214	870728	5040	27.34	15.05	12.37	36.57	36.01	8934	0.70	14.47
215	870730	5051	26.58	15.25	12.69	36.01	36.05	8914	0.69	13.34
216	870731	5051	27.40	16.24	11.65	36.62	35.49	8949	0.70	13.32
217	870801	5054	27.36	15.81	12.30	35.92	35.97	8837	0.61	13.72
218	870802	5052	26.26	16.28	13.30	35.64	34.78	8675	0.56	11.92
219	870805	5065	25.52	15.18	13.39	36.14	35.29	8774	0.51	12.17
220	870807	5041	25.47	15.78	12.82	35.61	35.79	8713	0.55	11.51
221	870810	5037	25.70	15.60	12.92	35.94	35.54	8699	0.51	11.97
222	870814	5054	26.26	15.43	14.83	35.71	34.03	8530	0.49	12.79
223	870817	5057	27.78	16.44	13.23	35.96	34.37	8667	0.45	13.52
224	870820	5044	27.65	15.19	12.73	36.26	35.82	8833	0.55	14.67
225	870823	5040	27.87	14.83	13.56	36.24	35.37	8806	0.53	15.29
226	870826	5057	27.66	15.45	12.19	36.73	35.63	8905	0.50	14.44
227	870829	5053	26.71	14.34	12.80	37.01	35.85	8941	0.57	14.42
228	870901	5052	28.03	14.49	17.55	34.59	33.37	8284	0.57	15.86
229	870904	5052	28.16	14.66	14.11	36.86	34.37	8673	0.56	15.81
230	870907	5055	28.57	15.48	13.95	36.05	34.52	8689	0.62	15.48
2nd Half	Average	[120979]	27.042	15.299	13.210	36.235	35.256	8796	0.625	13.851
	STDev		0.899	0.572	1.539	0.669	1.013	218	0.129	1.270
Full Year	Average	[388816]	25.082	14.812	12.346	36.640	36.202	8977	0.664	12.073
	STDev		2.182	1.115	2.166	1.001	1.601	313	0.146	2.522

(note) [number] : total tonnage of the period

Table 19-4 Selective Mining Coal Analysis by NAPOCOR, Delivered from 1985 to 1987

Table 19-4-(1) Selective Mining Coal Analysis by NAPOCOR, Delivered in 1985

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
30	2-07-85	5026	25.91	18.62	8.38	37.78	35.20	9116	0.62	8.95
31	2-14-85	5022	26.26	17.42	10.86	40.57	31.15	8840	0.59	10.69
32	2-19-85	8027	26.04	17.12	8.99	41.65	32.24	9166	0.59	10.76
33	2-23-85	5024	24.79	17.56	8.33	38.81	35.30	9210	0.65	8.77
34	2-24-85	7791	25.81	15.51	7.72	39.72	37.05	9358	0.61	12.19
35	3-04-85	5008	26.98	15.40	10.46	41.49	32.65	9157	0.50	13.69
36	3-08-85	8143	27.18	17.19	11.61	36.53	34.68	9166	0.75	12.03
37	3-08-85	5014	26.22	16.19	14.55	35.68	33.59	8737	0.77	11.95
38	3-14-85	5021	26.51	13.88	16.14	37.07	32.91	8866	0.77	14.66
39	3-23-85	8309	25.09	15.50	11.19	38.23	35.09	9226	0.70	11.35
40	3-28-85	5047	24.94	16.05	12.37	38.05	33.52	8963	0.73	10.59
41	3-31-85	8359	24.69	15.12	16.18	39.71	28.99	8578	0.79	11.26
42	3-31-85	5012	23.80	14.29	18.74	37.87	29.10	8902	0.88	11.09
43	4-03-85	5006	24.10	16.42	15.53	37.00	31.06	8580	0.72	9.19
44	4-09-85	8315	24.00	15.94	18.08	37.04	28.94	8066	0.72	9.59
45	4-11-85	5035	25.57	16.68	7.59	40.61	35.12	9433	0.67	10.66
46	4-14-85	5018	25.84	17.95	9.86	39.83	32.36	9054	0.76	9.61
47	4-17-85	5021	25.53	16.63	10.90	40.49	31.98	8823	0.77	10.67
48	5-23-85	5021	23.02	16.74	9.11	42.64	31.51	9029	0.88	3.55
49	5-24-85	7739	25.16	16.82	6.88	45.54	30.77	9304	0.82	10.04
50	5-25-85	5015	25.64	19.56	8.34	37.70	34.42	9164	0.60	7.57
51	5-27-85	7007	23.81	17.42	9.68	39.56	33.34	8938	0.73	7.74
52	5-29-85	5022	24.29	19.29	6.49	40.55	33.67	9045	0.52	6.19
53	5-31-85	6295	24.43	19.36	7.00	38.23	35.41	9074	0.51	6.29
54	6-03-85	7568	26.82	20.66	8.04	35.23	36.08	9106	0.52	7.79
55	6-06-85	7433	28.04	20.20	7.79	35.44	36.57	9179	0.61	9.83
56	6-25-85	8195	26.27	19.43	9.07	37.94	33.57	9035	0.77	8.49
1st Half	Average	[168493]	25.435	17.146	10.736	38.924	33.195	9004	0.687	9.822
	STDev		1.192	1.771	3.548	2.354	2.262	282	0.110	2.368

(note) [number] : total tonnage of the period

Table 19-4 (2) Selective Mining Coal Analysis by NAPOCOR, Delivered in 1985 Cont'd.

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
57	7-06-85	7984	25.68	18.47	13.48	36.77	31.29	8515	0.74	8.84
58	7-09-85	5021	24.58	19.00	12.99	34.24	33.77	8489	0.74	6.89
59	7-10-85	7651	26.73	20.06	13.72	33.86	32.36	8225	0.67	8.33
60	7-20-85	7607	25.55	20.35	12.49	36.28	30.89	8417	0.55	6.52
61	7-23-85	7758	25.96	20.71	10.93	36.76	31.61	8535	0.61	6.62
62	7-24-85	5014	26.22	20.27	8.65	37.89	33.18	8858	0.67	7.42
63	8-18-85	5008	26.44	20.77	12.51	34.15	32.57	8388	0.58	7.16
64	8-25-85	8094	26.45	19.68	10.40	35.74	34.18	8701	0.60	8.43
65	8-28-85	7805	25.44	19.08	12.31	35.19	33.43	8433	0.51	7.87
66	9-02-85	8191	23.91	18.62	16.72	32.29	32.38	7940	0.56	6.50
67	9-27-85	8288	26.80	20.19	12.80	34.40	32.61	8394	0.54	8.29
68	10-01-85	7993	24.43	17.75	14.49	34.60	33.16	8517	0.56	8.15
69	10-05-85	7582	26.39	21.09	12.64	33.91	32.36	8317	0.57	6.71
70	10-09-85	7772	27.77	20.61	8.91	35.39	35.10	8780	0.40	9.01
71	11-05-85	7875	25.74	20.19	8.70	36.44	34.67	8806	0.56	6.95
72	11-21-85	4860	28.74	21.58	10.16	34.46	33.80	8452	0.67	9.13
73	11-24-85	4992	27.59	20.32	10.29	34.88	34.51	8680	0.71	9.13
74	11-26-85	5028	25.86	19.49	10.00	35.60	34.91	8867	0.81	7.91
75	11-28-85	5024	27.13	15.48	9.54	37.44	37.54	9346	0.76	13.79
76	12-18-85	5009	26.20	16.13	9.20	36.47	38.19	9337	0.83	12.00
77	12-21-85	5005	24.20	14.52	15.51	35.02	34.95	8670	0.71	11.33
78	12-21-85	5014	26.01	15.02	12.05	36.27	36.66	9032	0.71	12.92
79	12-24-85	5010	24.56	16.42	10.84	35.58	37.16	8926	0.60	9.74
80	12-24-85	5005	26.30	16.56	10.00	36.30	37.14	9185	0.52	11.67
81	12-28-85	5034	24.20	14.79	10.50	37.44	37.26	9182	0.59	11.03
82	12-29-85	5010	24.80	16.47	11.60	35.83	36.10	9220	0.63	9.97
83	12-30-85	5041	25.32	16.29	10.86	36.24	36.61	9142	0.56	11.02
2nd Half	Average	[169675]	25.889	18.515	11.566	35.535	34.385	8717	0.628	9.012
	STDev		1.177	2.199	2.077	1.294	2.104	366	0.100	2.075
Full Year	Average	[338168]	25.662	17.831	11.151	37.230	33.790	8861	0.658	9.417
	STDev		1.196	2.095	2.910	2.543	2.245	354	0.108	2.243

(note) [number] : total tonnage of the period

Table 19-4 (3) Selective Mining Coal Analysis by NAPOCOR, Delivered in 1986

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
84	1-01-86	5004	22.89	15.73	9.86	35.78	38.63	9287	0.68	8.50
85	1-01-86	5017	22.13	14.57	10.59	36.81	38.03	9269	0.59	8.84
86	2-26-86	5082	23.88	15.33	12.44	36.00	36.24	8907	0.69	10.10
87	3-01-86	5022	23.33	14.18	14.45	35.38	35.99	8793	0.68	1.65
88	3-01-86	5030	24.12	14.07	13.77	35.79	36.37	8803	0.64	11.65
89	3-04-86	5030	23.82	12.40	10.77	37.94	38.89	9317	0.73	13.03
90	3-08-86	5020	24.87	14.43	9.97	38.04	37.56	9245	0.73	12.18
91	3-24-86	5063	22.92	14.56	12.61	36.47	36.36	9016	0.67	5.78
92	3-26-86	5056	23.77	13.56	14.08	36.65	35.71	8767	0.66	11.80
93	3-30-86	5065	22.66	15.38	13.53	36.19	34.90	8710	0.63	8.60
94	4-01-86	5060	25.54	16.42	13.14	35.35	35.08	8581	0.58	9.70
95	4-05-86	5027	24.15	18.42	9.94	35.24	36.40	8761	0.49	7.03
96	4-08-86	5059	24.86	15.88	9.63	36.37	38.12	8984	0.50	10.64
97	4-10-86	5045	22.57	16.56	9.54	35.73	38.16	9071	0.55	7.20
98	4-12-86	5040	22.68	15.28	10.02	36.25	38.45	9195	0.65	8.72
99	4-21-86	5060	20.64	13.93	10.04	35.86	40.18	9341	0.62	7.80
100	4-23-86	5055	22.17	16.32	9.51	35.51	38.67	9170	0.57	7.00
101	4-25-86	5065	22.66	16.05	8.53	36.29	39.12	9249	0.54	7.88
102	4-28-86	5047	23.01	16.90	8.29	36.40	38.42	9104	0.59	7.35
103	5-13-86	5009	24.05	18.35	8.72	36.07	36.87	8936	0.58	6.98
104	5-16-86	5053	23.06	16.40	10.70	35.59	37.30	8998	0.53	9.13
105	5-19-86	5056	24.92	16.83	12.21	34.57	36.40	8720	0.52	9.74
106	5-28-86	4999	25.52	17.42	11.14	35.59	35.85	8822	0.49	9.82
107	5-31-86	5009	23.99	17.90	10.94	35.63	35.52	8779	0.49	7.42
108	6-03-86	5047	24.99	16.88	10.29	36.37	36.46	9005	0.55	9.76
109	6-04-86	5070	26.29	19.28	9.08	36.23	35.40	8786	0.52	8.68
110	6-06-86	5023	27.01	21.14	6.98	35.20	36.68	8868	0.45	7.43
111	6-08-86	5068	26.53	19.59	8.42	35.86	36.13	8092	0.44	8.64
112	6-10-86	5025	25.71	20.03	9.64	35.21	35.12	8615	0.42	7.10
113	6-11-86	5071	24.27	17.99	13.73	34.86	33.42	8334	0.59	7.65
1st Half	Average	[151277]	23.967	16.393	10.752	35.974	36.881	8918	0.579	8.593
	STDev		1.463	2.067	1.958	0.761	1.530	292	0.085	2.186

(note) [number] : total tonnage of the period

Table 19-4 (4) Selective Mining Coal Analysis by NAPOCOR, Delivered in 1986 Cont'd.

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
114	7-10-86	5010	25.04	17.53	7.67	37.19	37.61	9209	0.50	9.10
115	7-13-86	5007	26.09	18.41	7.82	36.44	37.33	9111	0.51	9.41
116	7-15-86	5029	28.15	19.85	13.18	33.95	33.02	8211	0.59	10.35
117	7-19-86	5016	22.78	18.54	12.02	35.04	34.40	8480	0.61	5.20
118	7-22-86	5035	27.28	16.76	10.99	36.00	36.25	8829	0.58	12.63
119	7-23-86	5029	26.12	18.74	9.79	35.88	35.59	8792	0.58	9.07
120	7-25-86	5021	26.83	18.58	7.74	36.40	37.28	9139	0.60	10.14
121	8-20-86	4960	32.28	17.35	9.15	37.07	36.45	9057	0.52	18.05
122	8-22-86	5034	27.83	18.78	9.13	35.89	36.20	8881	0.52	11.13
123	8-24-86	5066	28.62	17.45	7.72	37.18	37.64	9149	0.45	13.52
124	8-25-86	5056	27.82	18.90	8.09	37.15	35.86	9089	0.53	11.00
125	8-27-86	5050	28.48	18.88	8.20	36.30	36.62	9007	0.53	11.83
126	9-10-86	5035	28.02	18.47	8.03	37.50	36.00	9062	0.57	11.72
127	9-13-86	5049	28.34	17.62	8.56	37.24	36.58	9121	0.62	13.00
128	9-13-86	5014	27.79	16.95	9.11	37.50	36.44	9128	0.57	13.04
129	9-15-86	5065	24.77	14.63	14.98	37.22	33.17	8656	0.74	11.86
130	9-29-86	5052	26.31	17.16	10.97	36.33	35.54	8886	0.63	11.04
131	10-01-86	5038	25.76	18.13	10.94	36.64	34.29	8695	0.62	9.31
132	10-03-86	5061	27.69	19.07	8.56	36.60	35.77	8958	0.56	10.64
133	10-05-86	5036	29.29	18.69	8.66	36.22	36.43	8953	0.54	13.03
134	10-07-86	5055	28.86	18.18	7.82	37.38	36.62	9100	0.51	13.02
135	10-08-86	5035	28.12	18.74	8.13	36.60	36.53	9037	0.51	11.54
136	10-09-86	5041	27.28	18.92	7.64	36.57	36.87	9088	0.46	10.30
137	10-10-86	5058	27.30	17.48	8.64	37.35	36.53	9151	0.48	11.89
138	10-13-86	5056	25.64	16.01	12.57	36.66	34.76	8770	0.51	11.47
139	10-14-86	5054	29.09	18.11	10.49	34.68	36.72	8791	0.54	13.39
140	10-16-86	5048	27.15	17.63	11.74	35.14	35.49	8682	0.54	11.55
141	10-17-86	5056	26.42	17.47	9.91	36.20	36.42	8897	0.49	10.82
142	10-18-86	5064	26.65	18.66	10.29	34.81	36.24	8770	0.59	9.81
143	10-22-86	5055	27.34	16.84	11.84	35.44	35.88	8779	0.58	12.61
144	10-24-86	5064	26.94	16.51	14.15	34.69	34.65	8539	0.59	12.47
145	11-21-86	5055	26.42	16.43	13.97	35.33	34.27	8601	0.55	11.93
146	11-22-86	5037	27.42	17.63	8.19	36.83	37.35	9149	0.57	11.87
147	11-23-86	5059	28.20	18.09	7.58	36.80	37.53	9228	0.77	12.32

Table 19-4 (5) Selective Mining Coal Analysis by NAPOCOR, Delivered in 1986 Cont'd.

