BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:

PROPOSED SITE SPECIFIC	)	
RULE FOR CITY OF SPRINGFIELD,	)	
ILLINOIS, OFFICE OF PUBLIC	)	
UTILITIES, CITY WATER, LIGHT	)	R09-8
AND POWER AND SPRINGFIELD	)	(Site Specific Rulemaking – Water)
METRO SANITARY DISTRICT	)	
FROM 35 ILL. ADM. CODE	)	
SECTION 302.208(g)	)	

NOTICE OF FILING

TO: Mr. John Therriault
Assistant Clerk of the Board
Illinois Pollution Control Board
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601
(VIA ELECTRONIC MAIL)

Marie E. Tipsord
Hearing Officer
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph, Suite 11-500
Chicago, Illinois 60601
(VIA U. S. MAIL)

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Illinois Pollution Control Board PETITIONERS' POST-HEARING DOCUMENT SUBMITTAL, a copy of which are herewith served upon you.

Respectfully submitted,

CITY OF SPRINGFIELD, ILLINOIS,
OFFICE OF PUBLIC UTILITIES,
CITY WATER, LIGHT AND POWER,

and

SPRINGFIELD METRO SANITARY
DISTRICT,

Date: November 21, 2008

By: /s/ Christine G. Zeman
One of Their Attorneys

Katherine D. Hodge
Christine G. Zeman
HODGE DWYER ZEMAN
3150 Roland Avenue
Post Office Box 5776
Springfield, Illinois 62705-5776
(217) 523-4900

THIS FILING SUBMITTED ON RECYCLED PAPER

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:

PROPOSED SITE SPECIFIC	)	
RULE FOR CITY OF SPRINGFIELD,	)	
ILLINOIS, OFFICE OF PUBLIC	)	
UTILITIES, CITY WATER, LIGHT	)	R09-8
AND POWER AND SPRINGFIELD	)	(Site Specific Rule – Water)
METRO SANITARY DISTRICT	)	
FROM 35 ILL. ADM. CODE	)	
SECTION 302.208(g)	)	

PETITIONERS' POST-HEARING DOCUMENT SUBMITTAL

NOW COME the Petitioners, City of Springfield, Illinois, Office of Public Utilities, City Water, Light and Power ("CWLP") and Springfield Metro Sanitary District ("District") (collectively "Petitioners"), by and through their attorneys, HODGE DWYER ZEMAN, and pursuant to the Illinois Pollution Control Board's ("Board") requests for additional information during the November 3, 2008 Hearing, and consistent with the November 6, 2008 Hearing Officer Order, provide the following:

1. The studies and evaluations that were referenced in the Technical Support Document ("TSD") and in the Pre-Filed Testimony of Petitioners, including:

   a. Burns & McDonnell Engineering Co., Phase II SO2 Compliance Study Report ("Report"), October 1998, referenced in the TSD at pages 6-1 and 6-2, regarding switching the CWLP coal supply from Illinois coal to Powder River Basin coal. See especially, pages IV-1 through IV-14 of the Report. The Report is attached hereto as Attachment A.

   b. Burns & McDonnell Engineering Co., New Generation Project Water Study ("Water Study"), February 2005, referenced in the TSD at pages 6-5 through 6-10, regarding evaluation of boron mitigation options. The Water Study is attached hereto as Attachment B.

c. Sargent and Lundy, LLC, City Water Light & Power Dallman & Lakeside Station Water Conservation Study ("Water Conservation Study"), April 2005, referenced in the TSD at page 6-5, regarding the investigation of the use of a completely dry bottom ash handling system at the CWLP Dallman Power Station. See especially, pages 3-4 and 3-5 of the Water Conservation Study. The Water Conservation Study is attached hereto as Attachment C.

d. Burns & McDonnell Engineering Co., Letter to Douglas Brown, CWLP, regarding Boron Removal Using Electrocoagulation ("EC Letter"), May 18, 2007, referenced in the TSD at page 6-10, regarding the capital cost and annual operating costs for removal of boron in the FGDS wastewater. See especially, pages 4 through 6 of the EC Letter. The EC Letter is attached hereto as Attachment D.

