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CONTROL OF COAL HANDLING PARTICULATE POLLUTION AT THE PORT OF HAINA

Prepared for
CORPORACIÓN DOMINICANA DE ELECTRICIDAD

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Prepared by
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Energy Technology Innovation Project

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U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

CONTROL OF COAL HANDLING PARTICULATE POLLUTION AT THE PORT OF HAINA

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CONTROL OF COAL HANDLING PARTICULATE POLLUTION AT THE PORT OF HAINA

1.0 EXECUTIVE SUMMARY

As part of its commitments under a joint power loan from the World Bank and the Inter-American Development Bank, the Dominican Republic's Corporacion Dominicana de Electricidad (CDE) must control fugitive coal dust pollution at the Port of Haina. Fugitive dust generated when coal is unloaded from ships and transported to CDE's 250 MW Itabo Power Station is causing health, aesthetic, sanitary, and other environmental problems.

The USAID mission in Santo Domingo sponsored this project through a buy-in with USAID's Office of Energy, Environment, and Technology. The Office of Energy, Environment, and Technology participated to lend expert assistance to the CDE for identifying actions that should be taken and estimated costs to control release of environmentally harmful particulates. The report also made recommendations on:

- Fugitive particulate emission control levels for coal handling and transport.
- A methodology for monitoring the pollution.
- Required upgrades of existing systems and equipment to meet recommended standards.

Information was obtained by the Project Team from a variety of sources, including site visits during the month of April 1994. The Port of Haina is a commercial establishment which handles dry bulk, liquid, and packaged materials. The port operations are independent from the CDE. The point of delivery for the CDE purchased coal is at the Itabo Plant. Therefore, CDE does not own or operate the ship unloading and transportation facilities which generate the particulate emissions. The Project Team was advised that there is no coal contract because the coal supply and transportation (sea and land) are spot market operations.

If CDE is to be responsible for the fugitive dust resulting from facilities it does not own or operate, CDE needs administratively or contractually enforceable mechanisms by which the fugitive dust control requirements are made the responsibility of the Port or coal suppliers. It is recommended that CDE include in all coal purchase orders and future coal contracts the necessary pollution control terms and conditions to assure the coal supply and associated material handling will control fugitive dust.

Regardless of the operator or owner of facilities and equipment, the objective of this report is to make a technical assessment of fugitive coal particulate emissions at the Port of Haina as a result of the coal unloading and transport activities related to the operation of the Itabo Power Plant. The report recommends changes in coal handling and dust control technology to reduce particulate emissions from the unloading and transport activities.

Recommendations are made on standards for opacity (20%) and ambient particulates (150 $\mu g/m^3$). The Government of the Dominican Republic (GODR) does not currently have their own standards for these pollution indicators. With regard to the most cost effective methodology for inspecting the particulate pollution at the port, the recommendation is to utilize a skilled specialist to monitor the coal transfer operations.

Finally, recommendations are made on how to reduce particulate emissions at the Port of Haina. One option had to do with installing a conveyor system between Haina and Itabo. The less expensive option involved upgrading the existing systems and equipment (still using trucks) to meet the recommended standards. Cost estimates are provided for both options. The recommended option amounts to a total estimated cost of $1.0 million.

Some consideration was given in the report to particulate problems evident at the Itabo Power Plant location. It was observed that the fugitive particulate problem might be more acute at the power plant than at the port. Coal handling system problem areas were identified. However, since the Scope of Work for this project did not include an analysis of the power plant location, it is recommended that a full-scale feasibility study be conducted to address this issue.

2.0 INTRODUCTION

As part of the preparation of a proposed Power Generation and Institutional Restructuring Project (Power II Project), the GODR must prepare an Environmental Assessment (EA) Report for the Dominican Power Sector.

As part of its commitments under a World Bank and an Inter-American Development Bank loan, the Corporación Dominicana de Electricidad (CDE) must control fugitive particulate pollution caused by the existing Itabo Power Plant coal unloading and transport operations between the Plant and the Port of Haina.

The objective of the work covered by this report is to assess fugitive coal particulate emissions at the Port of Haina as a result of the coal unloading and transport activities related to the operation of the Itabo Power Plant. The report recommends changes in coal handling and dust control technology to reduce particulate emissions from the unloading and transport activities.

The report addresses the following specific items:

- Recommend fugitive particulate emission control levels for coal handling.
- Recommend the required equipment to monitor pollution levels.
- Establish a methodology for the periodic monitoring of fugitive particulates.
- Make recommendations to keep the particulate pollution within acceptable levels.

- Fugitive particulates pollution at Itabo - this task was not included in the original Scope of Work. However, at the inspection of the site, it appeared that the particulate emissions at Itabo were more severe than at the Port of Haina.

The information presented in this report is based on observations made by Project Team members during a trip to the Dominican Republic in April 1994. Additionally, pertinent data was provided by U.S. Agency for International Development (USAID) and CDE personnel. No sampling or analyses were conducted by the Team. The last coal shipment was received in February 1994; therefore, no coal handling operations were directly observed.

The report presents recommended fugitive particulate emissions control levels for opacity and particulate emissions. It also recommends pollution monitoring equipment for opacity and ambient air monitors and provides a recommendation for a cost effective monitoring program. The report provides recommendations for changes in the port coal handling facility design and operation to reduce particulate emissions to within recommended limits. Finally, the report provides recommendations to reduce the coal particulate pollution at the Itabo Plant.

3.0 EMISSION STANDARDS, MEASUREMENT, AND CONTROL

3.1 RECOMMENDED FUGITIVE PARTICULATE EMISSIONS FOR COAL HANDLING

3.1.1 Opacity Level

The Project Team has been advised that there are no coal handling emission standards in the Dominican Republic. A straightforward, inexpensive method for measuring the fugitive dust emission is to observe the opacity. The opacity from a fugitive dust emission is quantitative when observed by a "certified smoke reader" and qualitative when observed by an untrained person. Except for re-certification (required every six months), no equipment is required. Regardless of expense, there is no other practical technique for measuring or monitoring fugitive dust emission that would be applicable to the Port of Haina coal handling operations.

A dust cloud is said to be opaque and the opacity of the dust cloud is 100 percent if light is not able to penetrate through it. A dust cloud from coal handling equipment will rarely have either zero or 100 percent opacity, but some intermediate value. Based on *EPA Effluent Guidelines and Standards for Steam Electric Power Generating,*[1] the discharged particulate matter from all the coal handling equipment shall not exceed 20 percent opacity. This is the maximum opacity level recommended to be established at the Port of Haina.

1 40 CFR 423; 47 FR 52304, November 19, 1982; Revised through July 1, 1991, Subpart Y, paragraph 60.525,C.

3.1.2 Particulate Ambient Standard

The Project Team has been advised that there are no particulate Ambient Air Quality Standards (AAQS) in the Dominican Republic. It has been suggested that the particulate AAQS from another jurisdiction be adopted for this project (e.g., 150 $\mu g/m^3$ maximum 24-hour average from USEPA). The particulate AAQS is measured from a stationary filter system. The particulate weighed on the filter comes from any source including the coal unloading and transportation operations. But only with extensive, time consuming, and expensive analyses can the AAQS measurement determine how much of the collected particulate material is from the coal handling operations because there is no practical measurement technique to connect the coal handling emissions to the AAQS.

A rule of "no spillage" should be applied at the Haina Port. This is essential to meet the particulate emission standard. A principal pollution problem at the port is caused by coal spillage during and between truck loadings from the portable hoppers. It is a system-oriented problem; the existing handling system is inadequate. The standard for pollution control at a port facility is usually more restricted because of the potential of material falling on the water. Spillage should not be allowed. Accidental spillage is required to be cleaned up immediately before it becomes wind-borne. Visual inspection is a meaningful method to detect any spillage of the system. Trucks and other vehicles traveling at the port will cause spilled coal to become airborne. Also, spilled coal will be rinsed into the water during rain events.

3.2 RECOMMENDATION FOR MONITORING OF THE PARTICULATE POLLUTION

No equipment is recommended. The most cost effective methodology for inspecting the particulate pollution at the port is to utilize a skilled specialist hired either as an outside consultant, contractor, or CDE employee to perform the periodic monitoring of the particulate data at the time that coal transfer operations occur. Candidates for possible selection as inspecting consultants must be able to demonstrate industry knowledge of environmental field measurement techniques and procedures.

Procedural criteria should be set in accordance with EPA Method 9, for the test method and procedures used to determine dust emission opacity. This criteria is available from USEPA's Office of Air Quality, Planning, and Standards.

3.3 RECOMMENDED METHODOLOGY FOR THE PERIODIC MONITORING OF THE POLLUTION

There are several elements required to make a good QA/QC program for monitoring the effectiveness of the particulate pollution control systems.

- Quality control of the pollution control system operation should be the responsibility of the supervisor directing the ship unloading and truck loading operations. The supervisor would take corrective action whenever fugitive dust or a spill was observed and/or reported.

- Quality control of the pollution control system hardware would include a written operating procedure for inspection and maintenance prior to ship unloading, during ship unloading, and storage after ship unloading. This quality control program would be administered by the ship unloading supervisor.

- Quality assurance of the pollution control system operation would be the responsibility of a CDE employee. This employee would make unannounced, random visits to the ship unloading operations. This employee would have authority to shut down operations that did not meet the visual standards of no fugitive dust and no spills. If there are disputes as to what constitutes 20 percent opacity (as opposed to 19 or 21 percent), the CDE employee requires certification as a "smoke reader." This CDE employee could also use this talent for material handling at the power plant and ash disposal areas. Because the CDE employee would have authority to stop the unloading operations if corrective action were required, this authority would have to be confirmed in the language of the coal purchasing agreements.

- Quality assurance of the written quality control program for the pollution control hardware would be conducted by a CDE employee.

- Environmental agency and lending institution personnel could also make visual observations and inspections of either the operation or the QA and QC programs.

4.0 DESCRIPTION OF THE EXISTING FACILITIES

4.1 PORT OF HAINA

Figure 4-1 is a diagram of the existing coal handling facilities at the Port of Haina. The following section describes the operation during coal unloading. Because no current emission or pollution data is available, an estimate of coal particulate pollution has been calculated and is provided in Section 4.1.2.

4.1.1 Coal Unloading and Transport

The Port of Haina provides only the unloading berth; neither the Port or CDE own or operate bulk material unloading equipment. Ship cranes are used to unload coal. Coal is dumped into unloading hoppers at the dockside. These hoppers are provided by the local contractor which is contracted by the coal company to transport the coal from the ship to the Itabo Power Plant. Currently the coal company is responsible for the delivery of the coal to the Itabo Plant receiving hopper.

The ship's cranes lift the coal from the ship's cargo holds to the dump hoppers with a clam-shell type grab bucket. The height from the grab bucket to the hopper varies due to the crane operator's visibility of the hopper, operator discipline, and limits on the ship's crane. A drop from a higher level generates more dust than from a grab bucket dumping from a lower height.

Water spraying is not used to suppress the dust, and the dust generated during the ship unloading operation is uncontrolled. Depending on the direction of the wind, the dust drifts either into the water or onto the land. When the wind blows at higher velocities, it carries larger particles, as well as dust, farther from the unloading dock. The nearby sugar factory has complained that coal dust is carried by the wind into their plant.

A gate operator at the hopper's platform manually opens a gate and fills the hauling truck below. Truck loading is another dumping action resulting in extensive fugitive dust released between the truck and the dump hopper. The gate operator is in visual contact with the truck and decides when to close the gate. Because of this visual measuring practice, some of the trucks may be overloaded and spill coal while in transit to the plant (see Appendix A, photographs A1 through A5).

Rear-end dump trucks of 12, 16, and 22 cubic meter capacities are used to haul the coal from the unloading hoppers to the plant. The trucks are not sprayed with water, and tarpaulins are not used to cover the coal.

Compared to equipment used in modern ports, the unloading dump hoppers are primitive equipment and were not designed to adopt dust pollution control devices. With two hoppers and the self unloading cranes on the ship, a minimum of two cargo holds can be unloaded at the same time. The unloading time is relatively short with the available truck fleet.

During the truck transport of the coal from the port to the plant, the dry fines are blown off the top of the coal by the wind. Road dust is also generated from the existing heavy traffic. The additional road dust from coal truck traffic causes an incremental increase in the ambient dust concentrations.

Burning coal in the two existing power units is intermittent with the burning of fuel oil. If two new power generating units are added in the future, four units might be burning coal at times. In the estimating of the potential emission from the coal, the future coal consumption for four units was used as a basis.