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
148	11-27-86	5050	27.40	19.86	7.78	35.72	36.64	9012	0.82	9.40
149	11-29-86	5050	25.91	16.58	12.90	35.64	34.88	8668	0.66	11.19
150	12-15-86	5052	24.91	16.34	12.30	35.66	35.70	8852	0.62	10.21
151	12-17-86	5053	25.58	16.15	13.26	35.27	35.32	8728	0.62	11.24
152	12-27-86	5055	24.86	14.71	10.43	37.18	37.68	9191	0.52	11.89
153	12-29-86	5061	25.51	16.42	9.44	36.44	37.70	9073	0.56	10.85
2nd Half	Average	[201721]	27.057	17.681	10.010	36.253	36.056	8913	0.572	11.371
	STDev		1.625	1.222	2.161	0.903	1.176	232	0.077	1.899
Full Year	Average	[352998]	25.733	17.129	10.328	36.134	36.410	8915	0.575	11.381
	STDev		2.183	1.747	2.095	0.851	1.391	257	0.080	10.276

(note) [number] : total tonnage of the period

Table 19-4 (6) Selective Mining Coal Analysis by NAPOCOR, Delivered in 1987

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
154	1-25-87	5053	24.77	12.73	9.00	37.22	41.05	9678	0.55	13.80
155	1-28-87	5043	25.25	13.51	7.34	37.69	41.46	9782	0.49	13.56
156	1-29-87	5062	25.85	15.05	9.90	37.31	37.74	9355	0.76	12.71
157	1-29-87	5069	25.95	13.71	8.55	38.47	39.27	9613	0.49	14.18
158	1-30-87	5062	24.67	14.66	8.66	37.46	39.22	9499	0.54	11.74
159	1-31-87	5048	25.37	13.46	10.79	37.48	38.27	9273	0.53	13.76
160	2-02-87	5049	23.16	11.61	13.69	36.92	37.78	9268	0.66	13.07
161	2-15-87	5058	23.20	12.75	11.34	36.60	39.31	9438	0.65	11.98
162	2-17-87	5047	23.65	13.41	10.61	37.43	38.55	9359	0.67	11.82
163	2-20-87	5062	25.03	14.62	10.04	37.48	37.86	9264	0.53	12.18
164	2-23-87	5052	23.07	15.47	13.98	36.03	34.52	8703	0.56	8.98
165	2-25-87	5083	23.89	14.79	12.02	36.37	36.82	9015	0.66	10.67
166	3-01-87	5064	24.10	12.91	12.54	36.48	38.07	9219	0.71	12.82
167	3-04-87	5052	23.72	14.58	12.20	36.71	36.51	9055	0.68	10.69
168	3-12-87	5050	24.40	15.87	11.93	36.46	35.74	8925	0.83	10.13
169	3-15-87	5059	24.71	15.90	12.18	35.75	36.17	8849	0.71	10.48
170	3-17-87	5067	25.34	15.64	10.94	36.14	37.28	9035	0.59	11.49
171	3-27-87	5047	24.32	15.58	11.27	36.68	36.47	9027	0.69	10.34
172	3-29-87	5067	23.99	13.86	13.79	36.70	35.65	8969	0.63	11.76
173	4-01-87	5057	23.96	12.98	13.63	36.47	36.92	9062	0.91	12.62
174	4-02-87	5077	24.83	16.07	11.81	35.93	36.19	8866	0.83	10.42
175	4-04-87	5063	24.91	15.43	12.41	35.98	36.18	8808	0.64	11.18
176	4-07-87	5058	24.06	13.79	14.43	36.20	35.58	8777	0.53	11.91
177	4-11-87	5060	22.39	15.09	15.80	35.11	34.00	8512	0.74	8.60
178	4-14-87	5065	23.15	13.27	14.30	37.07	35.36	8987	1.02	11.39
179	4-16-87	5057	22.74	14.36	15.25	35.39	35.00	8727	0.93	9.79
180	4-16-87	5050	23.75	14.48	14.35	35.72	35.45	8753	0.89	10.84
181	4-18-87	5055	23.70	14.73	16.32	34.70	34.25	8464	0.81	10.52
182	4-20-87	5057	23.68	14.16	17.22	35.02	33.60	8468	0.81	11.09
183	4-24-87	5058	22.21	13.62	14.29	36.17	35.92	8848	0.61	9.93
184	4-25-87	5051	24.74	11.93	16.58	35.72	35.77	8837	0.56	14.55
185	4-26-87	5060	25.34	13.59	16.34	35.28	34.79	8586	0.69	13.56
186	4-28-87	5049	25.41	13.51	11.66	37.50	37.33	9181	0.59	13.75
187	4-29-87	5032	25.26	15.47	10.23	36.83	37.47	9314	0.76	11.58

Table 19-4 (7) Selective Mining Coal Analysis by NAPOCOR, Delivered in 1987 Cont'd.

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
188	4-30-87	5016	24.68	16.88	10.32	35.96	36.84	9111	0.62	9.38
189	5-15-87	5045	23.63	15.45	11.66	37.05	35.84	9125	0.91	9.67
190	5-17-87	5056	23.70	14.14	12.52	37.35	35.99	9172	1.04	11.13
191	5-20-87	5048	23.07	14.35	11.15	36.83	37.67	9313	0.87	10.18
192	5-22-87	5043	23.24	15.07	11.81	36.59	36.53	9024	0.79	9.62
193	5-24-87	5062	22.48	14.92	13.34	35.59	36.15	8756	0.70	8.89
194	6-02-87	5029	22.95	15.13	15.06	34.14	35.67	8519	0.53	9.20
195	6-04-87	5033	23.44	15.89	10.30	35.83	37.98	9077	0.48	8.98
196	6-06-87	5051	22.67	14.52	11.61	36.01	37.86	9136	0.73	9.53
197	6-08-87	5045	20.69	13.79	13.44	35.22	37.55	9096	0.89	8.02
198	6-09-87	5017	21.76	15.00	10.55	36.06	38.39	9294	0.80	7.96
199	6-11-87	5058	21.97	14.74	10.99	36.18	38.09	9265	0.78	8.48
200	6-12-87	5046	27.97	14.66	10.64	36.53	38.17	9208	0.61	15.57
201	6-15-87	5059	26.94	16.68	6.87	36.60	39.85	9522	0.60	12.27
202	6-16-87	5068	29.62	14.59	15.38	35.02	35.01	8627	0.84	17.61
203	6-17-87	5050	29.18	14.66	10.36	37.80	37.18	9302	0.93	17.01
204	6-26-87	5044	30.64	15.02	11.15	37.14	36.69	9205	0.83	18.36
205	6-29-87	5072	27.11	14.23	10.99	37.24	37.54	9364	0.88	15.01
206	6-29-87	5052	28.15	14.83	11.91	36.44	36.82	9082	0.82	15.63
1st Half	Average	[267837]	24.499	14.474	12.178	36.416	36.932	9070	0.715	11.705
	STDev		1.970	1.100	2.330	0.876	1.655	311	0.145	2.424

(note) [number] : total tonnage of the period

Table 19-4 (8) Selective Mining Coal Analysis by NAPOCOR, Delivered in 1987 Cont'd.

Ship No.	Arrival Date	mt	TM	IM	Ash	VM	FC	BTU	S	ADL
207	7-02-87	5070	28.51	15.23	9.58	37.25	37.94	9366	0.90	15.66
208	7-03-87	5059	27.24	15.56	11.64	36.61	36.19	9070	1.08	13.83
209	7-05-87	5024	26.28	14.54	14.37	35.92	35.17	8726	0.87	13.74
210	7-07-87	5039	26.84	15.00	14.15	35.99	34.86	8711	0.73	13.93
211	7-10-87	5039	27.32	14.52	15.72	35.55	34.21	8574	0.67	14.96
212	7-25-87	4841	27.76	15.54	11.74	36.84	35.88	9012	0.91	14.46
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2nd Half	Average	[30072]	27.325	15.065	12.867	36.360	35.708	8910	0.860	14.430
	STDev		0.765	0.464	2.264	0.644	1.304	293	0.145	0.759
Full Year	Average	[297909]	24.787	14.534	12.248	36.410	36.807	9054	0.730	11.983
	STDev		2.067	1.066	2.314	0.851	1.656	311	0.150	2.451

(note) [number] : total tonnage of the period

Table 19-5 Summary of Analysis by SCC and NAPOCOR

Table 19-5 (1) Summary of Analysis by SCC

			mt	TM	IM	Ash	VM	FC	BTU	S	ADL
1984		Average	[148379]	26.740	17.120	16.298	34.888	31.695	8169	0.563	11.595
		STDev		2.101	1.279	3.413	1.014	2.347	380	0.056	2.521
1985	1st Half	Average	[168493]	24.464	15.723	9.027	37.923	37.328	9267	0.567	10.328
		STDev		1.541	2.155	2.495	1.237	1.416	312	0.080	2.119
	2nd Half	Average	[169675]	26.151	14.410	11.174	38.165	36.251	9201	0.547	13.704
		STDev		2.127	1.233	1.838	0.933	1.572	307	0.128	2.337
1986	1st Half	Average	[151277]	23.541	15.067	10.169	37.448	37.316	9295	0.509	9.984
		STDev		1.276	1.587	1.816	0.867	1.534	226	0.085	2.112
	2nd Half	Average	[201721]	26.682	16.920	9.807	37.026	36.247	9032	0.535	11.717
		STDev		1.426	1.214	2.096	0.996	1.181	229	0.081	1.982
1987	1st Half	Average	[267837]	24.194	14.592	11.954	36.823	36.630	9058	0.682	11.268
		STDev		2.007	1.231	2.304	1.076	1.640	316	0.151	2.542
	2nd Half	Average	[120979]	27.042	15.299	13.210	36.235	35.256	8796	0.625	13.851
		STDev		0.899	0.572	1.539	0.669	1.013	218	0.129	1.270

(note) [number] : total tonnage of a period

Table 19-5 (2) Summary of Analysis by NAPOCOR

			mt	TM	IM	Ash	VM	FC	BTU	S	ADL
1984		Average	[147403]	25.821	16.429	19.883	33.376	30.309	7804	0.658	11.207
		STDev		2.356	1.719	5.362	1.914	2.342	554	0.070	2.613
1985	1st Half	Average	[168493]	25.435	17.146	10.736	38.924	33.195	9004	0.687	9.822
		STDev		1.192	1.771	3.548	2.354	2.262	282	0.110	2.368
	2nd Half	Average	[169675]	25.889	18.515	11.566	35.535	34.385	8717	0.628	9.012
		STDev		1.177	2.199	2.077	1.294	2.104	366	0.100	2.075
1986	1st Half	Average	[151277]	23.967	16.393	10.752	35.974	36.881	8918	0.579	8.593
		STDev		1.463	2.067	1.958	0.761	1.530	292	0.085	2.186
	2nd Half	Average	[201721]	27.057	17.681	10.010	36.253	36.056	8913	0.572	11.371
		STDev		1.625	1.222	2.161	0.903	1.176	232	0.077	1.899
1987	1st Half	Average	[267837]	24.499	14.474	12.178	36.416	36.932	9070	0.715	11.705
		STDev		1.970	1.100	2.330	0.876	1.655	311	0.145	2.424
	2nd Half	Average	[30072]	27.325	15.065	12.867	36.360	35.708	8910	0.860	14.430
		STDev		0.765	0.464	2.264	0.644	1.304	293	0.145	0.759

(note) [number] : total tonnage of a period

3) Comparison of Ash and Calorific Value Analysis Data between SCC and NAPOCOR

Table 19-6 shows ash analysis data comparison from 1984 to 1987. It is indicated by half a year in 1985 and 1986, and in 1984 and 1987 are by a year due to a bias of data.

Table 19-7 shows calorific value data comparison by year from 1984 to 1987. It is also indicated in the same manner as ash analysis data comparison.

Table 19-8 shows ash composition analysis data issued to NAPOCOR by SCC. The analysis is done by Australian laboratory ordered by SCC. NAPOCOR had been unable to conduct ash composition analysis due to a lack of equipment until the required equipment was furnished by JICA in November 1987.