2. Data summarized by Crawford, Murphy & Tilly, Inc. ("CMT") that CWLP supplied to the District to demonstrate anticipated constituents in CWLP's flue gas desulfurization system ("FGDS") wastewater stream. CMT's analysis summary of raw scrubber blowdown wastewater and of jar test results are attached hereto as Attachment E.

3. The Intergovernmental Cooperation Agreement between CWLP and the District, which is attached hereto as Attachment F.

4. A summary in table format of the boron mitigation options considered, which is attached hereto as Attachment G.

5. Coordinates for the affected stream segments, which is attached hereto as Attachment H.

In addition, after the November 3, 2008 Hearing, Petitioners noticed that footnote 1 of Table 6-2 on page 6-11 of the TSD cited to incorrect sections of the TSD. As explained at hearing and in the TSD, Table 6-2 on page 6-11 of the TSD is a comparison to one another of each alternative Burns & McDonnell addressed in its 2005 Water Study report, not what it would ultimately cost to build or implement each option. For example, Table 6-2 does not include disposal costs for the brine concentrator system. See, TSD page 6-10 and Transcript of the November 3rd Hearing, pp. 50-52. A corrected version of Table 6-2 of the TSD, is attached hereto as Attachment I.

WHEREFORE, Petitioners, City of Springfield, Illinois, Office of Public Utilities, City Water, Light and Power and Springfield Metro Sanitary District respectfully submit this documentation and information in response to the Board's requests during the November 3, 2008 Hearing, consistent with the November 6, 2008 Hearing Officer Order.

Respectfully submitted,

CITY OF SPRINGFIELD, ILLINOIS,
OFFICE OF PUBLIC UTILITIES,
CITY WATER, LIGHT AND POWER,

and

SPRINGFIELD METRO SANITARY DISTRICT,

Date: November 21, 2008

By: /s/ Christine G. Zeman
One of Their Attorneys

Katherine D. Hodge
Christine G. Zeman
HODGE DWYER ZEMAN
3150 Roland Avenue
P.O. Box 5776
Springfield, Illinois 62705
(217) 523-4900

CWLP:002/Fil/Post-Hearing Document Submittal

CERTIFICATE OF SERVICE

I, Christine G. Zeman, the undersigned, certify that I have served the attached PETITIONERS' POST-HEARING DOCUMENT SUBMITTAL, upon:

Mr. John Therriault
Assistant Clerk of the Board
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601

Albert F. Ettinger, Esq.
for Prairie Rivers Network
c/o Environmental Law and Policy Center
35 East Wacker Drive
Suite 1300
Chicago, Illinois 60601
aettinger@elpc.org

via electronic mail on November 21, 2008; and upon:

Joey Logan-Wilkey, Assistant Counsel
Division of Legal Counsel
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Bill Richardson, Chief Legal Counsel
Illinois Department of Natural Resources
One Natural Resources Way
524 S. Second Street
Springfield, Illinois 62702-1271

Matthew Dunn, Chief
Environmental Bureau
Office of the Attorney General
69 West Washington Street, 18th Floor
Chicago, Illinois 60602

Marie E. Tipsord
Hearing Officer
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph, Suite 11-500
Chicago, Illinois 60601

by depositing said documents in the United States Mail, postage prepaid, in Springfield, Illinois on November 21, 2008.