4.1.2 Air Quality Impacts From Coal Handling Emissions

Ambient air concentrations of inhalable particulate matter (PM-10) were calculated at downwind receptors for the coal handling scenario described above by using the SCREEN2 dispersion model. The sources include emissions from dumping coal from the clam-shell bucket to the hopper, as well as emissions from dumping coal into the truck beds. Emissions of particulate matter from the trucks on the unpaved haul road in the vicinity of the port are also included. The total particulate matter emissions were calculated to be 36 lb/hr. The source was treated as a square area source that is 200 meters on a side.

The SCREEN2 model was run with unit emissions (i.e., the total emission rate for the area source was input as 100 grams/sec.) to give maximum one-hour concentrations. Downwind 24-hr average concentrations were determined by scaling the model output to the site specific emission rate of 36 lb/hr (4.5 g/sec.) and scaling the concentrations to 24-hr averages by incorporating the USEPA wind meander factor.

The predicted maximum 24-hr. average concentration was estimated to be 372 $\mu g/m^3$, which exceeds the recommended standard of 150 $\mu g/m^3$. Although this is the worst case scenario, because the predicted levels are considerably above the PM-10 standard, this impact is considered to be significant and should be mitigated.

If the modifications under the "Items Recommended to Reduce Particulate Emissions" are implemented, the predicted emission rate is calculated to be 3 lb/hr. Predicted maximum concentrations from these emissions would be 31 $\mu g/m^3$. Therefore, implementation of this option should mitigate the impacts to acceptable levels.

4.2 ITABO PLANT

Dumping coal from the truck through the grizzly into the receiving dump hopper is the first significant source of fugitive dust emission at the plant site. Spillage and drifted dust up to 40 meters from the grizzly clearly show the intensity of the emission (see Appendix A, photographs A6 and A7). Below the receiving dump hopper, the heavy layer of dust on the floor presents a safety hazard. Dust deposited on the equipment corrodes and deteriorates the equipment (see Appendix A, photographs A8 through A10).

Because the belt cleaning devices at the conveyor's discharge terminals are worn, a large amount of fines are carried on the return side of the belt (see Appendix A, photographs A11 and A12). These fines are removed by the return idlers near the discharge terminal of the conveyor. When the coal is wet, the fines deposit on the supporting structure of the conveyor and corrode the structure. When the coal is dry, the fines become airborne at the return idlers, and without dust control measures in place at the discharge point, the fines are emitted into the environment.

The heavy layer of dust on the floors of the screening plant indicates that partially covered screens without dust control devices are also a major source of dust emission (see Appendix A, photograph A13). Oversize coal pieces spilled on the ground also carry a large amount of fines which become airborne.

The boom conveyor of the stacker can be lowered to the stock pile to minimize the drop of the coal, but without dust control measures the dust is liberated at the top of the pile. Spillage on the stacker components and under the machine indicates that the stacker is also a major emission source (see Appendix A, photograph A14).

The coal is crushed before shipping for passing 25 by 25 mm screen openings. Coal crushed to this size contains a large amount of fines. To minimize spontaneous combustion, the stockpile at Itabo is compacted by mobile equipment. On the top of the pile, movement of the mobile equipment further degrades the coal and generates additional fines. During high winds, these fines are blown off the pile and the stockpile may become possibly the most active pollutant source at the plant site.

Coal fires at the pile toes are extinguished with water (see Appendix A, photograph A15 and A16). The fire and rain run-off water are drained directly into the ocean. This drainage carries coal fines and ash from the fires directly to the ocean.

Front end loaders are used to reclaim the coal from the stockpile. The loader dumps the load into a rail-mounted hopper which feeds it onto a belt conveyor. The conveyor system, through several transfer stations, feeds the coal into the pulverizer feed bunkers. Coal dust and spillage cover the area of the transfer stations, the ground under the conveyors, and the floors above the bunkers (see Appendix A, photographs A17 through A22).

5.0 ITEMS RECOMMENDED TO REDUCE PARTICULATE EMISSIONS

Following are recommendations for the Port of Haina relating to reducing particulate dust during the coal unloading and transport process. Additional detail on these general categories of information can be found in subsequent sections of the report.

- The ship unloading grab buckets are to be adjusted for tight fit to control spillage and fugitive dust due to dribble.
- Two new hoppers are required to control dust due to the dropping of coal into the hopper, wind blowing across the hopper, or discharging from the hopper into haul trucks. New hoppers will incorporate a dust suppression system and telescopic shoots.
- Trucks will have covers on the bed to control blowing dust from the bed of coal.
- Truck beds must be in good repair with no dribble from the tailgate.

5.1 TWO OPTIONS FOR COAL UNLOADING AND TRANSPORT SYSTEM

The current process of using the ship's crane to remove coal from the cargo holds is a low cost and high-capacity operation. The disadvantage of this method is that many of the newer and modern bulk carriers are not equipped with self unloading cranes. When coal is loaded into the ship at a commercial port, most coal suppliers will not specify the type of carrier for the shipment without an added charge. A long-term, competitively bid coal contract is recommended. The bid document should specify self-unloading ships.

For unloading ships equipped with self-unloading cranes, new hoppers are required to control dust due to dropping of coal into the hopper, wind blowing across the hopper, or discharging from hopper into haul trucks. The ship unloading grab buckets are to be adjusted for tight fit to control spillage and fugitive dust due to dribble. A second operator would assist grab bucket lowering to minimize load. The wind/spill guard would control spillage during high wind.

In the future, if the selection of this type of ship becomes unavailable, the unloading dock must be equipped with a ship unloader designed to unload a variety of types and sizes of ships. Preferably, the unloader should be a traveling, rail-mounted, continuous unloading type. This type of machine is used to unload only dry bulk materials and generally is installed on a dock dedicated to handle the same type of materials. The unloader travels parallel to the ship's selected cargo hold and the coal is removed from the hold vertically in an enclosure. The unloader continuously discharges coal onto a long distance belt conveyor system. The transfer points are all enclosed, and the airborne dust is suppressed by a sonic fog type water spray.

Two options for improving the current operations are identified in this section. The first option is less expensive and is a modification of the existing system of truck transport of coal. The second and more expensive option involves the use of a conveyor system to deliver the coal from the port to the power plant. The recommendation is to go with the less expensive option, modifying the existing system of truck transport.

5.1.1 Conveyor System - More Expensive and Not Recommended

In case of a continuous conveying line, the dump hoppers will be equipped with 60 mm wide belt feeders discharging coal onto a wharf conveyor. This method will assure regulated and smooth transfer of the coal from the hoppers onto the conveyor with minimum and controlled dust emission. A belt conveyor system, approximately 2.5 km long, will deliver the coal from the wharf conveyor transfer to the Itabo Plant (see Figure 5-2). All conveyor transfer points are provided with adequate belt cleaning devices and dust suppression system. The conveyors and transfer stations will be totally enclosed to prevent dust emission and spillage into the environment. The estimated cost of this system is shown on Table 5-1.

5.1.2 Modified Truck System - Recommended

When using dump trucks, a telescopic chute under the hopper discharge opening will be lowered to the truck. After the knife gate opens, the telescopic chute would be raised automatically as the dumped load rises. The chute would contain the generated dust and the dust would be suppressed with a sonic fog type spray system. A similar but more intensive spray system would be used to suppress the dust from dumping the coal from the ship's grab bucket. At the exit of the hopper, the load of coal would be sprayed with water, which would minimize loss of fines blown off by wind during transit. The hoppers would be equipped with pneumatic tired wheels for ease of positioning. Water and electricity supply would be connected to the hopper units and a portable vacuum cleaner would be used for clean-up after each unloading operation. This is shown in Table 5-1 as the Truck System option.

Based on lower estimated costs (as shown in Table 5-1), the recommendation is to upgrade the existing unloading and truck transport option.

5.2 COST ESTIMATES

An order-of-magnitude cost estimate has been prepared for two options: 1) the recommended upgrade of the existing truck system, and 2) for the conveyor system. Table 5-1 is based on the following assumptions:

- Cost factors are based on second quarter, 1994 US dollars.
- The cost of Engineering, Procurement and Construction Management (EPCM) services and contingency are estimated at 35 percent of the direct cost.
- The cost of major items such as belt feeders and belt conveyors are based on recent quotations from U.S. suppliers.
- Resources such as energy and water required for construction works are available at the battery limits.

Table 5-1: Capital Cost Estimate for Coal Transport & Unloading

ITEMS	Trucking System ($1,000's)	Conveyor System
Install a dust suppression system on the hoppers	100	100
Provide 2 new hoppers[1]	300	300
Add 2 belt feeders		360
Add a wharf conveyor[2]		600
Add a coal transfer conveyor system[3]		7,500
Provide water and power connections at the hoppers	60	
Add dust suppression systems on transfer points		200
Provide telescopic chutes under the hoppers	200	
Provide tarpaulins to cover the truck load[4]	92	
Provide an enclosure at the receiving dump hopper at the Itabo site		100
TOTAL DIRECT COSTS:	752	9,160
Engineering, Procurement, Construction Management (EPCM) and Contingency (35% of Total Direct Costs)	263	3,206
TOTAL COST	**$1,015**	**$12,366**

[1] The cost includes a pair of 150 m long rails.

[2] The wharf conveyor is based on a 42 inch (1,067 mm) wide by 150 m long completely enclosed belt conveyor. The troughing idlers will be closely spaced to avoid spills.

[3] The coal transfer system is based on a 42 inch (1,067 mm) wide by 2,500 m long completely enclosed belt conveyor. The cost estimate does not include the land procurement cost.

[4] The cost of tarpaulins to cover the truck load is based on a total of 46 trucks.

5.3 RECOMMENDED MODIFICATIONS TO THE COAL HANDLING SYSTEM AT ITABO FROM THE RECEIVING DUMP HOPPER TO THE STOCKPILE

The review of the coal handling system at the Itabo Plant is not in the Scope of Work for this report. However, during the inspection the fugitive dust problems were so severe that it warranted a preliminary review and also preliminary recommendations. An engineering feasibility study will be required for the selection of a more suitable system designed to minimize dust generation.

Several modifications to the coal handling system and equipment are required to control the particulate dust emission into the environment. These modifications will also extend equipment life, improve handling performance, save valuable fuel, and decrease coal handling cost.

5.3.1 Receiving Dump Hopper

The grizzly area should be enclosed. To allow truck entrance into the shed, the front of the enclosure can be made of hanging finger curtains from old conveyor belting. Sonic fog type water spray should be installed to suppress dust over the grizzly. The hopper bottom should be equipped with a "Decoaler" type dual vibrating feeder. The feeder will retain the dumped load within the hopper and will regulate the feed onto the belt with a minimum of dust generation. A truck mounted vacuum cleaner should be used to periodically clean the floor and equipment. This truck will be usable for general dust clean-up in the entire coal handling facility.

5.3.2 Belt Cleaners

It is recommended that dual type belt cleaners are installed at each discharge pulley. The primary cleaner generally is able to clean only about 90 percent of the carry-over fines from the belting. The secondary cleaner should be designed to clean the remaining carry-over fines up to 99 percent efficiency. A "V" plow should be installed on the returning belt before the tail pulley. This will effectively protect the tail pulley from spillage.

5.3.3 Screening Plant

The screens should be totally enclosed, and oversized material should be collected in an enclosed and vented bin. The chute for oversize materials should also be enclosed. The floors in the screening plant should be periodically vacuumed.

5.3.4 Transfer Stations

All transfer stations should be equipped with sonic type water spray systems to control the dust during transferring of coal from one conveyor belt to another. Fog type water spray is a suppression system with 97 to 98 percent control efficiency. The system keeps the dust within the handled materials. Fog type water spray is also a cost effective dust control system. The transfer chutes and skirt boards should be modified to place the transferred load in the center of the belt.

5.3.5 Stockpile

The coal storage piles should be protected from wind erosion and pile fires. Rain runoff and fire fighting water should be treated before release into the environment. The storage can be divided into four 50,000 ton piles. During construction of a pile, it should be continuously compacted with mobile equipment. The completed pile should be sealed with chemical sealant. The sealant is designed to enclose the surface and prevent circulation of air through the pile. This is important in preventing and suppressing coal pile fires. Also, the seal will prevent wind erosion of the pile. One pile should be used at a time. Use of each pile should be periodically rotated so that in two years all piles would receive fresh coal. The storage area run-off water should be collected in a pond, which is sized for a 10-year, 24-hour rainfall event. The water quality in the pond should be monitored and treated, as required, before discharging into the environment.