The specifications of the coal shipped out to the Calaca power plant are verified by both SCC and NAPOCOR by conducting analysis on the same samples that have been taken by the automatic sampler during the each shiploading as specified in the coal supply agreement. The analysis is stipulated to be done in accordance with ASTM, however, the ASTM specifies the both ash and calorific value on the basis of air dry condition in which moisture content varies depending upon situation. In order to compare the analysis data done by SCC and NAPOCOR on the same conditions without affected by the moisture content which can be variable even though in air dry condition, the analysis data has been converted into dry basis. Table 19-6 indicates the ash analysis comparison on dry basis and Table 19-7 for the calorific value comparison on dry basis.

The analysis data in 1984 shows higher ash content and lower calorific value than those in the other year, since the run-of-mine extraction was exclusively performed in 1984 and selective mining has been done since the beginning of 1985.

a. Ash analysis data

From a statistical viewpoint, significant difference is observed between SCC and NAPOCOR, which means that NAPOCOR's analysis has been showing higher ash content than that of SCC's as indicated in Table 19-6.

However, the average of the difference has been reducing steadily down to a level of -0.254% in 1987. The maximum and minimum values of the difference also shows the same tendency, indicating 0.31 and -1.00 respectively in 1987.

From a practical viewpoint, on the other hand, the acceptable error in ash content analysis is considered around 5% of the analyzed result according to the experiences of the coal industry.

The required precision of the ash analysis is specified in JIS as well as ASTM. According to JIS, the allowable tolerance is 0.6% for the sample with 10 to 20% ash content level. ASTM also gives 1% of allowable tolerance for the sample with more than 12% ash content.

Therefore, the current level of accuracy in ash content analysis by both SCC and NAPOCOR falls into the acceptable range.

b. Calorific value data

The statistical analysis of the calorific value data indicates inconsistent variation in the analysis data difference between SCC and NAPOCOR, for example, the difference is not significant in the periods of the second half of 1985 and 1986, on the other hand, the difference is significant in the other periods.

The required precisions are specified 144 Btu/lb and 100 Btu/lb in JIS and ASTM respectively, however, the difference upto 150 Btu/lb could be acceptable according to the experiences in the coal industry.

The current calorific value analysis data of both SCC and NAPOCOR is reasonably accurate, since the maximum and minimum differences fall within the ±150 Btu/lb range in 1987.

Table 19-6 Comparison of Ash Analysis Data from 1984 to 1987

Summary of Ash Analysis Data Comparison between SCC and NAPOCOR

On Dry Basis

Period	1984	1985		1986		1987
		1st Half	2nd Half	1st Half	2nd Half	
No. of Data	28	27	27	30	40	59
Average of SCC	19.640	10.684	13.060	11.962	11.785	14.071
Average of NPC	23.700	12.904	14.198	12.838	12.141	14.325
Difference (SCC-NPC)						
Average	-4.059	-2.219	-1.138	-0.876	-0.355	-0.254
Standard Deviation	3.498	1.749	0.992	0.607	0.296	0.272
Maximum	0.40	0.98	0.76	0.05	0.22	0.31
Minimum	-9.70	-6.11	-3.70	-2.24	-1.29	-1.00
Statistical Test	$t_o>t(1\%)$	$t_o>t(1\%)$	$t_o>t(1\%)$	$t_o>t(1\%)$	$t_o>t(1\%)$	$t_o>t(1\%)$

(NOTE) In the raw of 'Statistical Test',
t_o is a value of t statistics calculated from actual data.
$t(1\%)=t(0.01)$ is a value of t statistics obtained from t distribution table at significance level of 1% with a degree of freedom(no. of data - 1).
$t(5\%)=t(0.05)$ is a value at significance level of 5% with a degree of freedom in t distribution table.

Table 19-6 (1) Comparison of Ash Data, 1984

Data No.	Ship No.	SCC (adb) IM	SCC (adb) Ash	NPC (adb) IM	NPC (adb) Ash	SCC Ash(db)	NPC Ash(db)	Difference (SCC-NPC)
1	2	19.10	12.67	16.66	13.85	15.66	16.62	-0.96
2	3	16.91	17.60	16.48	18.65	21.18	22.33	-1.15
3	4	17.86	18.71	18.32	20.17	22.78	24.69	-1.91
4	5	17.51	21.35	18.37	22.24	25.88	27.24	-1.36
5	6	17.86	9.37	18.35	9.91	11.41	12.14	-0.73
6	7	17.11	13.79	17.49	13.40	16.64	16.24	0.40
7	8	17.79	17.61	18.77	17.20	21.42	21.17	0.25
8	9	17.92	13.07	16.87	14.70	15.92	17.68	-1.76
9	10	17.86	10.55	19.54	11.59	12.84	14.40	-1.56
10	11	17.72	9.14	20.64	9.62	11.11	12.12	-1.01
11	12	16.61	15.72	16.20	17.14	18.85	20.45	-1.60
12	13	14.97	19.17	16.58	20.04	22.54	24.02	-1.48
13	14	14.31	18.81	16.43	18.97	21.95	22.70	-0.75
14	15	14.85	20.53	14.85	22.32	24.11	26.21	-2.10
15	16	15.01	15.92	16.98	16.96	18.73	20.43	-1.70
16	17	17.57	13.97	16.22	15.94	16.95	19.03	-2.08
17	18	16.97	15.79	16.23	22.29	19.02	26.61	-7.59
18	19	15.32	19.91	14.20	24.84	23.51	28.95	-5.44
19	20	18.77	14.68	15.37	21.12	18.07	24.96	-6.88
20	21	17.60	17.22	14.67	25.20	20.90	29.53	-8.63
21	22	18.15	18.36	13.35	26.72	22.43	30.84	-8.41
22	23	17.68	17.54	15.55	23.26	21.31	27.54	-6.24
23	24	17.17	16.72	16.05	22.12	20.19	26.35	-6.16
24	25	16.11	17.49	15.80	24.43	20.85	29.01	-8.17
25	26	17.58	13.66	15.89	21.38	16.57	25.42	-8.85
26	27	19.22	14.92	15.38	23.76	18.47	28.08	-9.61
27	28	17.64	20.24	13.44	29.67	24.58	34.28	-9.70
28	29	16.19	21.84	15.32	29.24	26.06	34.53	-8.47
					Average	19.640	23.700	-4.059
					STDev	3.992	6.062	3.498

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 3.992
Standard Deviation of NPC Data S2= 6.062
Number of Data N= 28

$F_o = (S2*S2)/(S1*S1) =$ 2.3059489
$F(27,27,0.05) =$ 1.9
$F(27,27,0.01) =$ 2.51

Since $F_o > F(0.05)$,
the equality of variances is rejected at significance level of 5 %.
Since $F_o < F(0.01)$,
the equality of variances is not rejected at significance level of 1 %.

2) Comparison Test on Paired Ash Data

Average of Difference d=-4.059172
Standard Deviation of Difference Sd=3.4983411

$t_o = |d|/Sd*SQR(N) =$ 6.1398006
$t(27,0.05) =$ 2.052
$t(27,0.01) =$ 2.771

Since $t_o > t(0.01)$,
the difference is significant at significance level of 1 %, that is,
SCC presented lower ash than NPC did.

Table 19-6 (2) Comparison of Ash Data, 1st Half of 1985

Data No.	Ship No.	SCC (adb) IM	SCC (adb) Ash	NPC (adb) IM	NPC (adb) Ash	SCC Ash(db)	NPC Ash(db)	Difference (SCC-NPC)
1	30	19.83	6.17	18.62	8.38	7.70	10.30	-2.60
2	31	17.96	8.93	17.42	10.86	10.88	13.15	-2.27
3	32	18.81	7.49	17.12	8.99	9.23	10.85	-1.62
4	33	18.11	6.85	17.56	8.33	8.36	10.10	-1.74
5	34	19.04	5.65	15.51	7.72	6.98	9.14	-2.16
6	35	15.06	7.90	15.40	10.46	9.30	12.36	-3.06
7	36	15.00	8.87	17.19	11.61	10.44	14.02	-3.58
8	37	16.59	10.64	16.19	14.55	12.76	17.36	-4.60
9	38	16.70	10.52	13.88	16.14	12.63	18.74	-6.11
10	39	17.16	8.03	15.50	11.19	9.69	13.24	-3.55
11	40	15.81	9.58	16.05	12.37	11.38	14.73	-3.36
12	41	14.28	12.21	15.12	16.18	14.24	19.06	-4.82
13	42	13.09	15.68	14.29	18.74	18.04	21.86	-3.82
14	43	13.09	12.60	16.42	15.53	14.50	18.58	-4.08
15	44	15.22	14.69	15.94	18.08	17.33	21.51	-4.18
16	45	14.96	7.51	16.68	7.59	8.83	9.11	-0.28
17	46	18.44	8.95	17.95	9.86	10.97	12.02	-1.04
18	47	14.82	10.48	16.63	10.90	12.30	13.07	-0.77
19	48	11.23	8.99	16.74	9.11	10.13	10.94	-0.81
20	49	14.95	6.33	16.82	6.88	7.44	8.27	-0.83
21	50	13.50	9.82	19.56	8.34	11.35	10.37	0.98
22	51	14.50	7.67	17.42	9.68	8.97	11.72	-2.75
23	52	17.10	6.49	19.29	6.49	7.83	8.04	-0.21
24	53	13.02	6.84	19.36	7.00	7.86	8.68	-0.82
25	54	13.77	8.43	20.66	8.04	9.78	10.13	-0.36
26	55	17.28	7.35	20.20	7.79	8.89	9.76	-0.88
27	56	15.19	9.05	19.43	9.07	10.67	11.26	-0.59
					Average	10.684	12.904	-2.219
					STDev	2.826	4.051	1.749

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 2.826
Standard Deviation of NPC Data S2= 4.051
Number of Data N= 27
$F_o = (S2*S2)/(S1*S1) =$ 2.0539973
F(26,26,0.05)= 1.93
F(26,26,0.01)= 2.55

Since $F_o > F(0.05)$,
the equality of variances is rejected at significance level of 5 %.
Since $F_o < F(0.01)$,
the equality of variances is not rejected at significance level of 1 %.

2) Comparison Test on Paired Ash Data

Average of Difference d=-2.219029
Standard Deviation of Difference Sd=1.7486709
$t_o = |d|/Sd*SQR(N) =$ 6.5938143
t(26,0.05)= 2.056
t(26,0.01)= 2.779

Since $t_o > t(0.01)$,
the difference is significant at significance level of 1 %, that is,
SCC presented lower ash than NPC did.

Table 19-6 (3) Comparison of Ash Data, 2nd Half of 1985

Data No.	Ship No.	SCC (adb) IM	SCC (adb) Ash	NPC (adb) IM	NPC (adb) Ash	SCC Ash(db)	NPC Ash(db)	Difference (SCC-NPC)
1	57	15.22	12.62	18.47	13.48	14.89	16.53	-1.65
2	58	14.79	13.80	19.00	12.99	16.20	16.04	0.16
3	59	14.55	13.62	20.06	13.72	15.94	17.16	-1.22
4	60	15.22	10.64	20.35	12.49	12.55	15.68	-3.13
5	61	13.53	10.31	20.71	10.93	11.92	13.78	-1.86
6	62	14.54	9.15	20.27	8.65	10.71	10.85	-0.14
7	63	14.12	13.37	20.77	12.51	15.57	15.79	-0.22
8	64	15.75	10.81	19.68	10.40	12.83	12.95	-0.12
9	65	14.49	12.49	19.08	12.31	14.61	15.21	-0.61
10	66	14.98	15.75	18.62	16.72	18.53	20.55	-2.02
11	67	15.58	12.31	20.19	12.80	14.58	16.04	-1.46
12	68	16.01	13.02	17.75	14.49	15.30	17.62	-2.12
13	69	15.17	12.42	21.09	12.64	14.64	16.02	-1.38
14	70	17.32	9.00	20.61	8.91	10.89	11.22	-0.34
15	71	15.30	8.72	20.19	8.70	10.30	10.90	-0.61
16	72	13.98	10.93	21.58	10.16	12.71	12.96	-0.25
17	73	13.47	10.15	20.32	10.29	11.73	12.91	-1.18
18	74	13.25	9.45	19.49	10.00	10.89	12.42	-1.53
19	75	13.67	9.01	15.48	9.54	10.44	11.29	-0.85
20	76	13.64	8.76	16.13	9.20	10.14	10.97	-0.83
21	77	11.54	12.78	14.52	15.51	14.45	18.14	-3.70
22	78	11.72	11.34	15.02	12.05	12.85	14.18	-1.33
23	79	13.94	10.47	16.42	10.84	12.17	12.97	-0.80
24	80	14.62	9.84	16.56	10.00	11.52	11.98	-0.46
25	81	15.22	11.09	14.79	10.50	13.08	12.32	0.76
26	82	13.27	10.45	16.47	11.60	12.05	13.89	-1.84
27	83	14.18	9.40	16.29	10.86	10.95	12.97	-2.02
					Average	13.060	14.198	-1.138
					STDev	2.174	2.535	0.992

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 2.174
Standard Deviation of NPC Data S2= 2.535
Number of Data N= 27

$F_o = (S2*S2)/(S1*S1) =$ 1.3599579
$F(26,26,0.05) =$ 1.93
$F(26,26,0.01) =$ 2.55

Since $F_o < F(0.05)$,
the equality of variances is not rejected at significance level of 5 %.

Then,
the comparison test on ash data can be conducted.

2) Comparison Test on Paired Ash Data

Average of Difference d=-1.138466
Standard Deviation of Difference Sd=0.9916029

$t_o = |d|/Sd*SQR(N) =$ 5.9657382
$t(26,0.05) =$ 2.056
$t(26,0.01) =$ 2.779

Since $t_o > t(0.01)$,
the difference is significant at significance level of 1 %, that is,
SCC presented lower ash than NPC did.