By: /s/ Christine G. Zeman
Christine G. Zeman

CWLP:002/Filings/ NOF-COS – Post Hearing Doc Submittal

ATTACHMENT A

Phase II SO2 Compliance Study Report

PHASE II SO2 COMPLIANCE STUDY REPORT

For

City Water Light & Power
Springfield, Illinois

Dallman and Lakeside Stations

October, 1998

98-617-4

73% NOx Reduction
by May 1, 03

Burns
&
McDonnell

Burns & McDonnell
100
1898 • 1998

October 7, 1998

Mr. Jay Bartlett
City Water Light & Power
3100 Stevenson Drive
Springfield, IL 62757

Phase II SO_2 Compliance Study
Project No. 98-617-4 (G)
Final Report

Dear Mr. Bartlett:

Attached are fifteen copies of the final report for the Phase II SO_2 Compliance Study in accordance with our contract for professional engineering services (City of Springfield purchase order SCSCA99202021). This study investigated and evaluated Phase II SO_2 compliance options for the Dallman and Lakeside Stations.

The report was revised to include the comments received from City Water Light & Power on the draft copy of information included in the report. Submission of this report and completion of the presentation of study results scheduled for October 8, 1998 completes our work on this project.

We appreciate this opportunity to provide professional engineering services to City Water Light & Power and would like to thank you and your staff for your assistance in providing information used in the performance of the study and preparation of the report.

Sincerely,

Greg M. Graves

Greg M. Graves, P.E.
Vice President

Brian E. Basel

Brian E. Basel, P.E.
Project Manager

Attachments

ENGINEERS • ARCHITECTS • CONSULTANTS
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Kansas City, Missouri 64114-3319
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Fax: 816 333-3690
http://www.burnsmcd.com

City Water Light & Power
Springfield, Illinois

Phase II SO_2 Compliance Study
Project No. 98-617-4

INDEX AND CERTIFICATION PAGE

REPORT INDEX

CERTIFICATION

GARY W. PENCE
062-045946
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

Ex. 11/30/99

Gary W. Pence
10/8/98

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PART I
SUMMARY AND CONCLUSIONS

PART I

SUMMARY AND CONCLUSIONS

Burns & McDonnell performed a study of Phase II SO_2 compliance options as requested by City Water Light & Power (CWLP) for the Dallman and Lakeside Stations.

SUMMARY

CWLP has performed several previous studies of options for compliance with the requirements of Phase II of the Clean Air Act as amended in 1990. Burns & McDonnell was contracted to provide professional engineering services to update and expand the previous compliance option studies. The following tasks were accomplished during this study:

- Compliance options developed by CWLP were reviewed and additional options were prepared and included in the study.
- Each of the compliance options was defined and agreed to by CWLP and Burns & McDonnell.
- A technical and economic screening was performed of each option.
- This report was prepared to document the activities that were accomplished during the study.
- Three meetings were held with CWLP personnel to discuss the basis for the study, to review the compliance options and cost factors to use in the cost estimates, and to perform the technical K-T decision analysis.
- A presentation of the final results of the study was made to CWLP.

CONCLUSIONS

As stated above, both a technical and an economic analysis were performed of potential compliance options. Several conclusions were made from the results of these analyses.

Technical Analysis

The technical analysis of the options identified modifications that might be required to the existing plant based on the option conditions. The modifications involve boiler and coal handling modifications that would be required for options involving a change in the coal from the Turris coal presently being burned in all of the Dallman and Lakeside units. Some of the options are based on the installation of FGD systems on Dallman Unit 31 and 32, or taking the Dallman Unit 33 scrubber out of service. The modifications and

FGD system impact on several criteria were analyzed and scored during a "K-T" analysis meeting attended by both CWLP and Burns & McDonnell personnel.

The highest ranked compliance option is Option 1 based on the technical analysis performed. The scope of Option 1 includes the addition of an FGD system to Dallman Units 31 and 32. Turris coal would continue to be burned in all Dallman and Lakeside units for this option. The Dallman Unit 33 scrubber would also remain in service. Because the coal supply does not change, no unit or coal handling modifications would be required for implementation of this option.

Economic Analysis

An economic analysis similar to the analyses performed by CWLP for the previous studies was done for each of the options identified for this study. The capital and operation and maintenance cost of each modification that was might be required for each option was estimated and a total evaluated cost calculated.