5.3.6 Reclaim System

Major amounts of pollutant dust are generated by several operational features of the existing coal reclaiming coal system. The ramp built between the pile and the reclaim hopper is made of coal. As the front loader maneuvers to dump the coal from the pile into the reclaim hopper, coal is ground and pulverized under the wheels. The tire cleats lift the fines into the air and this dust becomes uncontrollable. Dust is also generated from scooping coal from the pile, dumping it into the reclaim hopper, and the uncontrolled feed from the hopper onto the belt.

The design could include an automated reclaim system with central controls. Other concepts could be adapted to the existing system with minor modifications. For instance, a bucket wheel reclaimer could be installed between the pile and the reclaim conveyor, requiring little change in the existing system. This modification offers a good possibility to control the dust. Another concept to be studied would be the installation of underground reclaim hoppers with feeders for controlled loading of coal onto the belts. These reclaim hoppers would be installed near the pile and a conveyor would transfer the coal to the existing reclaim system. Under this concept, the existing traveling hoppers would be converted to transfer chutes and positioned to transfer the coal from the working reclaim conveyor. Coal in an underground hopper is pushed instead of being dumped, and the maneuvering of the mobile equipment can be reduced to a minimum. A study would show which is the most satisfactory and cost effective concept for Itabo.

5.3.7 Bunkers

As with the transfer stations, the dust should be suppressed at the bunkers using sonic fog spray systems. To prevent bunker fires, the top surface of the coal stored in the bunker should be sealed with either chemical sealant or an inert material. The temperature in the bunker should be monitored at all times, and any coal with an elevated temperature should be removed before the start of spontaneous combustion. A central vacuum cleaning system is required for cleaning dust and spillage from the floors.

5.3.8 Maintenance

It is imperative that CDE prepares and implements an effective preventive maintenance program. The coal handling system and the dust control devices will not perform to specifications if their components are not in good condition at all times. In addition to the maintenance program, CDE should also implement a strict safety program. Some walkways and stairs require immediate repairs and extensive clean-up. Hard hat and safety goggle requirements should be enforced immediately and warning signs should be posted.

The above described modifications to the existing coal handling system and equipment are only the minimum to ensure that the particulate emission will be under the recommended level.

6.0 CONTROL FOR EXPANDED CAPACITY

If two additional power generating units are constructed at the Itabo Plant site, the frequency of the ship unloading operation will increase. The 24-hr maximum particulate emission, however, will remain the same as shown in Section 4.1.2. The yearly average emission will increase to two times the emission level calculated for the existing two units. No additional controls would be required if either of the two identified systems were to be implemented.

7.0 REFERENCES

ASTM D 2009-65, *Standard Recommended Practice for Collection by Filtration and Determination of Mass, Number and Optical Sizing of Atmospheric Particulates,* (Re-approved 1979)

USEPA, *EPA Effluent Guidelines and Standards for Steam Electric Powe.' Generating,* (40 CFR 423; 47 FR 52304, Nov. 19, 1982; Revised through July 1, 1991)

USEPA, 1988. *Compilation of Air Pollutant Emission Factors, AP-42*

FIGURES

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

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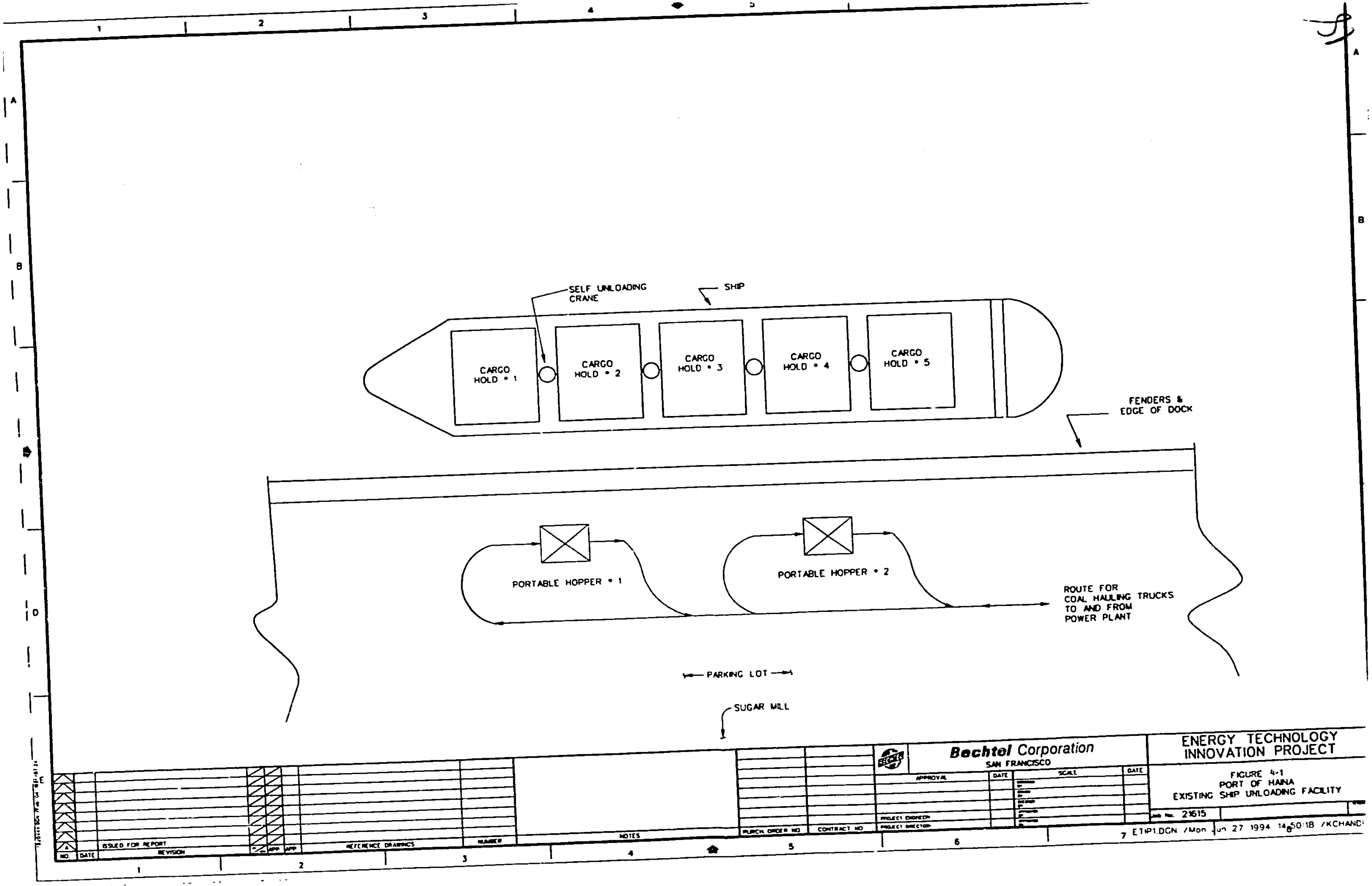
SELF UNLOADING CRANE
SHIP
CARGO HOLD • 1
CARGO HOLD • 2
CARGO HOLD • 3
CARGO HOLD • 4
CARGO HOLD • 5
FENDERS & EDGE OF DOCK
PORTABLE HOPPER • 1
PORTABLE HOPPER • 2
ROUTE FOR COAL HAULING TRUCKS TO AND FROM POWER PLANT
PARKING LOT
SUGAR MILL
Bechtel Corporation
SAN FRANCISCO
ENERGY TECHNOLOGY INNOVATION PROJECT
FIGURE 4-1
PORT OF HAINA
EXISTING SHIP UNLOADING FACILITY
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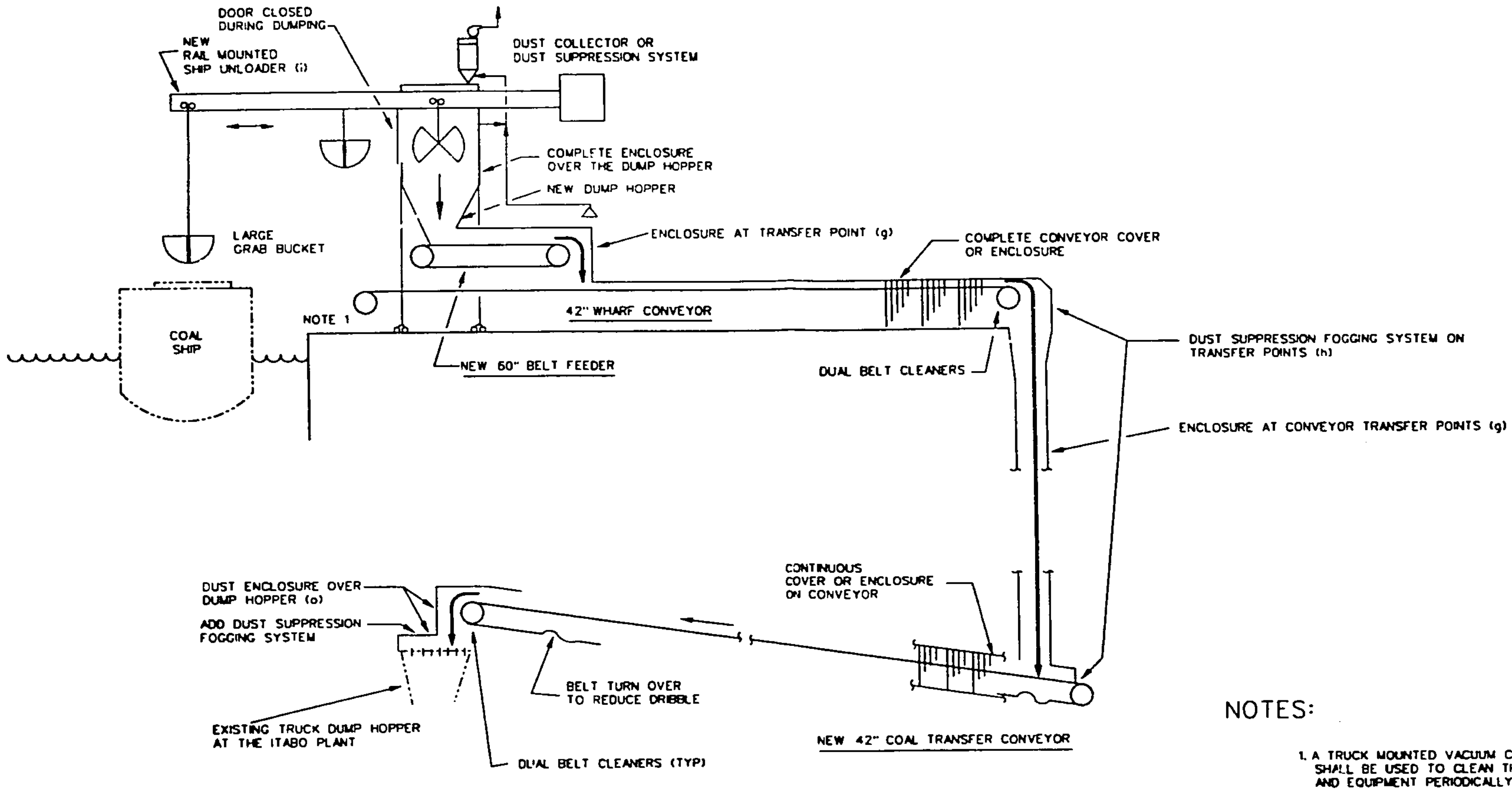
ISSUED FOR REPORT



NOTES:

1. A TRUCK MOUNTED VACUUM CLEANER SHALL BE USED TO CLEAN THE FLOOR AND EQUIPMENT PERIODICALLY.

NO.	DATE	REVISION	APP	APP	REFERENCE DRAWINGS	NUMBER	NOTES
A		ISSUED FOR REPORT					

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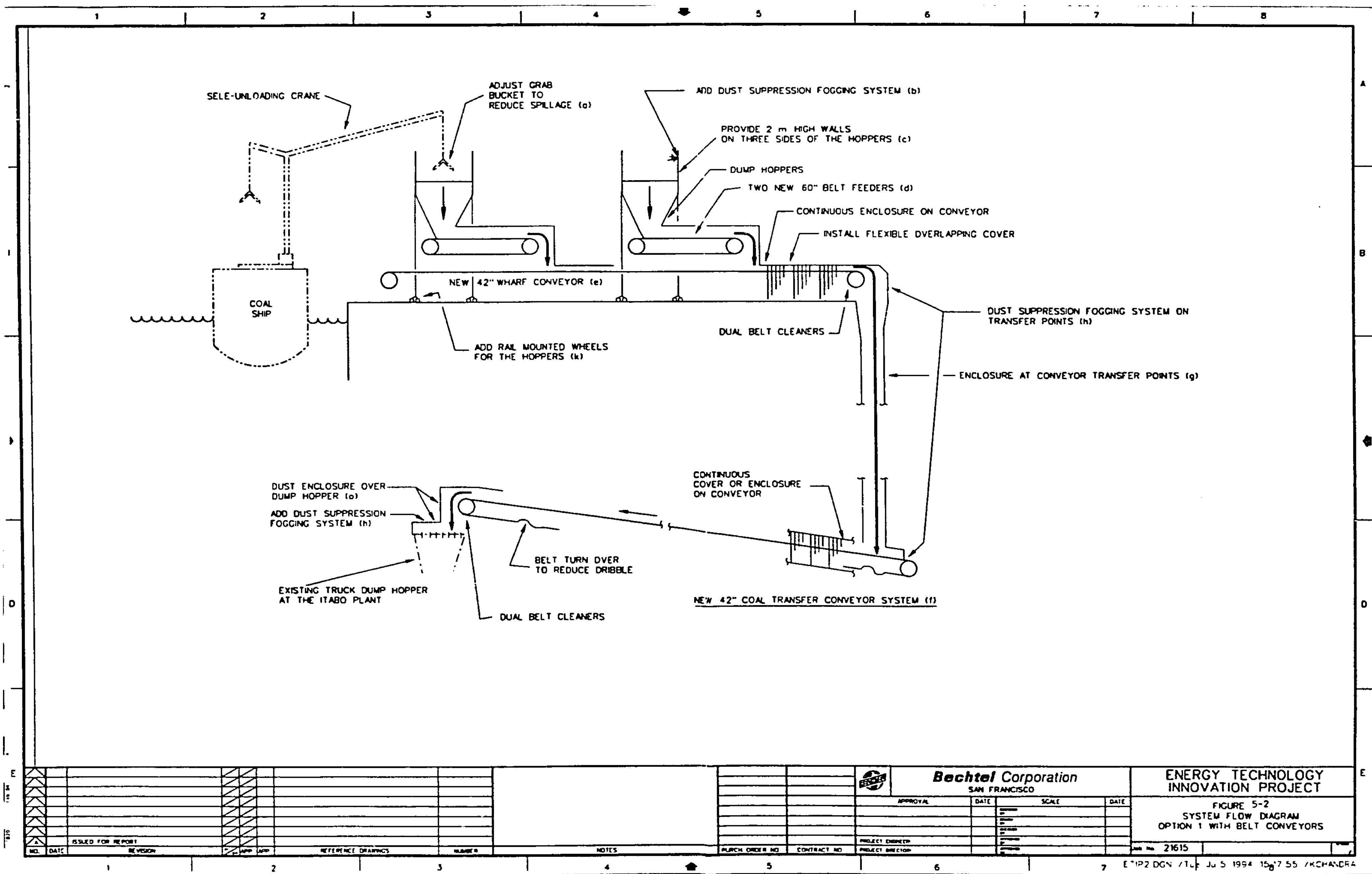
FIGURE 5-1
SYSTEM FLOW DIAGRAM
WITH NEW SHIP UNLOADER

Job No. 21615

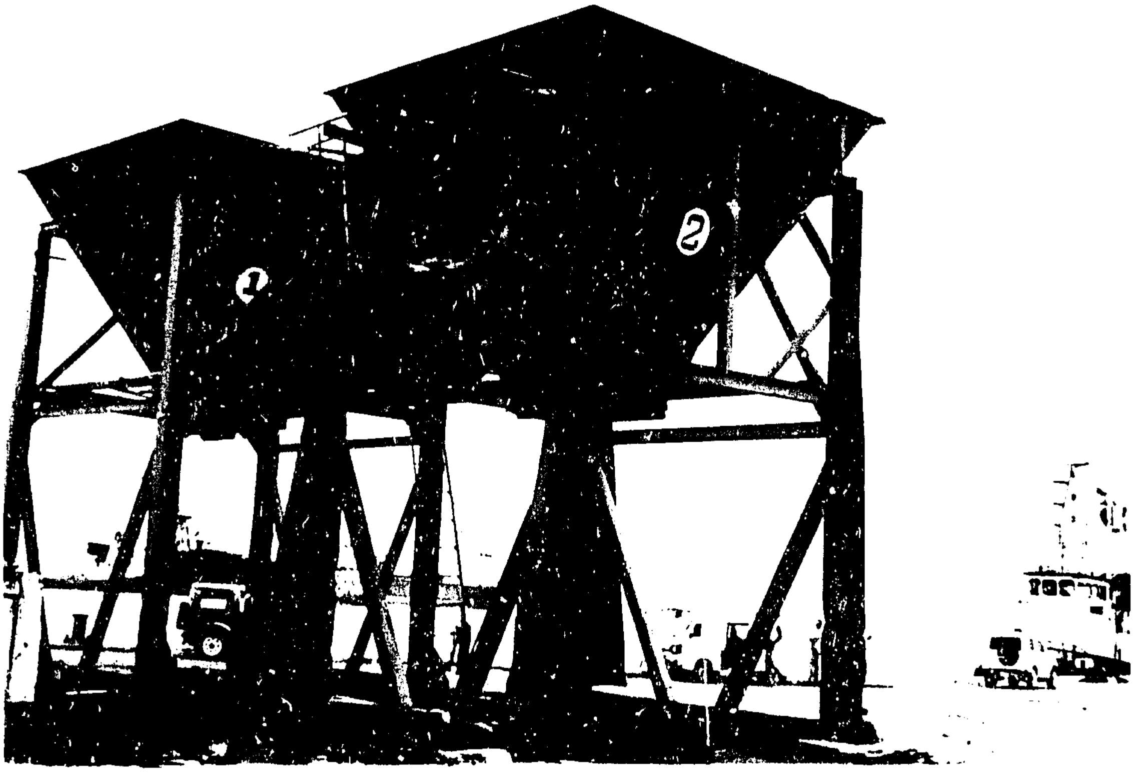
ETIP3.DGN /Wed Jun 29 1994 11:32:05 /KCHANDRA



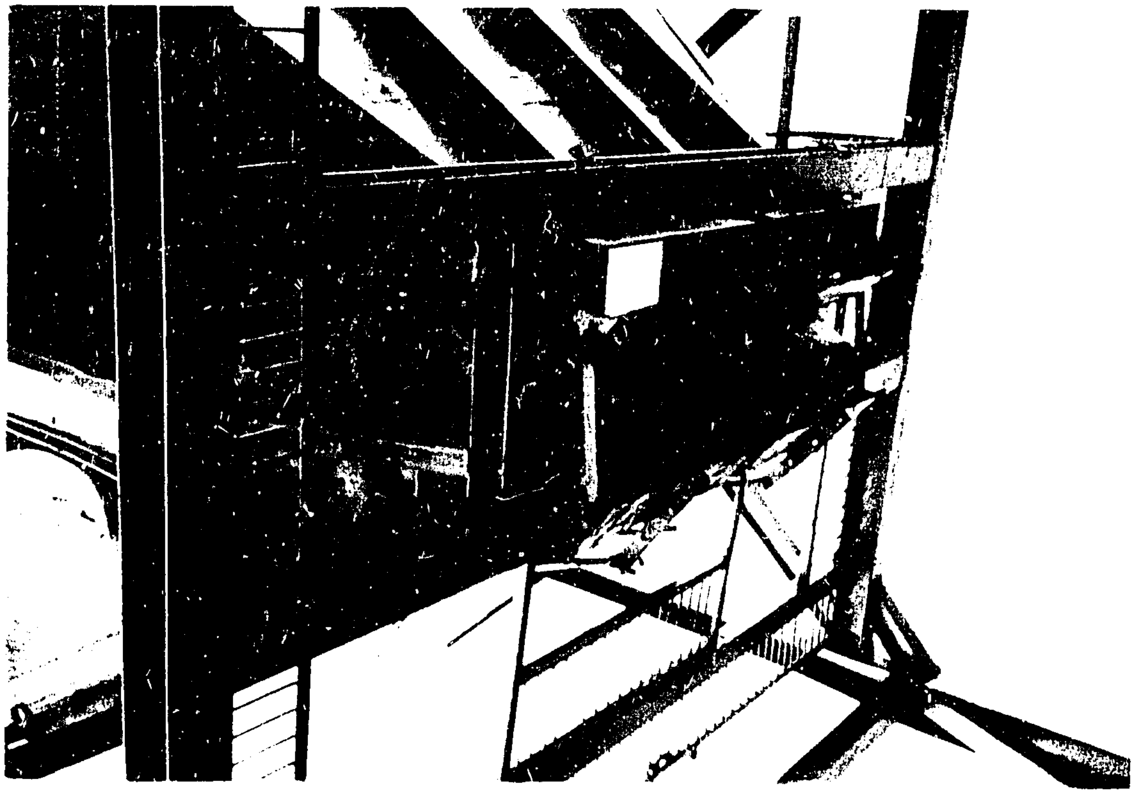
SELE-UNLOADING CRANE
ADJUST GRAB BUCKET TO REDUCE SPILLAGE (a)
ADD DUST SUPPRESSION FOGGING SYSTEM (b)
PROVIDE 2 m HIGH WALLS ON THREE SIDES OF THE HOPPERS (c)
DUMP HOPPERS
TWO NEW 60" BELT FEEDERS (d)
CONTINUOUS ENCLOSURE ON CONVEYOR
INSTALL FLEXIBLE OVERLAPPING COVER
COAL SHIP
NEW 42" WHARF CONVEYOR (e)
ADD RAIL MOUNTED WHEELS FOR THE HOPPERS (k)
DUAL BELT CLEANERS
DUST SUPPRESSION FOGGING SYSTEM ON TRANSFER POINTS (h)
ENCLOSURE AT CONVEYOR TRANSFER POINTS (g)
CONTINUOUS COVER OR ENCLOSURE ON CONVEYOR
DUST ENCLOSURE OVER DUMP HOPPER (o)
ADD DUST SUPPRESSION FOGGING SYSTEM (h)
BELT TURN OVER TO REDUCE DRIBBLE
EXISTING TRUCK DUMP HOPPER AT THE ITABO PLANT
DUAL BELT CLEANERS
NEW 42" COAL TRANSFER CONVEYOR SYSTEM (f)
ISSUED FOR REPORT
NO. DATE REVISION APP APP REFERENCE DRAWINGS NUMBER NOTES PURCH ORDER NO CONTRACT NO
Bechtel Corporation
SAN FRANCISCO
APPROVAL DATE SCALE DATE
PROJECT ENGINEER
PROJECT DIRECTOR
ENERGY TECHNOLOGY INNOVATION PROJECT
FIGURE 5-2
SYSTEM FLOW DIAGRAM
OPTION 1 WITH BELT CONVEYORS
Job No. 21615
ETIP2 DGN /Tue Jul 5 1994 15:17:55 /KCHANDRA