Table 19-6 (4) Comparison of Ash Data, 1st Half of 1986

Data No.	Ship No.	SCC (adb) IM	SCC (adb) Ash	NPC (adb) IM	NPC (adb) Ash	SCC Ash(db)	NPC Ash(db)	Difference (SCC-NPC)
1	84	13.08	10.11	15.73	9.86	11.63	11.70	-0.07
2	85	12.23	10.40	14.57	10.59	11.85	12.40	-0.55
3	86	12.28	12.04	15.33	12.44	13.73	14.69	-0.97
4	87	14.61	12.99	14.18	14.45	15.21	16.84	-1.63
5	88	14.67	12.74	14.07	13.77	14.93	16.02	-1.09
6	89	13.01	9.63	12.40	10.77	11.07	12.29	-1.22
7	90	16.34	9.36	14.43	9.97	11.19	11.65	-0.46
8	91	13.83	11.79	14.56	12.61	13.68	14.76	-1.08
9	92	14.99	13.24	13.56	14.08	15.57	16.29	-0.71
10	93	13.64	13.31	15.38	13.53	15.41	15.99	-0.58
11	94	14.21	12.04	16.42	13.14	14.03	15.72	-1.69
12	95	15.84	9.67	18.42	9.94	11.49	12.18	-0.69
13	96	17.93	9.14	15.88	9.63	11.14	11.45	-0.31
14	97	17.34	8.41	16.56	9.54	10.17	11.43	-1.26
15	98	14.87	9.58	15.28	10.02	11.25	11.83	-0.57
16	99	12.98	8.66	13.93	10.04	9.95	11.66	-1.71
17	100	15.19	8.88	16.32	9.51	10.47	11.36	-0.89
18	101	15.50	8.50	16.05	8.53	10.06	10.16	-0.10
19	102	13.85	8.61	16.90	8.29	9.99	9.98	0.02
20	103	17.08	8.36	18.35	8.72	10.08	10.68	-0.60
21	104	15.08	10.21	16.40	10.70	12.02	12.80	-0.78
22	105	13.95	11.62	16.83	12.21	13.50	14.68	-1.18
23	106	14.61	10.81	17.42	11.14	12.66	13.49	-0.83
24	107	16.49	9.30	17.90	10.94	11.14	13.33	-2.19
25	108	15.43	10.51	16.88	10.29	12.43	12.38	0.05
26	109	15.76	7.59	19.28	9.08	9.01	11.25	-2.24
27	110	16.96	6.73	21.14	6.98	8.10	8.85	-0.75
28	111	15.75	8.05	19.59	8.42	9.55	10.47	-0.92
29	112	17.96	9.88	20.03	9.64	12.04	12.05	-0.01
30	113	16.54	12.92	17.99	13.73	15.48	16.74	-1.26
					Average	11.962	12.838	-0.876
					STDev	2.065	2.195	0.607

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 2.065
Standard Deviation of NPC Data S2= 2.195
Number of Data N= 30

$F_o = (S2*S2)/(S1*S1) =$ 1.1297267
$F(29,29,0.05) =$ 1.86
$F(29,29,0.01) =$ 2.42

Since $F_o < F(0.05)$,
the equality of variances is not rejected at significance level of 5 %.

2) Comparison Test on Paired Ash Data

Average of Difference d=-0.875689
Standard Deviation of Difference Sd=0.6074619

$t_o = |d|/Sd*SQR(N) =$ 7.8957167
$t(29,0.05) =$ 2.045
$t(29,0.01) =$ 2.756

Since $t_o > t(0.01)$,
the difference is significant at significance level of 1 %, that is,
SCC presented lower ash than NPC did.

Table 19-6 (5) Comparison of Ash Data, 2nd Half of 1986

Data No.	Ship No.	SCC (adb) IM	SCC (adb) Ash	NPC (adb) IM	NPC (adb) Ash	SCC Ash(db)	NPC Ash(db)	Difference (SCC-NPC)
1	114	17.30	7.50	17.53	7.67	9.07	9.30	-0.23
2	115	19.42	7.29	18.41	7.82	9.05	9.58	-0.54
3	116	17.36	12.88	19.85	13.18	15.59	16.44	-0.86
4	117	14.41	12.22	18.54	12.02	14.28	14.76	-0.48
5	118	15.31	10.09	16.76	10.99	11.91	13.20	-1.29
6	119	16.03	9.51	18.74	9.79	11.33	12.05	-0.72
7	120	16.90	7.26	18.58	7.74	8.74	9.51	-0.77
8	121	16.44	9.27	17.35	9.15	11.09	11.07	0.02
9	122	17.67	8.86	18.78	9.13	10.76	11.24	-0.48
10	123	16.76	7.69	17.45	7.72	9.24	9.35	-0.11
11	124	17.99	8.02	18.90	8.09	9.78	9.98	-0.20
12	125	17.88	8.48	18.88	8.20	10.33	10.11	0.22
13	126	16.97	7.98	18.47	8.03	9.61	9.85	-0.24
14	127	16.35	8.81	17.62	8.56	10.53	10.39	0.14
15	128	15.98	9.10	16.95	9.11	10.83	10.97	-0.14
16	129	13.92	14.57	14.63	14.98	16.93	17.55	-0.62
17	130	16.02	10.78	17.16	10.97	12.84	13.24	-0.41
18	131	17.41	10.76	18.13	10.94	13.03	13.36	-0.33
19	132	17.94	8.38	19.07	8.56	10.21	10.58	-0.37
20	133	17.53	8.69	18.69	8.66	10.54	10.65	-0.11
21	134	17.16	7.75	18.18	7.82	9.36	9.56	-0.20
22	135	18.31	7.68	18.74	8.13	9.40	10.00	-0.60
23	136	17.91	7.58	18.92	7.64	9.23	9.42	-0.19
24	137	16.23	8.41	17.48	8.64	10.04	10.47	-0.43
25	138	15.31	12.41	16.01	12.57	14.65	14.97	-0.31
26	139	16.87	10.10	18.11	10.49	12.15	12.81	-0.66
27	140	16.32	11.59	17.63	11.74	13.85	14.25	-0.40
28	141	17.55	9.57	17.47	9.91	11.61	12.01	-0.40
29	142	18.36	10.37	18.66	10.29	12.70	12.65	0.05
30	143	16.38	11.28	16.84	11.84	13.49	14.24	-0.75
31	144	16.18	13.68	16.51	14.15	16.32	16.95	-0.63
32	145	16.13	13.80	16.43	13.97	16.45	16.72	-0.26
33	146	17.25	8.09	17.63	8.19	9.78	9.94	-0.17
34	147	17.81	7.54	18.09	7.58	9.17	9.25	-0.08
35	148	20.44	7.54	19.86	7.78	9.48	9.71	-0.23
36	149	17.04	12.51	16.58	12.90	15.08	15.46	-0.38
37	150	16.89	11.83	16.34	12.30	14.23	14.70	-0.47
38	151	16.21	13.04	16.15	13.26	15.56	15.81	-0.25
39	152	15.73	10.00	14.71	10.43	11.87	12.23	-0.36
40	153	17.13	9.38	16.42	9.44	11.32	11.29	0.02
					Average	11.785	12.141	-0.355
					STDev	2.412	2.516	0.296

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Table 19-6 (6) Comparison of Ash Data, 2nd Half of 1986 Cont'd.

1) Test on Equality of Variances

Standard Deviation of SCC Data	S1=	2.412
Standard Deviation of NPC Data	S2=	2.516
Number of Data	N=	40

F_o =(S2*S2)/(S1*S1)= 1.0873505
F(39,39,0.05)= 1.71
F(39,39,0.01)= 2.14

Since $F_o < F(0.05)$,
the equality of variances is not rejected at significance level of 5 %.

2) Comparison Test on Paired Ash Data

Average of Difference	d= -0.35544
Standard Deviation of Difference	Sd=0.2961407

t_o =|d|/Sd*SQR(N)= 7.5909793
t(39,0.05)= 2.023
t(39,0.01)= 2.709

Since $t_o > t(0.01)$,
the difference is significant at significance level of 1 %, that is,
SCC presented lower ash than NPC did.

Table 19-6 (7) Comparison of Ash Data, 1987

Data No.	Ship No.	SCC (adb) IM	SCC (adb) Ash	NPC (adb) IM	NPC (adb) Ash	SCC Ash(db)	NPC Ash(db)	Difference (SCC-NPC)
1	154	12.40	9.05	12.73	9.00	10.33	10.31	0.02
2	155	13.40	7.35	13.51	7.34	8.49	8.49	0.00
3	156	14.75	9.48	15.05	9.90	11.12	11.65	-0.53
4	157	13.92	8.27	13.71	8.55	9.61	9.91	-0.30
5	158	14.38	8.89	14.66	8.66	10.38	10.15	0.24
6	159	13.41	10.37	13.46	10.79	11.98	12.47	-0.49
7	160	11.46	13.09	11.61	13.69	14.78	15.49	-0.70
8	161	12.80	11.11	12.75	11.34	12.74	13.00	-0.26
9	162	13.15	10.54	13.41	10.61	12.14	12.25	-0.12
10	163	14.61	9.96	14.62	10.04	11.66	11.76	-0.10
11	164	15.46	13.83	15.47	13.98	16.36	16.54	-0.18
12	165	15.20	11.98	14.79	12.02	14.13	14.11	0.02
13	166	12.75	12.61	12.91	12.54	14.45	14.40	0.05
14	167	14.65	12.23	14.58	12.20	14.33	14.28	0.05
15	168	15.36	11.76	15.87	11.93	13.89	14.18	-0.29
16	169	14.42	12.18	15.90	12.18	14.23	14.48	-0.25
17	170	15.21	10.85	15.64	10.94	12.80	12.97	-0.17
18	171	15.96	11.01	15.58	11.27	13.10	13.35	-0.25
19	172	15.02	13.72	13.86	13.79	16.14	16.01	0.14
20	173	13.36	13.63	12.98	13.63	15.73	15.66	0.07
21	174	17.00	11.77	16.07	11.81	14.18	14.07	0.11
22	175	15.86	12.46	15.43	12.41	14.81	14.67	0.13
23	176	15.13	14.17	13.79	14.43	16.70	16.74	-0.04
24	177	15.38	15.64	15.09	15.80	18.48	18.61	-0.13
25	178	13.49	13.98	13.27	14.30	16.16	16.49	-0.33
26	179	14.44	14.85	14.36	15.25	17.36	17.81	-0.45
27	180	14.63	14.21	14.48	14.35	16.65	16.78	-0.13
28	181	14.93	16.16	14.73	16.32	19.00	19.14	-0.14
29	182	13.69	16.86	14.16	17.22	19.53	20.06	-0.53
30	183	13.45	14.29	13.62	14.29	16.51	16.54	-0.03
31	184	11.96	16.27	11.93	16.58	18.48	18.83	-0.35
32	185	13.30	15.99	13.59	16.34	18.44	18.91	-0.47
33	186	13.52	11.60	13.51	11.66	13.41	13.48	-0.07
34	187	14.41	10.10	15.47	10.23	11.80	12.10	-0.30
35	188	16.65	9.74	16.88	10.32	11.69	12.42	-0.73
36	189	15.08	10.86	15.45	11.66	12.79	13.79	-1.00
37	190	14.26	12.18	14.14	12.52	14.21	14.58	-0.38
38	191	14.19	10.94	14.35	11.15	12.75	13.02	-0.27
39	192	16.06	11.35	15.07	11.81	13.52	13.91	-0.38
40	193	14.58	13.19	14.92	13.34	15.44	15.68	-0.24
41	194	15.12	14.99	15.13	15.06	17.66	17.74	-0.08
42	195	16.02	10.15	15.89	10.30	12.09	12.25	-0.16
43	196	14.91	11.12	14.52	11.61	13.07	13.58	-0.51
44	197	13.72	13.12	13.79	13.44	15.21	15.59	-0.38
45	198	15.82	10.22	15.00	10.55	12.14	12.41	-0.27
46	199	15.95	10.75	14.74	10.99	12.79	12.89	-0.10
47	200	15.88	10.26	14.66	10.64	12.20	12.47	-0.27
48	201	17.55	6.68	16.68	6.87	8.10	8.25	-0.14
49	202	15.00	14.66	14.59	15.38	17.25	18.01	-0.76
50	203	15.38	10.25	14.66	10.36	12.11	12.14	-0.03
51	204	15.00	10.72	15.02	11.15	12.61	13.12	-0.51
52	205	14.52	10.58	14.23	10.99	12.38	12.81	-0.44
53	206	14.83	11.55	14.83	11.91	13.56	13.98	-0.42

/ Cont'd

Table 19-6 (8) Comparison of Ash Data, 1987 Cont'd.

Data No.	Ship No.	SCC (adb) IM	SCC (adb) Ash	NPC (adb) IM	NPC (adb) Ash	SCC Ash(db)	NPC Ash(db)	Difference (SCC-NPC)
54	207	15.05	9.53	15.23	9.58	11.22	11.30	-0.08
55	208	15.00	11.46	15.56	11.64	13.48	13.78	-0.30
56	209	14.30	13.96	14.54	14.37	16.29	16.81	-0.53
57	210	15.74	13.48	15.00	14.15	16.00	16.65	-0.65
58	211	15.14	14.86	14.52	15.72	17.51	18.39	-0.88
59	212	15.06	12.07	15.54	11.74	14.21	13.90	0.31
					Average	14.071	14.325	-0.254
					STDev	2.609	2.663	0.272

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 2.609
Standard Deviation of NPC Data S2= 2.663
Number of Data N= 59
F_o =(S2*S2)/(S1*S1)= 1.0417845
F(58,58,0.05)= 1.55
F(58,58,0.01)= 1.87

Since F_o < F(0.05),
the equality of variances is not rejected at significance level of 5 %.

2) Comparison Test on Paired Ash Data

Average of Difference d=-0.254009
Standard Deviation of Difference Sd=0.2724002
t_o =|d|/Sd*SQR(N)= 7.1625543
t(58,0.05)= 2.002
t(58,0.01)= 2.664

Since t_o > t(0.01),
the difference is significant at significance level of 1 %, that is,
SCC presented lower ash than NPC did.

Table 19-7 Comparison of Heating Value Data from 1984 to 1987

Table 19-7 Summary of BTU Analysis Data Comparison between SCC and NAPOCOR

On Dry Basis

Period	1984	1985		1986		1987
		1st Half	2nd Half	1st Half	2nd Half	
No. of Data	28	27	27	30	40	59
Average of SCC	9859.6	11001.2	10749.1	10945.2	10874.6	10599.9
Average of NPC	9350.4	10874.5	10697.3	10667.7	10829.9	10594.4
Difference (SCC-NPC)						
Average	509.2	126.7	51.8	277.5	44.7	5.6
Standard Deviation	480.2	312.4	147.7	217.4	86.6	55.5
Maximum	1300	488	476	1152	238	147
Minimum	-444	-664	-261	-31	-203	-112
Statistical Test	$t_o > t(1\%)$	$t_o > t(5\%)$	$t_o < t(5\%)$	$t_o > t(1\%)$	$t_o > t(1\%)$	$t_o < t(5\%)$

(NOTE) In the raw of 'Statistical Test',
t_o is a value of t statistics calculated from actual data.
$t(1\%)=t(0.01)$ is a value of t statistics obtained from t distribution table at significance level of 1% with a degree of freedom(no. of data - 1).
$t(5\%)=t(0.05)$ is a value at significance level of 5% with a degree of freedom in t distribution table.

Table 19-7 (1) Comparison of BTU Data, 1984

Data No.	Ship No.	SCC (adb) IM	SCC (adb) BTU	NPC (adb) IM	NPC (adb) BTU	SCC BTU(db)	NPC BTU(db)	Difference (SCC-NPC)
1	2	19.10	8549	16.66	8679	10567	10414	153
2	3	16.91	8136	16.48	7961	9792	9532	260
3	4	17.86	7792	18.32	7783	9486	9528	-42
4	5	17.51	7520	18.37	7232	9116	8859	257
5	6	17.86	9009	18.35	9091	10968	11134	-166
6	7	17.11	8521	17.49	8128	10280	9851	429
7	8	17.79	7876	18.77	7836	9580	9647	-66
8	9	17.92	8438	16.87	8466	10280	10184	96
9	10	17.86	8881	19.54	8453	10812	10506	306
10	11	17.72	8652	20.64	8697	10515	10959	-444
11	12	16.61	8261	16.20	8006	9906	9554	353
12	13	14.97	8074	16.58	7820	9495	9374	121
13	14	14.31	8143	16.43	7850	9503	9393	110
14	15	14.85	7961	14.85	7580	9349	8902	447
15	16	15.01	8464	16.98	8116	9959	9776	183
16	17	17.57	8445	16.22	8243	10245	9839	406
17	18	16.97	8322	16.23	7625	10023	9102	921
18	19	15.32	7905	14.20	7392	9335	8615	720
19	20	18.77	8190	15.37	7838	10082	9261	821
20	21	17.60	7948	14.67	7248	9646	8494	1152
21	22	18.15	7777	13.35	7107	9502	8202	1300
22	23	17.68	7960	15.55	7504	9670	8886	784
23	24	17.17	8081	16.05	7662	9756	9127	629
24	25	16.11	8206	15.80	7374	9782	8758	1024
25	26	17.58	8493	15.89	7742	10305	9205	1100
26	27	19.22	8031	15.38	7413	9942	8760	1181
27	28	17.64	7542	13.44	6803	9157	7859	1298
28	29	16.19	7554	15.32	6849	9013	8088	925
					Average	9859.6	9350.4	509.2
					STDev	504.3	809.8	480.2

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 504.336
Standard Deviation of NPC Data S2= 809.754
Number of Data N= 28

$F_o = (S2*S2)/(S1*S1) =$ 2.5778981
$F(27,27,0.05) =$ 1.9
$F(27,27,0.01) =$ 2.51

Since $F_o > F(0.01)$,
the equality of variances is rejected at significance level of 1 %.
Therefore, strictly speaking,
the comparison test on BTU data can't be conducted due to the variation difference.

2) Comparison Test on Paired BTU Data

Average of Difference d=509.19273
Standard Deviation of Difference Sd=480.16193

$t_o = |d|/Sd*SQR(N) =$ 5.6114293
$t(27,0.05) =$ 2.052
$t(27,0.01) =$ 2.771

Since $t_o > t(0.01)$,
the difference is significant at significance level of 1 %, that is,
SCC presented higher BTU than NPC did.

Table 19-7 (2) Comparison of BTU Data, 1st Half of 1985

Data No.	Ship No.	SCC (adb) IM	SCC (adb) BTU	NPC (adb) IM	NPC (adb) BTU	SCC BTU(db)	NPC BTU(db)	Difference (SCC-NPC)
1	30	19.83	9216	18.62	9116	11496	11202	294
2	31	17.96	9045	17.42	8840	11025	10705	320
3	32	18.81	9147	17.12	9166	11266	11059	207
4	33	18.11	9325	17.56	9210	11387	11172	215
5	34	19.04	9362	15.51	9358	11564	11076	488
6	35	15.06	9577	15.40	9157	11275	10824	451
7	36	15.00	9366	17.19	9166	11019	11069	-50
8	37	16.59	8922	16.19	8737	10697	10425	272
9	38	16.70	8946	13.88	8866	10739	10295	445
10	39	17.16	9328	15.50	9226	11260	10918	342
11	40	15.81	9236	16.05	8963	10970	10677	294
12	41	14.28	8993	15.12	8578	10491	10106	385
13	42	13.09	8639	14.29	8902	9940	10386	-446
14	43	13.09	9070	16.42	8580	10436	10266	170
15	44	15.22	8496	15.94	8066	10021	9596	426
16	45	14.96	9613	16.68	9433	11304	11321	-17
17	46	18.44	9078	17.95	9054	11130	11035	96
18	47	14.82	9166	16.63	8823	10761	10583	178
19	48	11.23	9628	16.74	9029	10846	10844	2
20	49	14.95	9722	16.82	9304	11431	11185	246
21	50	13.50	9280	19.56	9164	10728	11392	-664
22	51	14.50	9628	17.42	8938	11261	10823	437
23	52	17.10	9506	19.29	9045	11467	11207	260
24	53	13.02	9807	19.36	9074	11275	11252	23
25	54	13.77	9398	20.66	9106	10899	11477	-578
26	55	17.28	9303	20.20	9179	11246	11503	-256
27	56	15.19	9411	19.43	9035	11097	11214	-117
					Average	11001.2	10874.5	126.7
					STDev	422.4	462.4	312.4

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 422.415
Standard Deviation of NPC Data S2= 462.386
Number of Data N= 27

$F_o = (S2*S2)/(S1*S1) =$ 1.1982054
$F(26,26,0.05) =$ 1.93
$F(26,26,0.01) =$ 2.55

Since $F_o < F(0.05)$,
the equality of variances is not rejected at significance level of 5 %.

Then,
the comparison test on BTU data can be conducted.

2) Comparison Test on Paired BTU Data

Average of Difference d=126.68023
Standard Deviation of Difference Sd=312.35978

$t_o = |d|/Sd*SQR(N) =$ 2.1073449
$t(26,0.05) =$ 2.056
$t(26,0.01) =$ 2.779

Since $t(0.05) < t_o < t(0.01)$,
the difference is significant at significance level of 5 %, that is,
SCC presented slightly higher BTU than NPC did.

Table 19-7 (3) Comparison of BTU Data, 2nd Half of 1985

Data No.	Ship No.	SCC (adb) IM	SCC (adb) BTU	NPC (adb) IM	NPC (adb) BTU	SCC BTU(db)	NPC BTU(db)	Difference (SCC-NPC)
1	57	15.22	8892	18.47	8515	10488	10444	44
2	58	14.79	8920	19.00	8489	10468	10480	-12
3	59	14.55	8802	20.06	8225	10301	10289	12
4	60	15.22	8925	20.35	8417	10527	10567	-40
5	61	13.53	9082	20.71	8535	10503	10764	-261
6	62	14.54	9463	20.27	8858	11073	11110	-37
7	63	14.12	9009	20.77	8388	10490	10587	-97
8	64	15.75	9062	19.68	8701	10756	10833	-77
9	65	14.49	8993	19.08	8433	10517	10421	95
10	66	14.98	8541	18.62	7940	10046	9757	289
11	67	15.58	8964	20.19	8394	10618	10517	101
12	68	16.01	8785	17.75	8517	10460	10355	105
13	69	15.17	9012	21.09	8317	10624	10540	84
14	70	17.32	9145	20.61	8780	11061	11059	1
15	71	15.30	9366	20.19	8806	11058	11034	24
16	72	13.98	9229	21.58	8452	10729	10778	-49
17	73	13.47	9494	20.32	8680	10972	10894	78
18	74	13.25	9640	19.49	8867	11112	11014	99
19	75	13.67	9695	15.48	9346	11230	11058	172
20	76	13.64	9600	16.13	9337	11116	11133	-16
21	77	11.54	9393	14.52	8670	10618	10143	476
22	78	11.72	9623	15.02	9032	10901	10628	272
23	79	13.94	9352	16.42	8926	10867	10680	187
24	80	14.62	9346	16.56	9185	10946	11008	-62
25	81	15.22	9104	14.79	9182	10738	10776	-37
26	82	13.27	9471	16.47	9220	10920	11038	-118
27	83	14.18	9513	16.29	9142	11085	10921	164
					Average	10749.1	10697.3	51.8
					STDev	295.5	335.4	147.7

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 295.499
Standard Deviation of NPC Data S2= 335.437
Number of Data N= 27

$F_o = (S2*S2)/(S1*S1) =$ 1.2885773
$F(26,26,0.05) =$ 1.93
$F(26,26,0.01) =$ 2.55

Since $F_o < F(0.05)$,
the equality of variances is not rejected at significance level of 5 %.

Then,
the comparison test on BTU data can be conducted.

2) Comparison Test on Paired BTU Data

Average of Difference d=51.771481
Standard Deviation of Difference Sd= 147.7221

$t_o = |d|/Sd*SQR(N) =$ 1.8210715
$t(26,0.05) =$ 2.056
$t(26,0.01) =$ 2.779

Since $t_o < t(0.05)$,
the difference is not significant at significance level of 5 %, that is,
SCC presented the same level of BTU as NPC did.

Table 19-7 (4) Comparison of BTU Data, 1st Half of 1986

Data No.	Ship No.	SCC (adb) IM	SCC (adb) BTU	NPC (adb) IM	NPC (adb) BTU	SCC BTU(db)	NPC BTU(db)	Difference (SCC-NPC)
1	84	13.08	9552	15.73	9287	10989	11021	-31
2	85	12.23	9592	14.57	9269	10929	10850	79
3	86	12.28	9370	15.33	8907	10682	10520	162
4	87	14.61	8928	14.18	8793	10456	10246	210
5	88	14.67	8952	14.07	8803	10491	10244	247
6	89	13.01	9536	12.40	9317	10962	10636	326
7	90	16.34	9243	14.43	9245	11048	10804	244
8	91	13.83	9268	14.56	9016	10755	10552	203
9	92	14.99	9001	13.56	8767	10588	10142	446
10	93	13.64	9069	15.38	8710	10501	10293	208
11	94	14.21	9031	16.42	8581	10550	10267	283
12	95	15.84	9244	18.42	8761	10984	10739	245
13	96	17.93	9007	15.88	8984	10975	10680	295
14	97	17.34	9235	16.56	9071	11172	10871	301
15	98	14.87	9409	15.28	9195	11053	10853	199
16	99	12.98	9735	13.93	9341	11187	10853	334
17	100	15.19	9399	16.32	9170	11082	10958	124
18	101	15.50	9483	16.05	9249	11222	11017	205
19	102	13.85	9711	16.90	9104	11272	10955	317
20	103	17.08	9352	18.35	8936	11278	10944	334
21	104	15.08	9250	16.40	8998	10893	10763	129
22	105	13.95	9234	16.83	8720	10731	10485	246
23	106	14.61	9242	17.42	8822	10823	10683	140
24	107	16.49	9465	17.90	8779	11334	10693	641
25	108	15.43	9147	16.88	9005	10816	10834	-18
26	109	15.76	9460	19.28	8786	11230	10885	345
27	110	16.96	9413	21.14	8868	11336	11245	90
28	111	15.75	9449	19.59	8092	11215	10063	1152
29	112	17.96	9119	20.03	8615	11115	10773	343
30	113	16.54	8919	17.99	8334	10687	10162	524
					Average	10945.2	10667.7	277.5
					STDev	270.1	305.8	217.4

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 270.136
Standard Deviation of NPC Data S2= 305.783
Number of Data N= 30

$F_o = (S2*S2)/(S1*S1) =$ 1.2813322
$F(29,29,0.05) =$ 1.86
$F(29,29,0.01) =$ 2.42

Since $F_o < F(0.05)$,
the equality of variances is not rejected at significance level of 5 %.

2) Comparison Test on Paired BTU Data

Average of Difference d= 277.4935
Standard Deviation of Difference Sd= 217.4495

$t_o = |d|/Sd*SQR(N) =$ 6.9896436
$t(29,0.05) =$ 2.045
$t(29,0.01) =$ 2.756

Since $t_o > t(0.01)$,
the difference is significant at significance level of 1 %, that is,
SCC presented higher BTU than NPC did.