APPENDIX A

PHOTOGRAPHS OF PORT HAINA & ITABO POWER PLANT

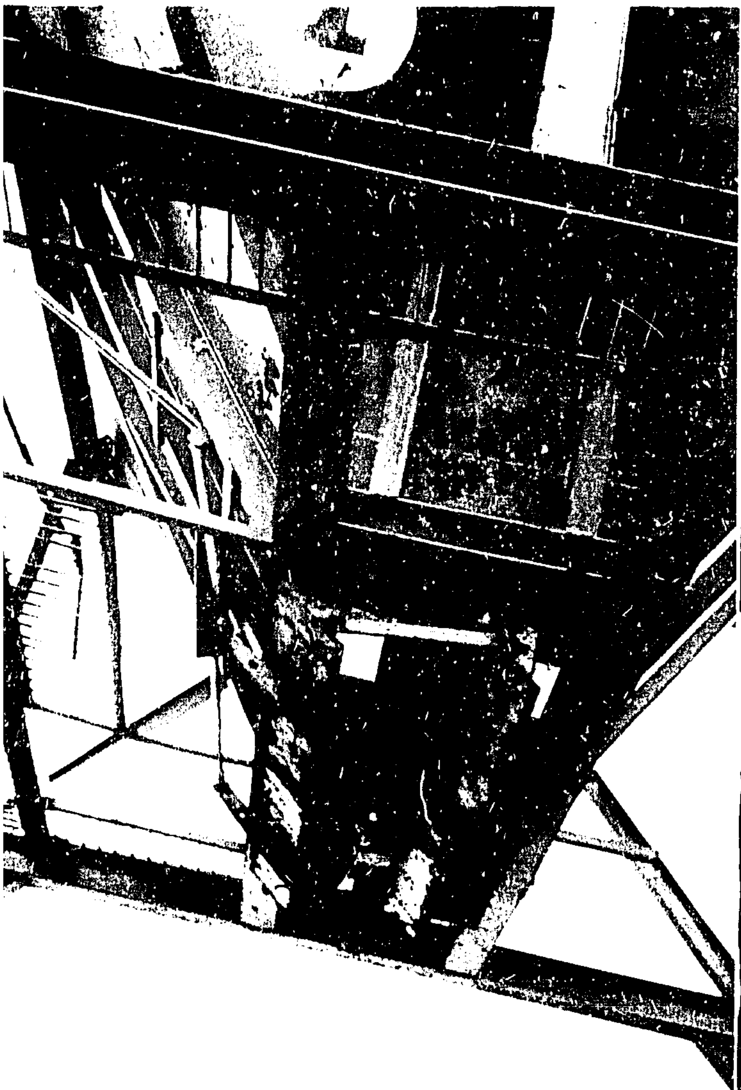


TRUCK LOADING HOPPER



MANUALLY OPERATED GATE

22

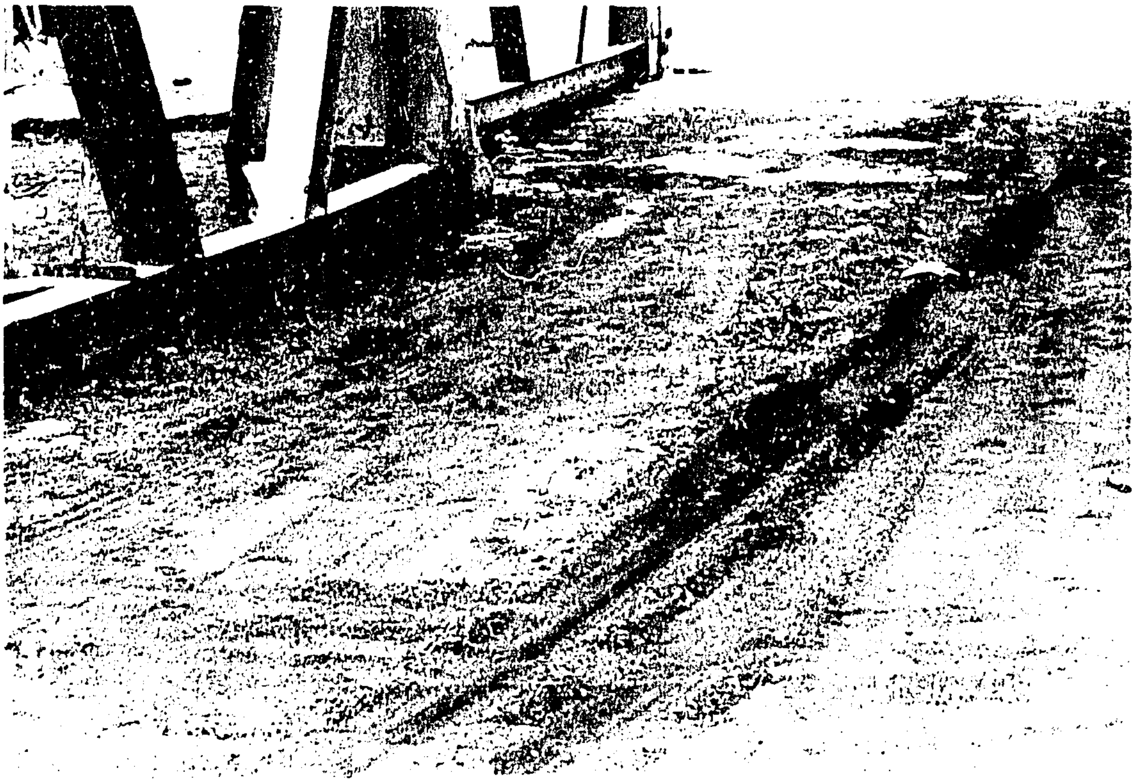


GATE & OPERATOR'S PLATFORM

SPILL GUARD

23

SPILLAGE UNDER THE HOPPER



SPILLAGE

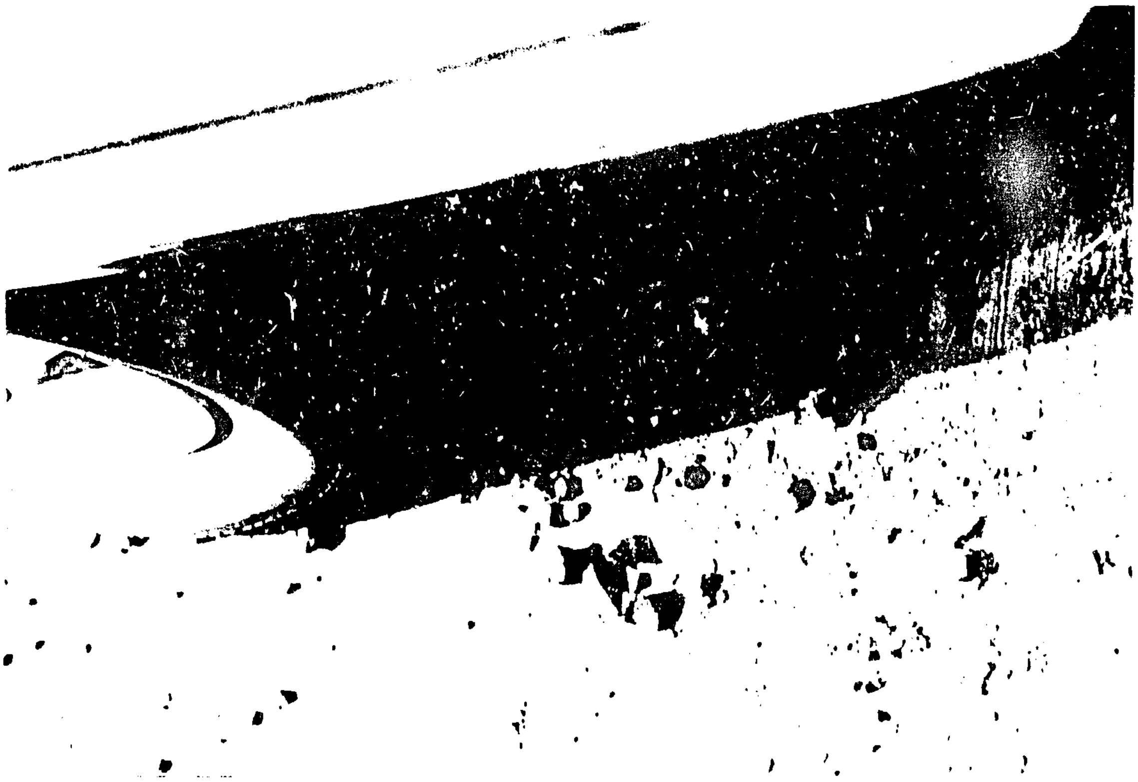
7k

SPILLAGE

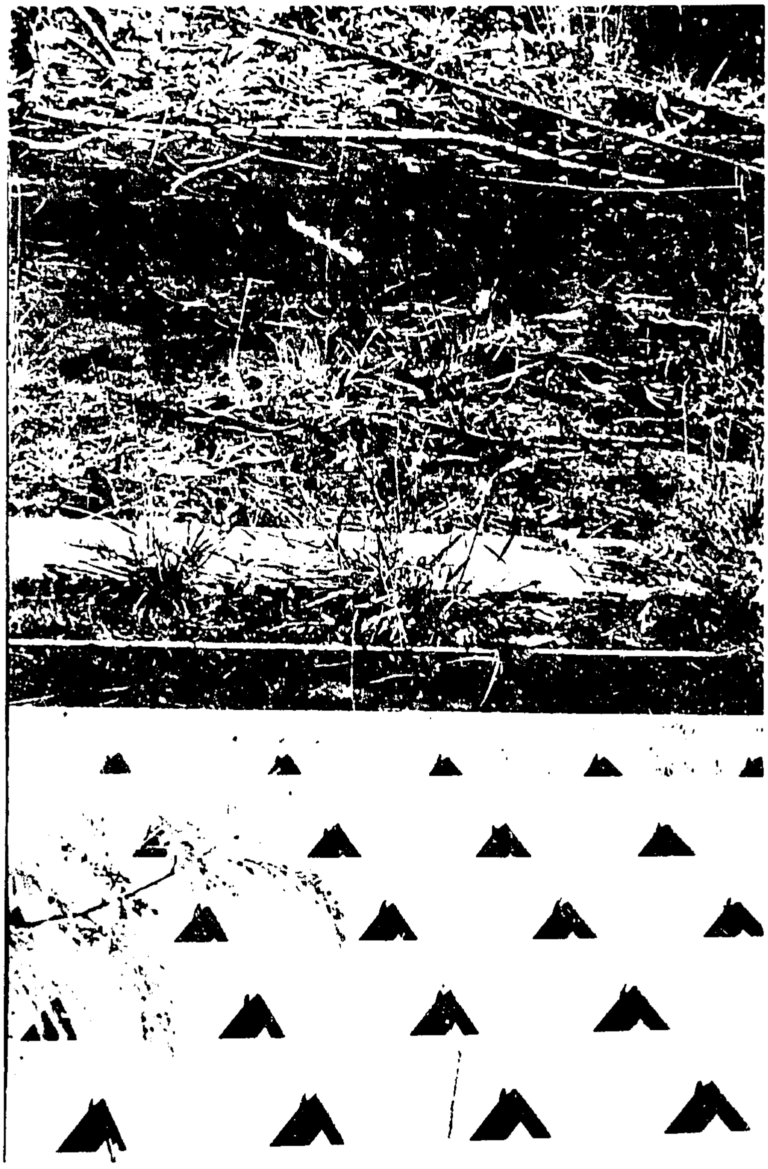
PARKING LOT - SPILLAGE

25

PARKING LOT - SPILLAGE



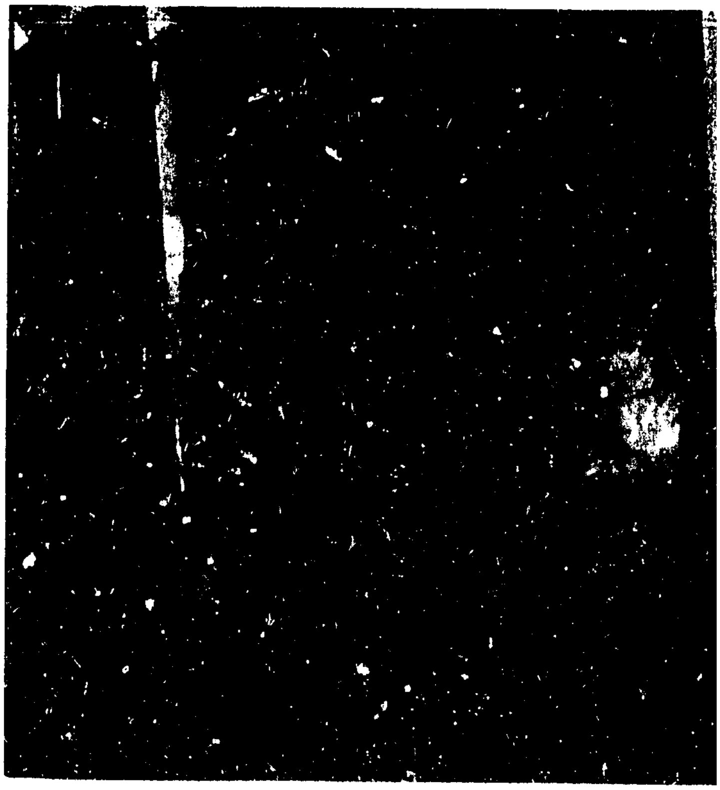
26



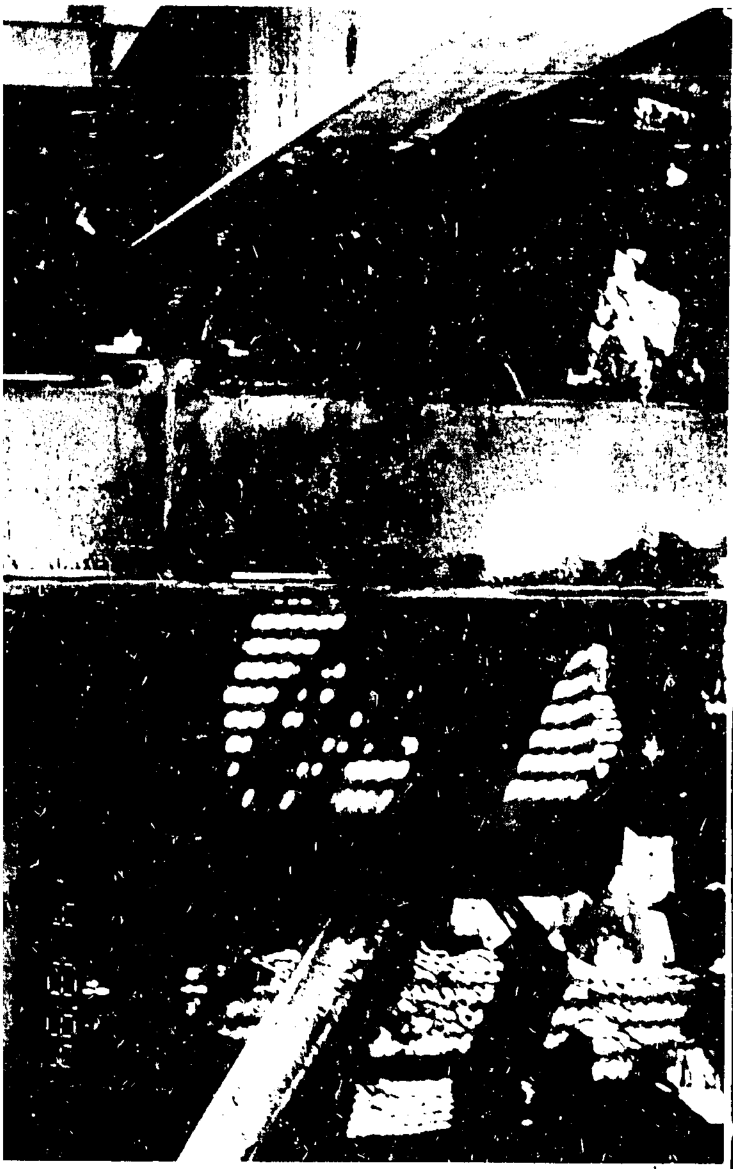
GRIZZLY OVER DUMP HOPPER
SPILLAGE AROUND GRIZZLY

COAL DUST DRIFT
40 m FROM GRIZZLY

28



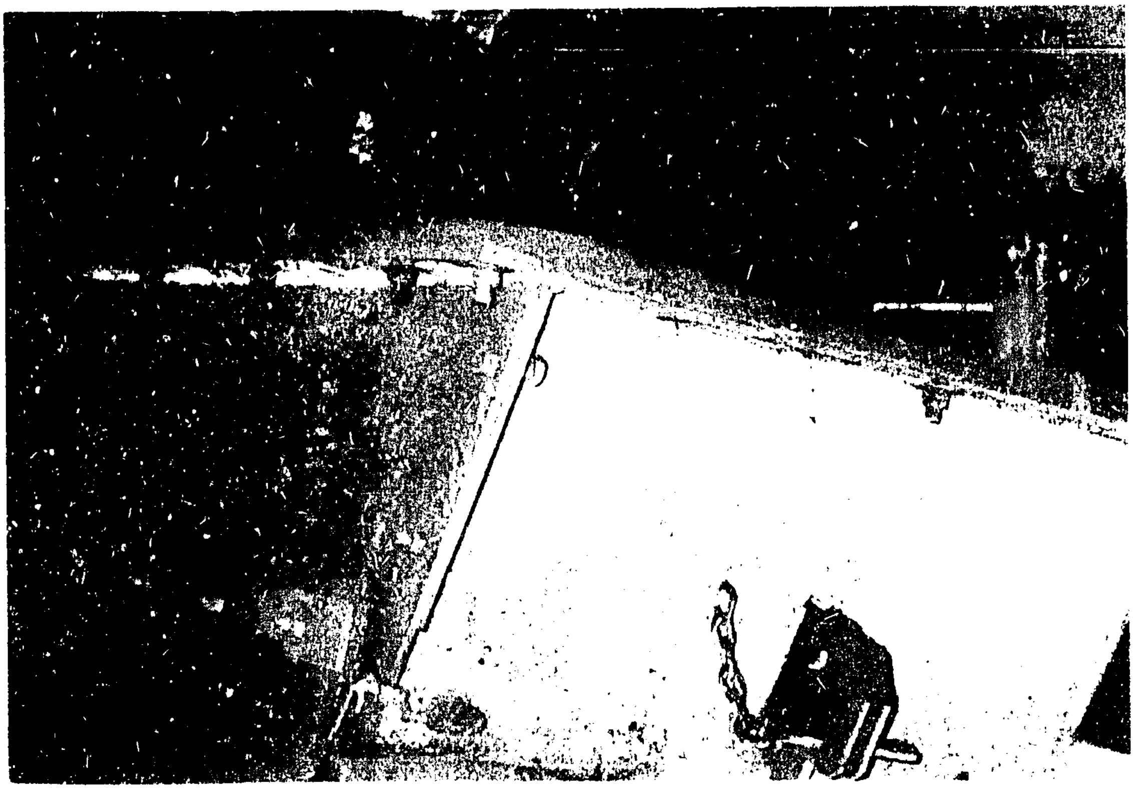
TUNNEL UNDER RECEIVING
DUMP HOPPER IN THE PLANT
LAYER OF COAL DUST ON THE FLOOR



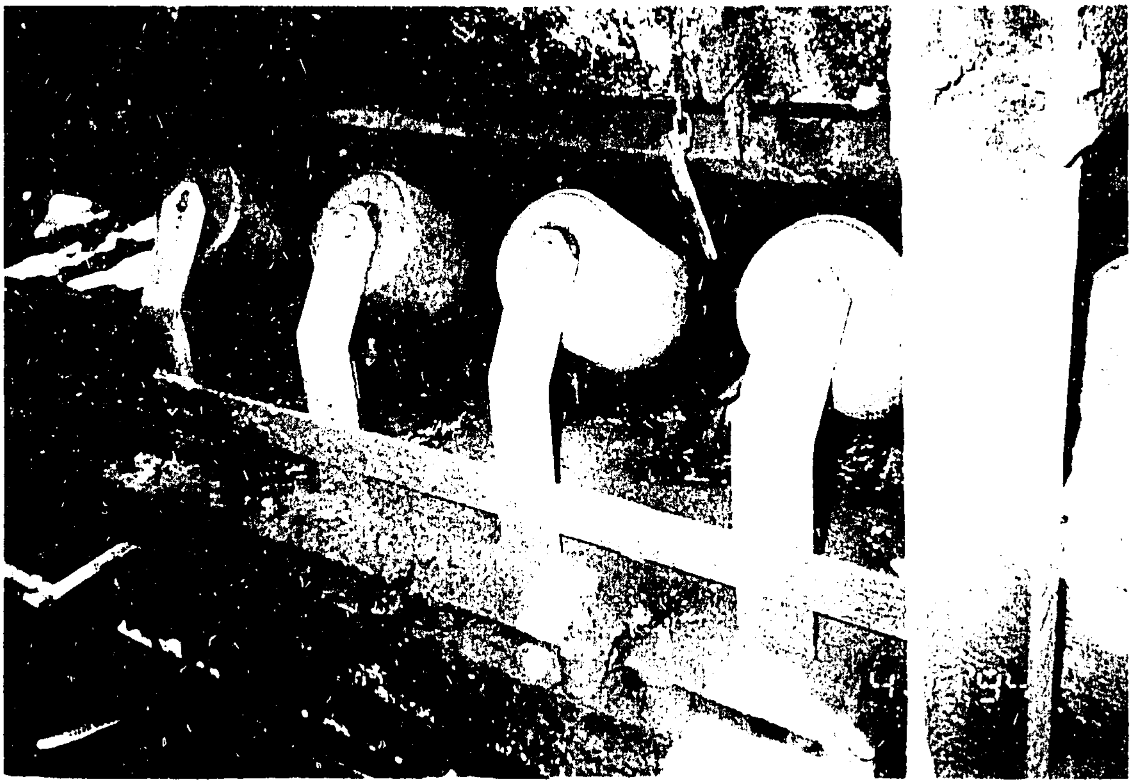
HEAVY SPILLAGE ON SUPPORTING STRUCTURE

SPILLAGE ON AND UNDER THE CONVEYOR

30

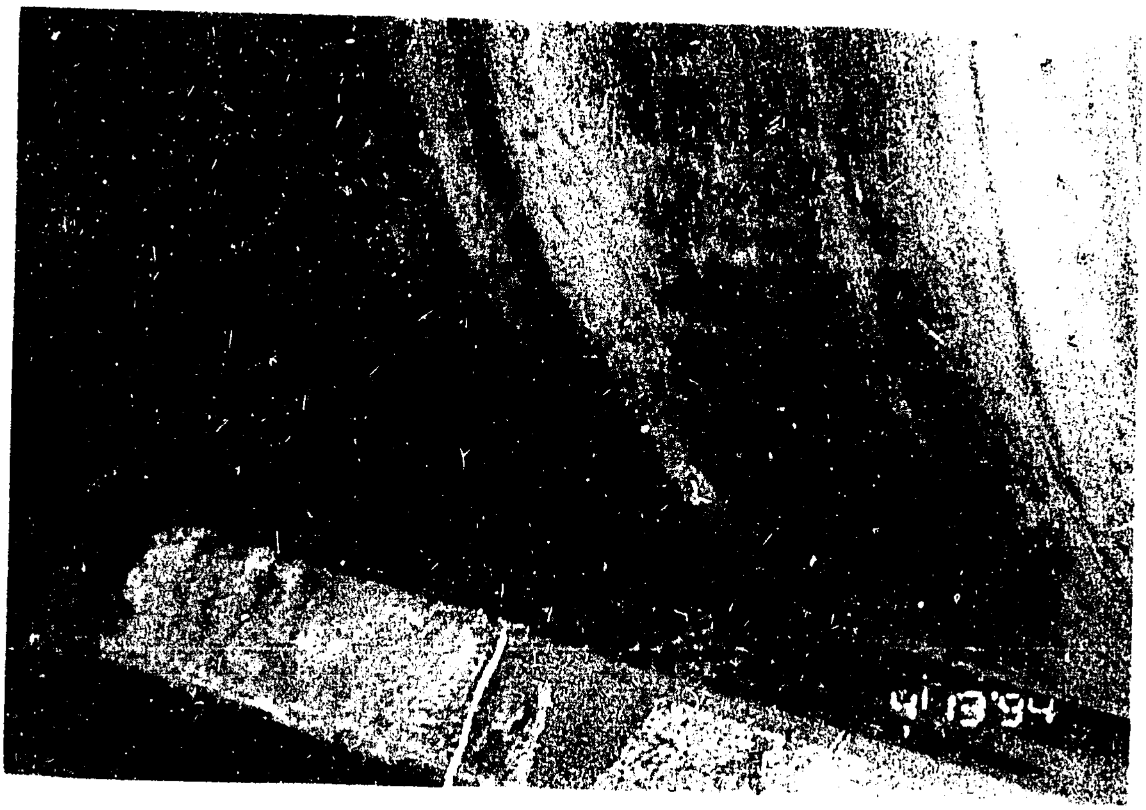


DUST DEPOSIT



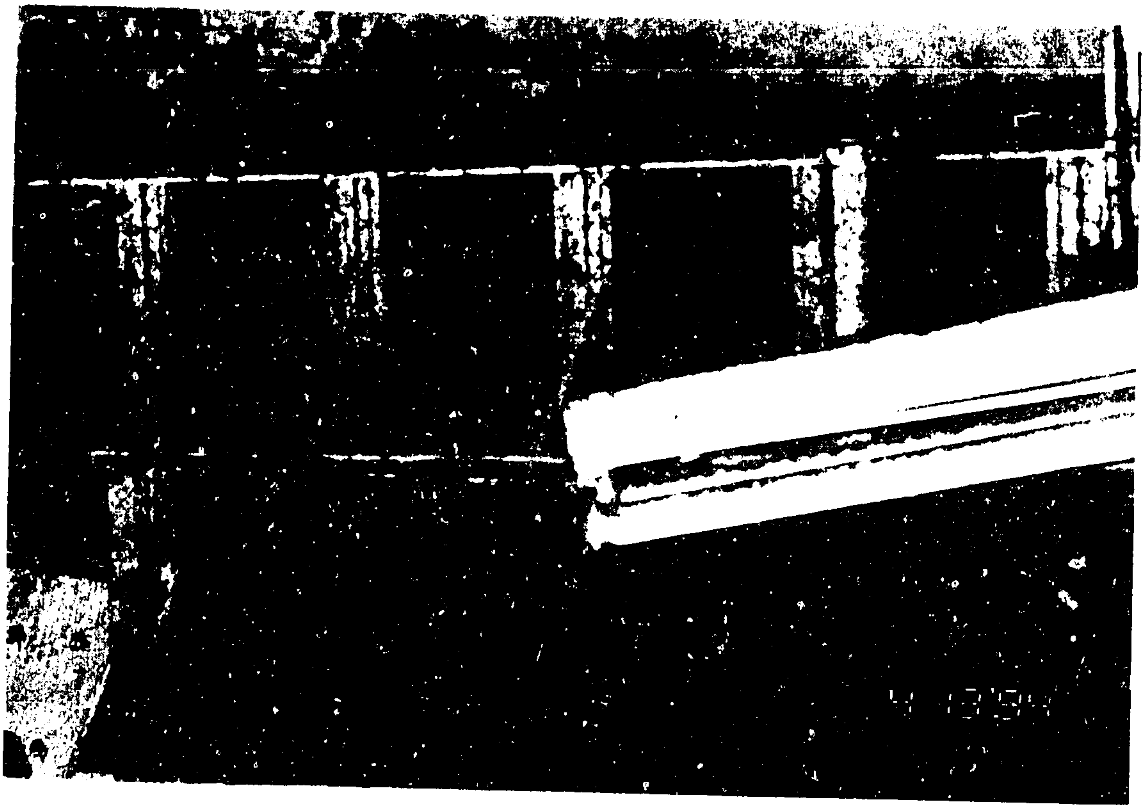
SPILLAGE AND DUST DEPOSIT

31