Table 19-7 (5) Comparison of BTU Data, 2nd Half of 1986

Data No.	Ship No.	SCC (adb) IM	SCC (adb) BTU	NPC (adb) IM	NPC (adb) BTU	SCC BTU(db)	NPC BTU(db)	Difference (SCC-NPC)
1	114	17.30	9331	17.53	9209	11283	11166	116
2	115	19.42	9138	18.41	9111	11340	11167	173
3	116	17.36	8554	19.85	8211	10351	10245	106
4	117	14.41	9045	18.54	8480	10568	10410	158
5	118	15.31	9184	16.76	8829	10844	10607	238
6	119	16.03	9022	18.74	8792	10744	10820	-75
7	120	16.90	9254	18.58	9139	11136	11225	-89
8	121	16.44	9133	17.35	9057	10930	10958	-28
9	122	17.67	9007	18.78	8881	10940	10934	6
10	123	16.76	9262	17.45	9149	11127	11083	44
11	124	17.99	9163	18.90	9089	11173	11207	-34
12	125	17.88	9091	18.88	9007	11070	11103	-33
13	126	16.97	9267	18.47	9062	11161	11115	46
14	127	16.35	9341	17.62	9121	11167	11072	95
15	128	15.98	9298	16.95	9128	11066	10991	75
16	129	13.92	8825	14.63	8656	10252	10139	113
17	130	16.02	9030	17.16	8886	10753	10727	26
18	131	17.41	8825	18.13	8695	10685	10620	65
19	132	17.94	9165	19.07	8958	11169	11069	100
20	133	17.53	9154	18.69	8953	11100	11011	89
21	134	17.16	9255	18.18	9100	11172	11122	50
22	135	18.31	9131	18.74	9037	11178	11121	57
23	136	17.91	9163	18.92	9088	11162	11209	-47
24	137	16.23	9396	17.48	9151	11216	11089	127
25	138	15.31	8861	16.01	8770	10463	10442	21
26	139	16.87	9056	18.11	8791	10894	10735	159
27	140	16.32	8869	17.63	8682	10599	10540	58
28	141	17.55	9013	17.47	8897	10931	10780	151
29	142	18.36	8763	18.66	8770	10734	10782	-48
30	143	16.38	8931	16.84	8779	10680	10557	124
31	144	16.18	8562	16.51	8539	10215	10228	-13
32	145	16.13	8615	16.43	8601	10272	10292	-20
33	146	17.25	9150	17.63	9149	11057	11107	-50
34	147	17.81	9246	18.09	9228	11250	11266	-16
35	148	20.44	8960	19.86	9012	11262	11245	17
36	149	17.04	8695	16.58	8668	10481	10391	90
37	150	16.89	8625	16.34	8852	10378	10581	-203
38	151	16.21	8685	16.15	8728	10365	10409	-44
39	152	15.73	9161	14.71	9191	10871	10776	95
40	153	17.13	9070	16.42	9073	10945	10855	89
					Average	10874.6	10829.9	44.7
					STDev	331.7	331.2	86.6

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Table 19-7 (6) Comparison of BTU Data, 2nd Half of 1986 Cont'd.

1) Test on Equality of Variances

Standard Deviation of SCC Data	S1=	331.731
Standard Deviation of NPC Data	S2=	331.197
Number of Data	N=	40
F_o =(S1*S1)/(S2*S2)=	1.0032239	
F(39,39,0.05)=	1.71	
F(39,39,0.01)=	2.14	

Since $F_o < F(0.05)$,
the equality of variances is not rejected at significance level of 5 %.

2) Comparison Test on Paired BTU Data

Average of Difference	d=	44.682989
Standard Deviation of Difference	Sd=	86.621141
t_o =|d|/Sd*SQR(N)=	3.2624835	
t(39,0.05)=	2.023	
t(39,0.01)=	2.709	

Since $t_o > t(0.01)$,
the difference is significant at significance level of 1 %, that is,
SCC presented higher BTU than NPC did.

Table 19-7 (7) Comparison of BTU Data, 1987

Data No.	Ship No.	SCC (adb) IM	SCC (adb) BTU	NPC (adb) IM	NPC (adb) BTU	SCC BTU(db)	NPC BTU(db)	Difference (SCC-NPC)
1	154	12.40	9682	12.73	9678	11053	11090	-37
2	155	13.40	9813	13.51	9782	11331	11310	21
3	156	14.75	9385	15.05	9355	11009	11012	-4
4	157	13.92	9625	13.71	9613	11181	11140	41
5	158	14.38	9573	14.66	9499	11181	11131	50
6	159	13.41	9340	13.46	9273	10786	10715	71
7	160	11.46	9301	11.61	9268	10505	10485	20
8	161	12.80	9408	12.75	9438	10789	10817	-28
9	162	13.15	9425	13.41	9359	10852	10808	44
10	163	14.61	9304	14.62	9264	10896	10850	46
11	164	15.46	8717	15.47	8703	10311	10296	15
12	165	15.20	9010	14.79	9015	10625	10580	45
13	166	12.75	9278	12.91	9219	10634	10586	48
14	167	14.65	9084	14.58	9055	10643	10601	43
15	168	15.36	8913	15.87	8925	10530	10609	-78
16	169	14.42	8973	15.90	8849	10485	10522	-37
17	170	15.21	9060	15.64	9035	10685	10710	-25
18	171	15.96	8972	15.58	9027	10676	10693	-17
19	172	15.02	8906	13.86	8969	10480	10412	68
20	173	13.36	8980	12.98	9062	10365	10414	-49
21	174	17.00	8827	16.07	8866	10635	10564	71
22	175	15.86	8811	15.43	8808	10472	10415	57
23	176	15.13	8765	13.79	8777	10328	10181	147
24	177	15.38	8480	15.09	8512	10021	10025	-3
25	178	13.49	9005	13.27	8987	10409	10362	47
26	179	14.44	8732	14.36	8727	10206	10190	15
27	180	14.63	8716	14.48	8753	10210	10235	-25
28	181	14.93	8426	14.73	8464	9905	9926	-21
29	182	13.69	8491	14.16	8468	9838	9865	-27
30	183	13.45	8892	13.62	8848	10274	10243	31
31	184	11.96	8735	11.93	8837	9922	10034	-112
32	185	13.30	8536	13.59	8586	9845	9936	-91
33	186	13.52	9178	13.51	9181	10613	10615	-2
34	187	14.41	9336	15.47	9314	10908	11019	-111
35	188	16.65	9102	16.88	9111	10920	10961	-41
36	189	15.08	9178	15.45	9125	10808	10792	15
37	190	14.26	9137	14.14	9172	10657	10683	-26
38	191	14.19	9289	14.35	9313	10825	10873	-48
39	192	16.06	8937	15.07	9024	10647	10625	22
40	193	14.58	8763	14.92	8756	10259	10291	-33
41	194	15.12	8538	15.13	8519	10059	10038	21
42	195	16.02	9067	15.89	9077	10797	10792	5
43	196	14.91	9178	14.52	9136	10786	10688	98
44	197	13.72	9097	13.79	9096	10544	10551	-7
45	198	15.82	9150	15.00	9294	10870	10934	-65
46	199	15.95	9084	14.74	9265	10808	10867	-59
47	200	15.88	9152	14.66	9208	10880	10790	90
48	201	17.55	9395	16.68	9522	11395	11428	-33
49	202	15.00	8608	14.59	8627	10127	10101	26
50	203	15.38	9168	14.66	9302	10834	10900	-66
51	204	15.00	9181	15.02	9205	10801	10832	-31
52	205	14.52	9303	14.23	9364	10883	10918	-34
53	206	14.83	9087	14.83	9082	10669	10663	6

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Table 19-7 (8) Compariosn of BTU Data, 1987 Cont'd.

Data No.	Ship No.	SCC (adb) IM	SCC (adb) BTU	NPC (adb) IM	NPC (adb) BTU	SCC BTU(db)	NPC BTU(db)	Difference (SCC-NPC)
54	207	15.05	9361	15.23	9366	11019	11049	-29
55	208	15.00	9139	15.56	9070	10752	10741	10
56	209	14.30	8809	14.54	8726	10279	10211	68
57	210	15.74	8732	15.00	8711	10363	10248	115
58	211	15.14	8615	14.52	8574	10152	10030	122
59	212	15.06	9056	15.54	9012	10662	10670	-8
					Average	10599.9	10594.4	5.6
					STDev	360.7	365.5	55.5

1) Test on Equality of Variances

Standard Deviation of SCC Data S1= 360.723
Standard Deviation of NPC Data S2= 365.542
Number of Data N= 59
$F_o = (S2*S2)/(S1*S1) =$ 1.0268983
F(58,58,0.05)= 1.55
F(58,58,0.01)= 1.87
Since $F_o < F(0.05)$,
the equality of variances is not rejected at significance level of 5 %.

2) Comparison Test on Paired BTU Data

Average of Difference d=5.5826646
Standard Deviation of Difference Sd=55.531819
$t_o = |d|/Sd*SQR(N) =$ 0.7721926
t(58,0.05)= 2.002
t(58,0.01)= 2.664
Since $t_o < t(0.05)$,
the difference is not significant at significance level of 5 %, that is,
SCC presented the same level of BTU as NPC did.

Table 19-8 Ash Composition Analysis by SCC

Table 19-8 (1) Ash Composition of SCC Coal

Year	Ship No.	Ash (db)	Ash Composition (db) SiO2	Al2O3	Fe2O3	CaO	MgO	Na2O	K2O	TiO2	Mn3O4	SO3	P2O5	BaO	SrO	ZnO
1985	64	12.83	44.30	23.40	6.20	6.90	6.30	3.85	1.60	1.05	0.050	5.28	0.302	0.14	0.17	0.018
	65	14.61	49.00	23.30	5.80	5.50	5.00	3.90	1.63	1.05	0.049	3.62	0.277	0.15	0.14	0.018
	67	14.58	49.30	23.90	5.80	5.80	4.86	3.06	1.65	1.16	0.046	2.65	0.257	0.13	0.14	0.019
	68	15.50	49.90	24.20	6.00	5.70	4.83	3.60	1.59	1.18	0.046	3.80	0.291	0.13	0.15	0.018
	69	14.64	48.50	23.90	4.82	6.70	5.30	3.35	1.57	1.16	0.040	3.38	0.266	0.14	0.14	0.019
	70	10.89	43.70	22.80	6.10	8.20	7.80	2.54	1.56	1.03	0.051	4.88	0.243	0.19	0.19	0.019
	71	10.30	46.70	21.80	6.10	8.10	5.50	1.28	1.46	0.98	0.071	7.10	0.231	0.16	0.18	0.021
	73	11.73	46.30	23.30	6.80	7.70	4.95	0.60	1.49	1.02	0.087	6.88	0.252	0.16	0.17	0.021
	74	10.89	43.10	21.60	6.00	9.10	7.70	2.90	1.43	0.99	0.057	5.65	0.234	0.15	0.19	0.016
1986	86	13.73	43.30	24.80	4.91	6.39	5.75	4.12	1.47	1.00	0.060	6.99	0.255	0.10	0.17	0.020
	87	15.21	48.30	26.20	4.61	5.07	4.41	3.43	1.52	1.18	0.050	5.03	0.266	0.08	0.16	0.020
	88	14.93	45.80	25.20	4.39	5.41	5.28	3.70	1.36	1.05	0.020	6.81	0.200	0.08	0.13	0.020
	89	11.07	43.50	24.90	5.94	7.40	4.95	2.30	1.31	1.05	0.120	7.69	0.286	0.11	0.15	0.020
	91	13.68	48.10	24.90	5.13	6.08	5.14	2.46	1.42	1.14	0.060	5.45	0.245	0.11	0.14	0.010
	92	15.57	49.00	25.10	4.52	5.39	4.68	2.00	1.47	1.10	0.050	5.74	0.300	0.11	0.13	0.010
	93	15.41	48.10	25.70	4.85	5.65	4.84	1.71	1.48	1.15	0.050	6.34	0.315	0.10	0.16	0.030
	94	14.03	50.40	25.80	4.36	5.46	4.77	1.60	1.52	1.20	0.040	4.70	0.243	0.11	0.14	0.010
	95	11.49	42.60	24.10	5.33	6.46	5.87	6.13	1.55	0.99	0.060	5.86	0.258	0.14	0.14	0.010
	96	11.14	41.10	23.40	6.05	6.91	6.22	6.65	1.51	0.99	0.070	6.45	0.339	0.16	0.17	0.020
	97	10.17	41.70	23.00	5.55	7.04	6.12	5.88	1.49	0.99	0.070	7.31	0.245	0.14	0.16	0.020
	98	11.25	40.50	22.40	5.58	7.79	6.43	4.97	1.37	0.99	0.090	8.60	0.275	0.14	0.18	0.010
	99	9.95	41.40	23.20	5.07	7.85	6.76	4.82	1.43	1.01	0.090	7.01	0.257	0.13	0.18	0.010
	100	10.47	36.50	20.90	7.83	8.78	7.48	6.09	1.38	0.87	0.150	8.70	0.271	0.14	0.19	0.020
	101	10.06	36.00	21.20	6.71	9.19	7.55	6.39	1.40	0.87	0.090	9.21	0.263	0.17	0.21	0.020
	102	9.99	35.80	20.40	7.08	9.83	7.74	4.93	1.34	0.80	0.110	11.60	0.291	0.14	0.20	0.030
	103	10.08	44.70	21.10	5.66	7.85	6.49	2.53	1.37	0.88	0.070	9.16	0.237	0.14	0.20	0.010
	104	12.02	46.20	24.30	5.71	5.90	5.62	1.51	1.47	1.10	0.060	7.75	0.272	0.14	0.17	0.010
	105	13.50	46.90	24.00	5.03	5.68	5.37	1.60	1.51	1.08	0.050	7.64	0.232	0.12	0.16	0.010
	106	12.66	46.60	23.80	4.48	5.92	5.55	2.82	1.51	0.92	0.040	7.90	0.257	0.15	0.14	0.020
	107	11.14	43.70	22.90	4.81	6.99	6.31	3.04	1.46	0.89	0.050	9.46	0.246	0.17	0.17	0.020
	108	12.43	46.90	23.80	5.79	6.47	4.57	1.05	1.45	1.03	0.090	8.42	0.225	0.14	0.14	0.010
	109	9.01	38.90	20.80	5.86	8.21	7.72	3.64	1.35	0.92	0.060	11.10	0.251	0.18	0.22	0.010

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Table 19-8 (2) Ash Composition of SCC Coal, Cont'd.

Year	Ship No.	Ash (db)	Ash Composition (db) SiO2	Al2O3	Fe2O3	CaO	MgO	Na2O	K2O	TiO2	Mn3O4	SO3	P2O5	BaO	SrO	ZnO
1986	110	8.10	35.40	19.70	6.55	9.76	8.91	3.55	1.29	0.82	0.070	12.40	0.306	0.17	0.26	0.020
	111	9.55	41.10	21.70	5.91	7.24	7.11	3.37	1.45	0.91	0.060	9.76	0.239	0.18	0.19	0.010
	112	12.04	44.70	22.60	5.95	6.33	6.37	1.95	1.47	1.00	0.070	8.22	0.246	0.16	0.18	0.020
	113	15.48	45.50	25.74	5.51	4.61	4.33	1.92	1.52	1.10	0.100	6.58	0.188	0.11	0.11	0.020
	114	9.07	41.40	19.70	7.40	9.80	6.60	0.66	1.31	0.84	0.110	11.00	0.316	0.20	0.28	0.018
	115	9.05	42.10	20.80	6.70	9.20	6.60	1.01	1.41	0.83	0.091	10.00	0.323	0.20	0.28	0.021
	116	15.59	49.30	23.80	7.20	5.40	3.81	2.03	1.59	1.15	0.077	4.75	0.238	0.14	0.18	0.031
	117	14.28	47.80	22.30	6.00	6.60	4.80	2.10	1.43	1.17	0.068	6.50	0.312	0.13	0.22	0.052
	118	11.91	46.30	22.80	5.80	6.90	5.20	4.10	1.48	1.07	0.042	5.30	0.307	0.12	0.25	0.032
	119	11.33	45.00	21.30	6.20	7.90	5.90	3.80	1.36	0.88	0.049	6.50	0.312	0.13	0.26	0.023
	120	8.74	42.40	17.80	8.00	9.50	6.40	3.03	1.15	0.74	0.062	9.80	0.284	0.14	0.27	0.024
	121	11.09	43.00	22.90	7.27	8.36	5.39	3.46	1.48	1.01	0.060	5.85	0.271	0.11	0.19	0.030
	122	10.76	41.70	23.20	7.33	8.51	5.99	3.76	1.49	1.06	0.060	5.60	0.279	0.11	0.20	0.020
	123	9.24	38.40	21.20	7.14	11.10	5.90	5.02	1.33	0.92	0.050	7.90	0.224	0.11	0.17	0.020
	124	9.78	41.90	23.20	6.86	8.66	7.96	1.82	1.44	0.93	0.080	6.92	0.255	0.14	0.20	0.020
	125	10.33	42.30	23.60	7.37	8.74	7.20	1.81	1.48	1.00	0.090	6.24	0.253	0.13	0.20	0.020
	126	9.61	41.10	22.80	7.18	9.28	7.06	1.70	1.41	0.99	0.100	6.96	0.284	0.14	0.22	0.020
	127	10.53	44.40	24.20	7.52	8.43	5.44	0.94	1.38	1.04	0.130	6.28	0.269	0.14	0.17	0.020
	128	10.83	45.60	24.60	6.93	8.14	5.05	0.89	1.46	1.07	0.120	5.92	0.290	0.14	0.16	0.020
	129	16.93	52.30	25.40	5.82	4.55	3.70	0.93	1.73	1.24	0.050	3.16	0.177	0.11	0.13	0.020
	130	12.84	44.50	23.90	5.86	7.41	4.74	5.15	1.60	1.10	0.040	4.49	0.237	0.11	0.14	0.020
	131	13.03	44.10	23.60	5.62	7.15	4.82	5.00	1.53	1.10	0.050	5.93	0.274	0.11	0.14	0.020
	132	10.21	40.60	21.50	6.84	8.98	6.03	5.72	1.42	0.89	0.060	7.74	0.235	0.13	0.16	0.020
	133	10.54	39.80	22.40	6.96	8.45	5.75	6.44	1.47	0.98	0.050	6.78	0.233	0.13	0.16	0.020
	134	9.36	37.30	22.00	6.50	9.10	6.27	7.82	1.41	0.93	0.040	7.35	0.258	0.15	0.16	0.020
	135	9.40	38.30	22.00	6.28	9.47	6.45	6.80	1.38	0.91	0.040	7.17	0.260	0.13	0.19	0.020
	136	9.23	39.20	22.60	6.21	9.54	6.67	5.39	1.39	0.92	0.040	6.68	0.267	0.12	0.25	0.030
	137	10.04	41.60	23.10	5.35	8.71	6.26	5.47	1.43	0.95	0.030	5.75	0.260	0.12	0.23	0.020
	138	14.65	46.80	25.80	5.60	5.89	5.21	3.28	1.75	1.10	0.040	3.35	0.253	0.09	0.19	0.020
	139	12.15	44.10	24.50	5.80	6.92	5.00	5.53	1.60	1.10	0.040	4.22	0.260	0.12	0.14	0.020
	140	13.85	46.80	26.40	5.65	6.14	4.70	3.75	1.57	1.16	0.040	3.65	0.267	0.10	0.15	0.020
	141	11.61	43.50	24.70	6.02	7.72	5.51	3.56	1.49	1.06	0.050	5.09	0.272	0.11	0.20	0.020

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Ash Composition of SCC Coal, Cont'd. (3)

Year	Ship No.	Ash (db)	Ash Composition (db) SiO2	Al2O3	Fe2O3	CaO	MgO	Na2O	K2O	TiO2	Mn3O4	SO3	P2O5	BaO	SrO	ZnO
1986	142	12.70	43.90	23.50	6.76	7.35	5.86	3.58	1.41	1.10	0.050	5.23	0.216	0.09	0.18	0.020
	143	13.49	46.40	25.80	6.14	6.01	4.66	2.63	1.52	1.19	0.050	4.97	0.271	0.10	0.16	0.020
	144	16.32	49.50	26.80	5.36	4.86	4.08	2.01	1.66	1.25	0.040	3.29	0.227	0.11	0.14	0.020
	145	16.45	50.50	26.10	5.17	5.16	4.53	0.93	1.65	1.19	0.040	3.75	0.258	0.10	0.15	0.020
	146	9.78	43.40	22.40	8.21	8.64	6.31	1.06	1.40	0.96	0.070	7.15	0.255	0.14	0.21	0.020
	147	9.17	41.80	20.60	8.52	9.29	5.92	1.14	1.34	0.88	0.110	9.13	0.250	0.15	0.19	0.010
	148	9.48	44.30	21.40	8.61	8.35	4.86	0.99	1.33	0.87	0.110	9.07	0.227	0.14	0.16	0.010
	149	15.08	49.60	24.90	5.73	5.52	4.62	2.61	1.56	1.18	0.040	4.13	0.221	0.12	0.14	0.020
	150	14.23	48.50	25.80	6.33	4.70	4.28	3.39	1.59	1.21	0.040	3.15	0.244	0.14	0.14	0.020
	151	15.56	44.40	23.50	7.11	6.61	5.62	4.19	1.58	1.01	0.050	4.65	0.241	0.17	0.19	0.020
	152	11.87	43.10	22.90	6.81	6.87	5.97	5.32	1.56	1.00	0.050	5.15	0.252	0.17	0.18	0.020
	153	11.32	47.70	25.60	5.77	5.48	4.84	3.05	1.60	1.17	0.050	3.58	0.241	0.12	0.15	0.020
	Average		44.187	23.306	6.141	7.299	5.744	3.304	1.474	1.024	0.064	6.516	0.260	0.133	0.178	0.019
	STDev		3.815	1.803	0.967	1.548	1.079	1.752	0.107	0.116	0.026	2.174	0.030	0.026	0.038	0.006
	C.V.(%)		8.6	7.7	15.8	21.2	18.8	53.0	7.2	11.4	40.7	33.4	11.6	19.7	21.2	33.3

(Note) C.V.(%) : coefficient of variation = STDev/Average*100 (%)

19-4 Grade of Semirara Coal (Unong pit)

Originally, it was estimated that the coal to be produced from the Unong pit is ranked as medium-soft sub-bituminous (C-rank) lignitic black coal. The expected characteristics of the average as received run-of-mine or raw coal are mentioned as follows:

Ash:	16–19%
Fixed Carbon:	26–29%
Volatile matters:	35–41%
Sulfer:	1% max.
H_2O:	16–19%
Calorific value:	8,000–9,000 Btu/lb
Hardgrove index:	40–50
Size:	0–400 mm

The actual characteristics of the coal delivered to the NAPOCOR Calaca Coal-fired Thermal Power Plant are as follows:

Calorific value: (Air-dry basis)	7,800–9,300 Btu/lb
Inherent moisture: (Air-dry basis)	15–16%
Calorific value: (Moist*, Mineral matter-free base as specified in ASTM) Nonagglomerating	10,400–10,600 Btu/lb

* Note:

Moist refers to coal containing its natural inherent moisture but not including visible water on the surface of the coal.

In the light of the coal classification specified in ASTM D388 shown in Table 19-9, the Semirara coal is ranked sub-bituminous.

Table 19-9 Classification of Coals by Rank

Class	Group	Fixed Carbon Limits, percent (Dry, Mineral-Matter-Free Basis)		Volatile Matter Limits, percent (Dry, Mineral-Matter-Free Basis)		Calorific Value Limits, Btu per pound (Moist,[B] Mineral-Matter-Free Basis)		Agglomerating Character
		Equal or Greater Than	Less Than	Greater Than	Equal or Less Than	Equal or Greater Than	Less Than	
I. Anthracitic	1. Meta-anthracite	98	...	...	2	...	...	nonagglomerating
	2. Anthracite	92	98	2	8	...	...	
	3. Semianthracite[C]	86	92	8	14	...	...	
II. Bituminous	1. Low volatile bituminous coal	78	86	14	22	...	...	commonly agglomerating[E]
	2. Medium volatile bituminous coal	69	78	22	31	...	...	
	3. High volatile *A* bituminous coal	...	69	31	...	14 000[D]	...	
	4. High volatile *B* bituminous coal	...	...	...	...	13 000[D]	14 000	
	5. High volatile *C* bituminous coal	...	...	...	...	11 500	13 000	
						10 500	11 500	agglomerating
III. Subbituminous	1. Subbituminous *A* coal	...	...	...	...	10 500	11 500	nonagglomerating
	2. Subbituminous *B* coal	...	...	...	...	9 500	10 500	
	3. Subbituminous *C* coal	...	...	...	...	8 300	9 500	
IV. Lignitic	1. Lignite *A*	...	...	...	...	6 300	8 300	
	2. Lignite *B*	...	...	...	...	...	6 300	

[A] This classification does not include a few coals, principally nonbanded varieties, which have unusual physical and chemical properties and which come within the limits of fixed carbon or calorific value of the high-volatile bituminous and subbituminous ranks. All of these coals either contain less than 48 % dry, mineral-matter-free fixed carbon or have more than 15 500 moist, mineral-matter-free British thermal units per pound.

[B] Moist refers to coal containing its natural inherent moisture but not including visible water on the surface of the coal.

[C] If agglomerating, classify in low-volatile group of the bituminous class.

[D] Coals having 69 % or more fixed carbon on the dry, mineral-matter-free basis shall be classified according to fixed carbon, regardless of calorific value.

[E] It is recognized that there may be nonagglomerating varieties in these groups of the bituminous class, and that there are notable exceptions in high volatile *C* bituminous group.

19-5 Pilot Coal Washing Plant

1) Outline

Since the commencement of the selective mining in 1985, aiming at the coal quality improvement by minimizing mudstone, so called clay contamination, mudstone plies thicker than 0.3 meters, namely #2, #8 and #10 plies have been removed. At the same time, #11 ply which is low-grade coal having inter-bedded mudstone have been stockpiled at the north side of the stock-pile area, together with the contaminated coal removed at each ply contact. Those #11 ply and the contaminated coal are called "washable coal", which is virtually not salable due to its low calorific value of only 6,100 Btu/lb and high clay content. The washable coal has been building up in the stockpiling area at a rate of approximately 3,000 to 4,000 tons per month since the beginning of 1985. Consequently, the capacity of the stock-pile area is becoming to be saturated.

The pilot coal washing plant was constructed in 1986 to up-grade the washable coal to a quality acceptable for blending with selective mining coal, and a trial operation was performed in early 1987.

Encouraged by the successful result of the trial operation, the washed coal has been blended with selective mining coal since April 1987 at the rate of 10 percent maximum which was agreed upon with NAPOCOR.

2) Concept of the Plant

Considering the trial nature of the plant and the financial status of the whole mining operations, the design and construction of the plant was made as simple and economical as possible by utilizing available used equipment and materials to attain the maximum effect at the lowest cost.

As indicated in Fig. 19-1 Pilot Coal Washing Plant Flowsheet, the washable coal at the stockpile is fed into the feed hopper of the plant by a front-end loader. From the bottom of the hopper, the coal is designed to load onto the 18 inch wide belt conveyor at the rate of 25 tons per hour. The belt conveyor reports to the 4 feet diameter x 8 feet long drum washer which scrubs the fed coal with 1.2 m^3/min. of circulating water.

After the drum washer, the coal is fed to the 4 feet wide and 8 feet long

vibrating screen on which dewatering is done after further desliming with a clean water spray. The +0.75 mm screen oversize is discharged onto the product belt conveyor which reports to the washed coal stockpile adjacent to the washing plant. The -0.75 mm screen undersize reports to the spiral classifier with the water and the oversize of the classifier goes onto the same product belt conveyor that mentioned above. The overflow of the classifier is pumped to the 12 meter diameter thickener. The thickener underflow is drained by gravity and is pumped to the tailing pond at the eastern side of the thickener. The clarified thicker overflow is recycled back into the process.

3) Plant Capacity and Performance

The plant is designed to process 25 tons of washable coal and to recover 16 tons of product coal so called washed coal per hour, it gives 64% of plant yield.

The estimated average calorific value of the washable coal is about 6,100 Btu/lb (air dry) and the washed coal is expected to have 8,100 Btu/lb (air dry), which gives 2,000 Btu/lb improvement after processing through the washing plant.

During the trial operation of the washing plant in early 1987, it was confirmed that the plant was comfortable to take 18 tons of feed per hour. It has been operated on three shifts/day and 25 days/month since the initiation of the regular operation in April 1987. As of August 1987, average monthly output of the plant is 3,750 tons, which gives 150 tons of daily production.