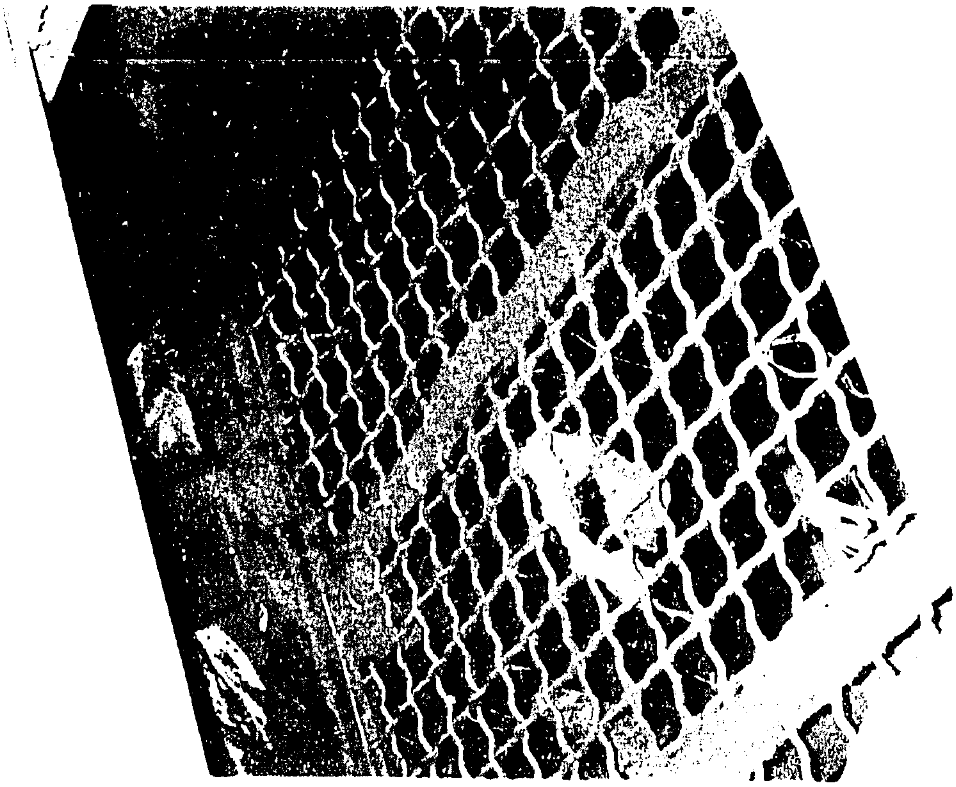


WORN BELT CLEANER

32



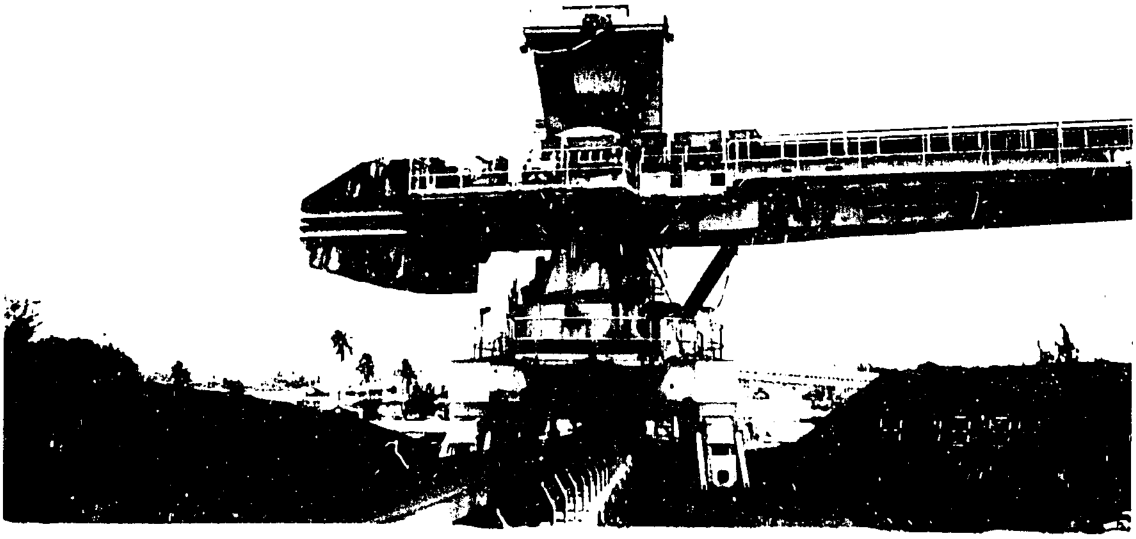
CARRY OVER & SPILLAGE
UNDER THE RETURNING BELT



PARTIALLY COVERED SCREEN

SPILLAGE AT SCREEN FEED CONVEYOR HEAD TERMINAL

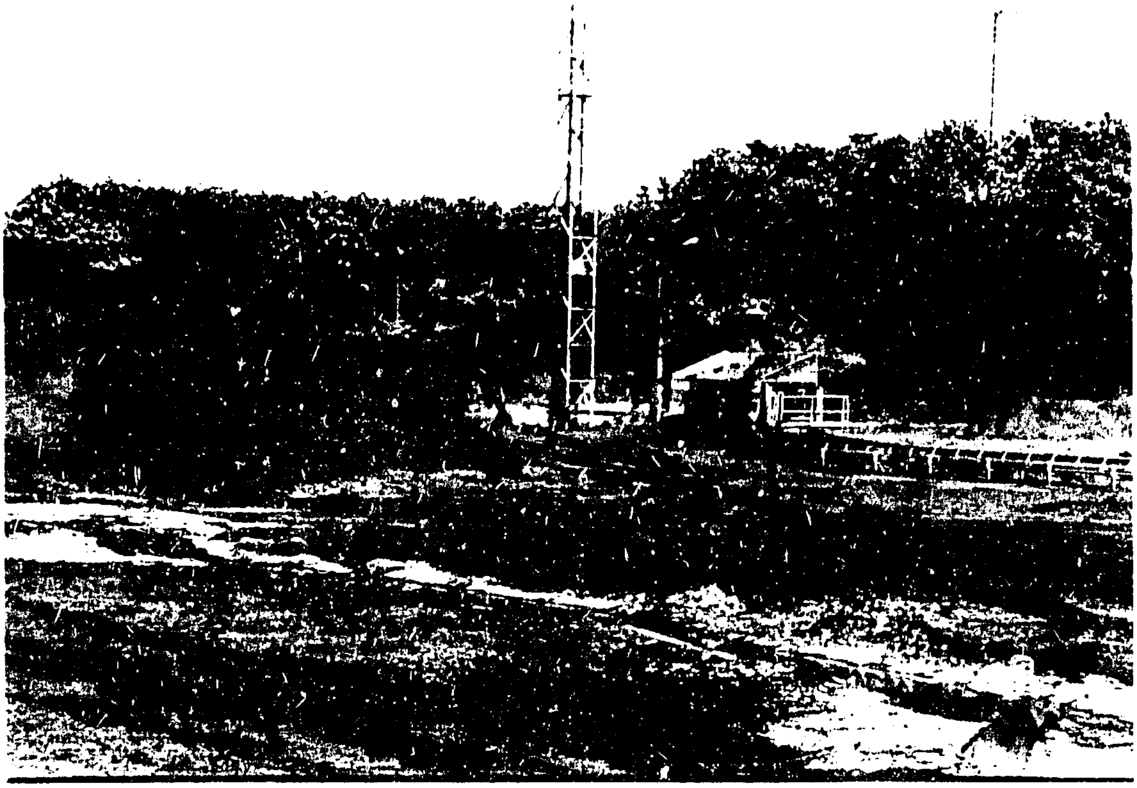
34



STACKER WITH BOOM CONVEYOR

STACKER SUPPORTING STRUCTURE

EXTINGUISHED FIRE AT THE TOE OF THE PILE



RECLAIM HOPPER (IN BACKGROUND)
WATER DRAINAGE

WATER DRAINAGE AND PLANT FEED CONVEYOR

37

RECLAIM HOPPER WITH
RAMP FROM COAL