The number of workers assigned to the plant operation is 22 which allocation is as follows:

Foreman	1
Shift foreman	3
Loader operator	3
Plant mechanic	2
Statistician	1
Plant operator	6
Conveyor tender	4
Sampler	2
Total	22

4) Construction Cost

As previously mentioned the construction of the coal washing plant was implemented at the minimum cost by utilizing second hand equipment and materials. The aggregated capital cost was less than 5 million pesos including rehabilitation of the second hand equipment and installation. Major areas of the expenses classified as follows:

Process equipment and building structures	3,000,000 pesos
Cat 980 front end-loader (for plant feed)	1,200,000 pesos
Miscellaneous expense	800,000 pesos
Total	5,000,000 pesos

5) Recommendations

The plant operations were inspected during the first and second site survey. Some recommendations were made to SCC plant personnel based on the findings in the first survey and it was found in the second survey that the recommendations had been most of all put into practice. The fact indicates the eagerness of SCC operational people on upgrading the operations.

Understanding that the plant was constructed by utilizing second hand equipment to minimize the capital expenditure, followings are noted to draw out better performance:

a. Spiral classifier

Due to deformation and wear in the spiral ribbon, a classification is not taking place well. As a result, fine particles, over 0.125 mm to be recovered as product coal, are pumped to the thickener contained in overflowing water of the classifier.

b. Thickener

Due to an insufficient thickener underflow rate, -200 mesh material

cannot be drained fast enough, consequently it flows out of the thickener contained in the thickener overflow and recycles back to the spiral classifier via the drum washer and vibrating screen. Consequently, specific gravity of the water becomes higher than 1.0, providing with similar conditions to a heavy media coal processing in the spiral classifier, under which conditions, higher quality coal particles are easier to float and easily flow out of it and go to the thickener.

Moreover, the overflow of the spiral classifier is converging at the center of the tail end weir on which overflow is supposed to be uniform. It provides higher quality coal particles with easier conditions to flow out.

c. Settling pond

It unlikely happens that density of the thickener underflow exceed 30% in weight even though sedimentate with flocculant, since very fine clay like particles are of strong affinity.

Currently, the density seems to be fairly high because of higher content of larger particles. Therefore, more underflow should be drained out to the tailing pond even if the density is low.

In this respect, the settling pond capacity could be one of the factors restricting the plant feed rate.

Assuming that monthly washable coal production is 4,000 tons, for instance, if -0.125 mm particles are 30% of it, the tailing pond must be large enough to handle 1,200 tons/month of solid by drying and reclaiming or some other ways.

The present settling pond capacity does not seem to be sufficiently large enough.

d. Application of flocculant

Flocculant is not so effective unless aforementioned -200 mesh material is drained out satisfactorily fast enough.

During the plant survey, it was pointed out that the flocculant must be dosed only at the thickener instead of the present two locations, the

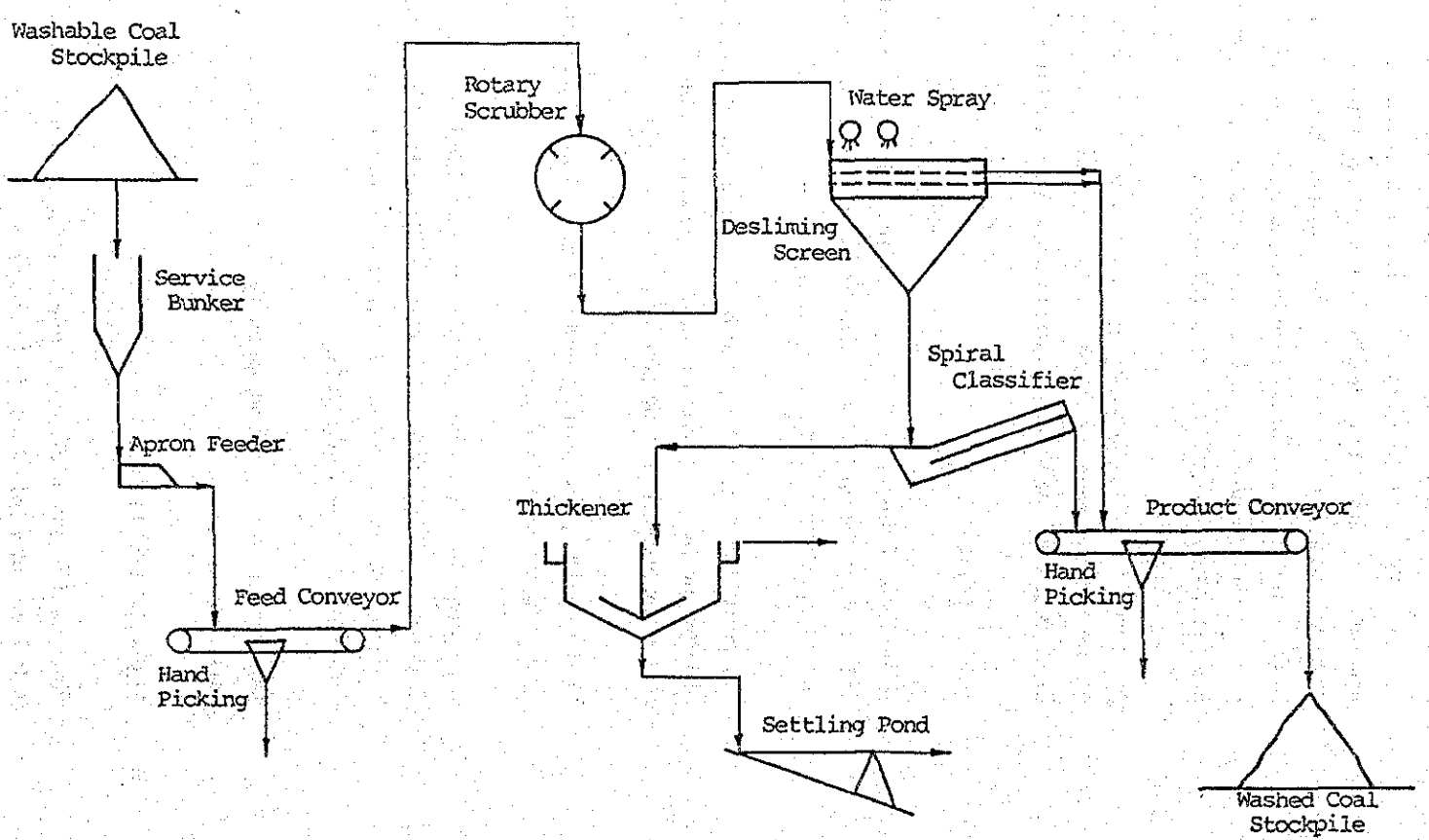

Fig. 19-1 Pilot Coal Washing Plant Flowsheet

spiral classifier pump box and the thickener. It may have been tried out by SCC preparation plant people, however it must be noted that an improvement in the flocculant consumption and water clarity can not be obtained without improving the thickener underflow drainage rate, since the -200 mesh material is accumulated in the thickener and go into overflow to recirculate back to the system.

e. Others

a) Washing drum

It was observed that the sprocket on the drum had uneven wear, since the driving chain was exposed to the dirty water.

b) Vibrating screen

It was advised to check the motor rpm and pulley size, since the screen exciter might not have high enough rpm.

Understanding the idea of the present set-up of protecting the motor shaft, the motor foundation should be modified to give stronger spring force to avoid the continuous motor vibration.

The building members on which the vibrating screen is installed do not seem to be robust enough.

6) Sample Analysis Results

Samplings were conducted at the pilot coal preparation plant to evaluate the performance of the plant. The total number of coal samples were 9, 4 samples each at the plant feed and plant product. In addition to those samples, one sample was taken from the carbonatious mudstone rejected by hand at the plant feed conveyor.

Table 19-10 shows ash analysis data by size fraction.

As the screenings were done in dry for the plant feed and in wet for the product, it may not be appropriate to compare the results of the plant feed and product, however, the results of the analysis indicate that the ash content is improved in the coarser size fractions after processed by the plant, on the

Table 19-10 Pilot Coal Preparation Plant Sample Analysis Data

Ash Analysis Data

Size Fraction, mm		+45	45 | 11.2	11.2 | 0.4	4.0 | 1.4	1.4 | 0.5	0.5 | 0.15	0.15 | 0.045	-0.045	
Feed	Weight %	4.2	22.2	23.3	27.0	14.2	7.3	1.6	0.2	100.0
	Ash %	37.7	44.7	42.8	42.1	45.5	47.6	47.4	50.0	43.6
Product	Weight %	1.9	35.5	35.6	10.8	2.5	1.4	1.1	11.2	100.0
	Ash %	36.7	32.2	27.7	34.8	41.3	51.4	50.9	71.0	36.0

Desliming Test Data

	Hoor 1	3	6	12	24	48	72	Residue (%)
Plant Feed	26.8	29.3	31.1	32.0	32.6	33.2	33.5	66.5
Plant Product	16.4	17.3	17.9	18.2	18.4	18.6	18.8	81.2

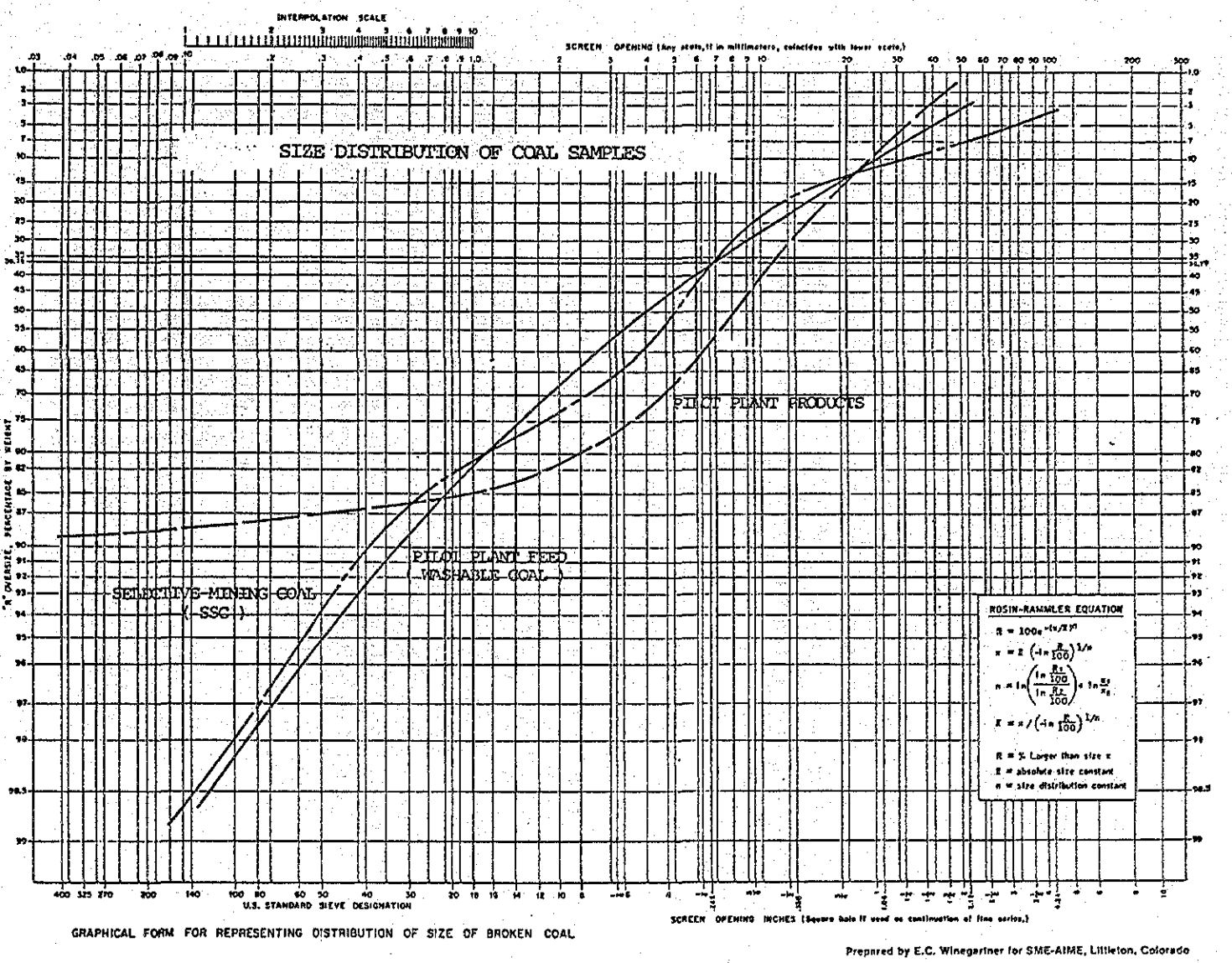

Fig. 19-2 Size Distribution of Coal Samples

other hand, the ash content in the -0.5 mm size fraction shows higher value. It is interpreted that the clay or mudstone removed from the coarser particle, leaching with process water stays in finer size fraction without discharged efficiently from the circuit.

The plant performance was not able to conclude from the analysis data due to the degradation of the plant product samples with fairly high moisture content, which contributed to enhance the degradation during the transportation as far as to Japan. Thus, plant efficiency cannot be evaluated by size fraction.

It is observed that weight percentage increases in the -0.045 mm size fraction after processed by the plant. It is interpreted that the retention time in the drum scrubber is not sufficient to leach the water soluble clay or mudstone small enough to flow out with process water back to the thickener, as a result, the clay or mudstone stays in -0.045 mm size fraction and recovered as product coal.

Fig. 19-2 shows the size distribution of the plant feed and product. The calorific values of the plant feed and product are estimated 6,680 and 7,710 Btu/lb respectively based on the ash contents by using the regression equation obtained from the analysis data of the Semirara coal.

The designing efficiency of the plant is calculate 54% based on the desliming rate of the plant feed and product. It is defined that the ratio of removed water soluble material by processing through the plant against that in the plant feed in weight. The desliming rate of the plant feed is 33.5% which means 35.5% is clay and 66.5% is coal in the plant feed. The desliming rate of the plant product is 18.8%, which means 81.2% of coal and 18.8% of clay. Therefore, the material balance turns out as indicated below;

Material Balance Coal vs. Clay