RECLAIM CONVEYOR

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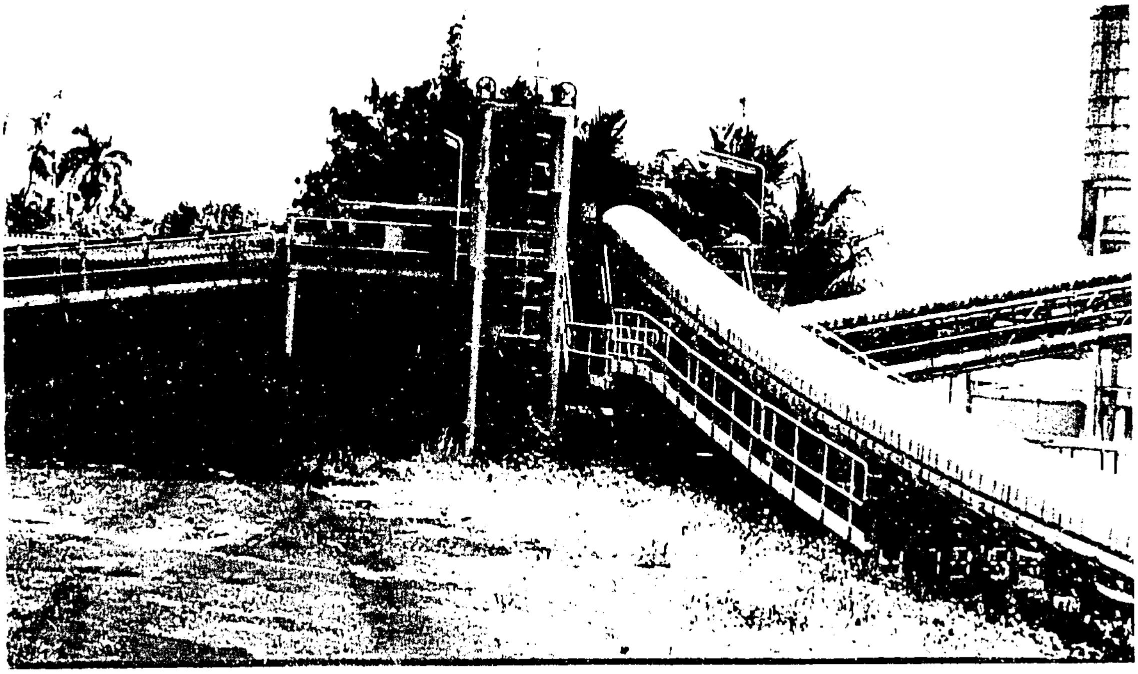
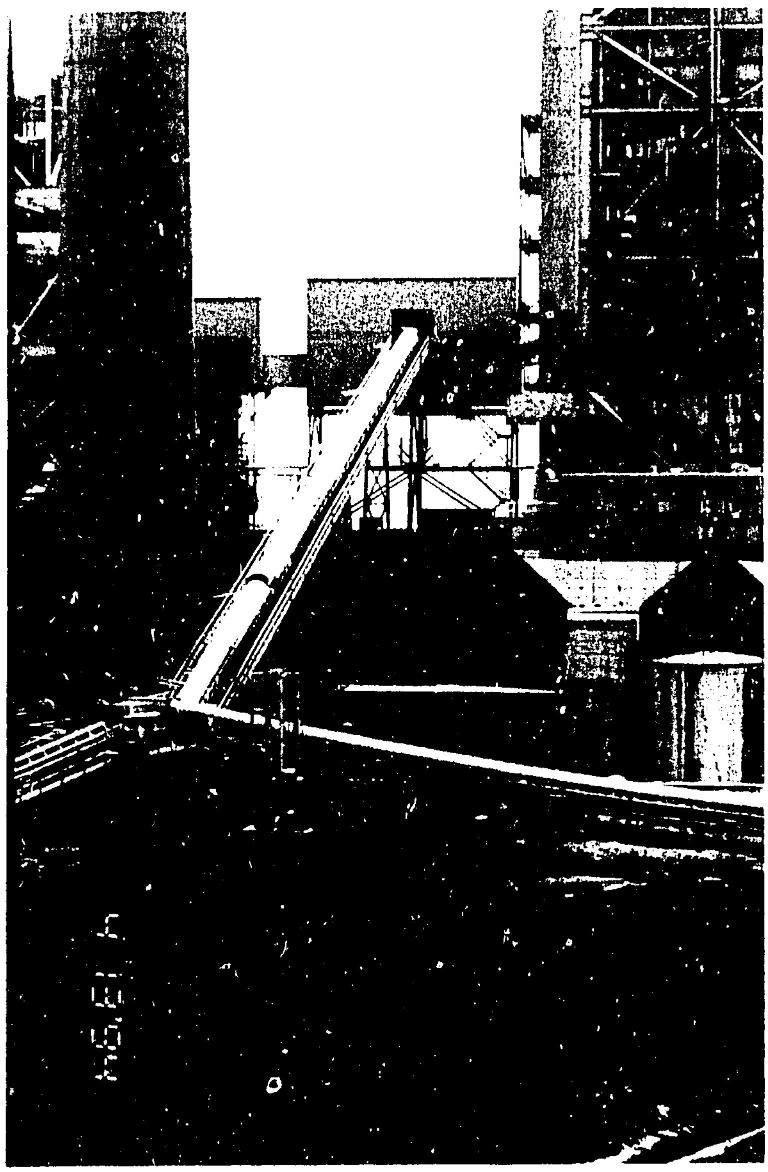
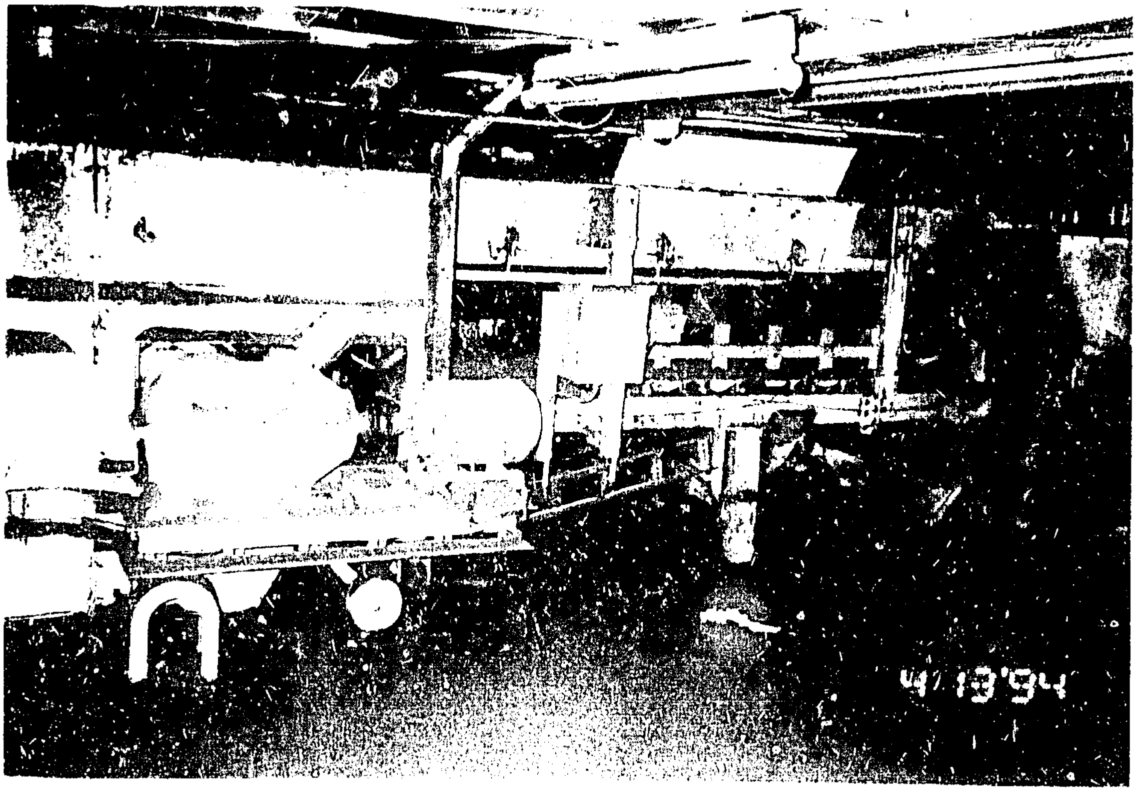


TRANSFER STATION ONTO PLANT FEED CONVEYOR

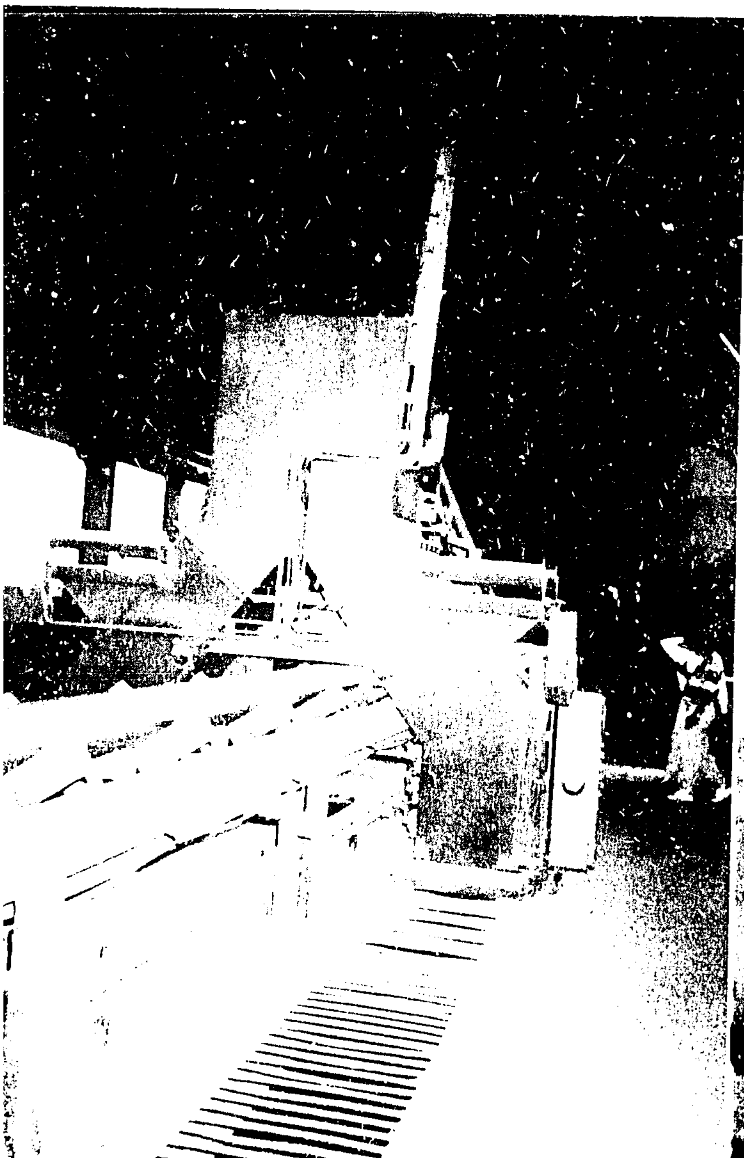


COMPONENTS OF
PLANT FEED CONVEYOR



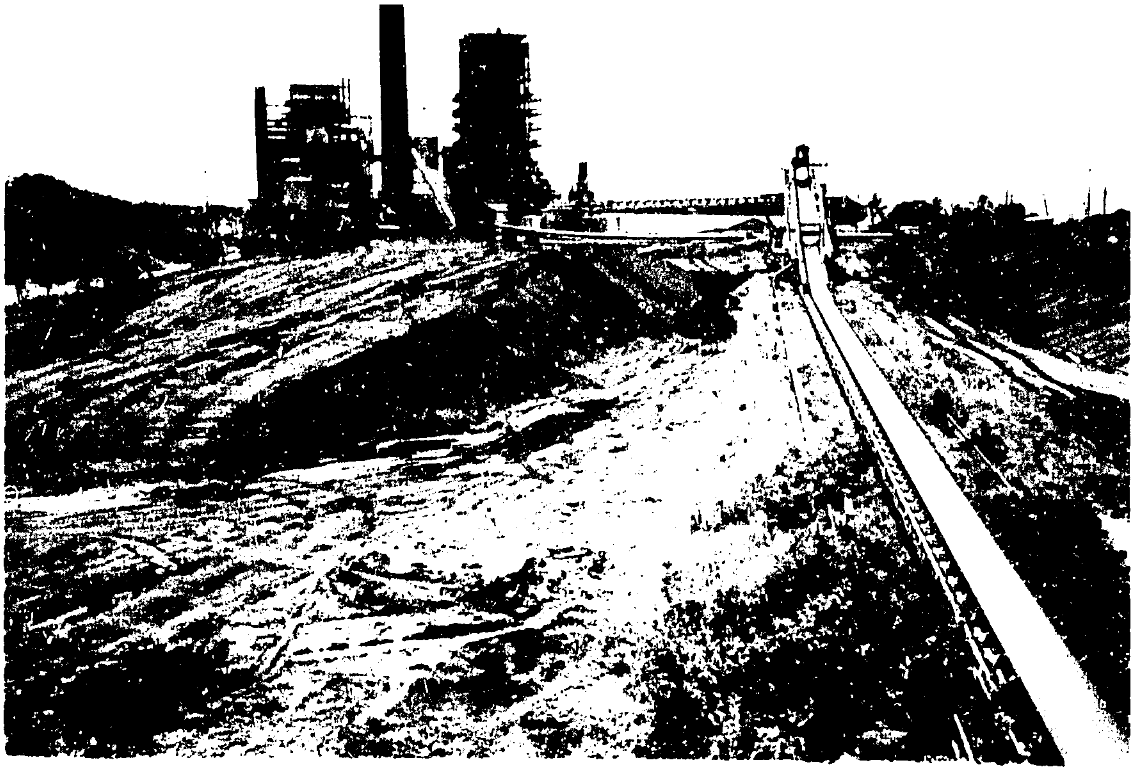
REVERSIBLE CONVEYOR BETWEEN BUNKERS

141



BUNKER FEED TRIPPER CONVEYOR

BUNKER FIRE



COAL STOCKPILE - LEFT SIDE

COAL STOCKPILE - RIGHT SIDE