Key Assumptions: The economic analysis was based on the following significant assumptions, many of which parallel those made by CWLP in its previous studies. These assumptions should be clearly understood and considered in interpretation of the reported economic analysis results:

- The positive bias in SO2 emissions due to the discrepancy between the CEMS-reported and fuel-based calculated emissions was included in determination of allowances required.
- No banking of SO_2 allowances was permitted. This includes the previous purchase of 27,000 allowances by CWLP, which are not specifically accounted for in this analysis.
- The significant reduction in the number of allowances available to the Lakeside units after the year 2009 was not specifically accounted for. The results of the evaluation are therefore most relevant for the first 10 years of Phase II.
- The analysis was based on assumed capacity factors that resulted in a total annual net generation of 2,409,000 MWh. This is somewhat higher than historical generation levels.
- The "best estimate" price of PRB coal delivered to the plant site is equivalent to $1.45/mmBtu.
- The "eval;uated costs" used in the analysis do not represent CWLP's full power production costs.
- Even though some options evaluated would result in violation of the current Turris coal contract, no cost or penalty which may result from such violation or dissolution of that contract are included.

- Unit 33 FGD O & M costs are considered in the evaluation of each option, including the "base case".

Results: The lowest cost option based on the evaluated life cycle cost was Option 2, which is identical to Option 1 except that Monterey coal would be burned in the Lakeside units. Options1 and 2 include the addition of an FGD system to Dallman Units 31 and 32.

Although Option 2 is the lowest evaluated cost option, it has the highest capital cost requirement of any option evaluated. This would require CWLP to take on a substantial long-term debt burden. This may make this option less attractive to CWLP, depending on the current financial condition and overall cash flow requirements of the utility.

PART II
INTRODUCTION

PART II
INTRODUCTION

This report presents the results of the Phase II SO_2 Compliance Study conducted by Burns & McDonnell for City Water Light & Power (CWLP) of Springfield, Illinois.

BACKGROUND

Phase II refers to the second phase of sulfur dioxide emission reductions under Title IV of the Clean Air Act as amended in 1990 (The Act). The specific requirements for Phase II are provided in Section 405 of the Act. CWLP's Dallman and Lakeside generating stations are affected sources under Section 405, and all coal-fired units at the two generating stations are affected units. Section 405 requires that, beginning January 1, 2000, these units are subject to annual emission limitations for sulfur dioxide (SO_2). Under the provisions of Section 403 of the Act, each unit has been assigned an allowance of a certain number of tons of annual SO_2 emissions based on the specific emission limitations for that unit.

Beginning in calendar year 2000, the total actual SO_2 emissions (as determined by the continuous emissions monitoring systems, or CEMS) from each of the affected coal-fired units cannot exceed the emission limitation unless the owner holds allowances to cover the actual emissions. The U.S. EPA has established an allowance trading system, and holds annual auctions that help to set the price of SO_2 allowances. Several brokerage firms also track and periodically report the market value of allowances.

For any source subject to the Phase II SO_2 emission limitation requirements of The Act, there are basically three options for compliance:

1. Limit operation so as to insure that the total actual SO_2 emissions fall at or below the number of allowances held.

2. Reduce SO_2 emission rates so that the total actual SO_2 emissions fall at or below the number of allowances held. This is typically done by some combination of switching to coal with lower sulfur content or retrofitting SO_2 emission control equipment.

3. Procure additional allowances to cover the anticipated difference between actual emissions and the base number of allowances granted by the U.S. EPA.

Various combinations of these compliance strategies are also possible.

CWLP has previously studied the situation with regard to Phase II SO_2 compliance for the Lakeside and Dallman stations. The previous CWLP studies investigated the cost of switching to low-sulfur Illinois coal, the cost of retrofitting a flue gas desulfurization (FGD) system to Dallman Units 31 and 32, and the cost of relying completely on SO_2 allowance purchases for Phase II compliance.

Since the latest CWLP study was completed in early 1996, several factors have changed, and CWLP determined that it should update the study, including expansion of the compliance options to include consideration of switching to Powder River Basin (PRB) coal. For this reason, CWLP retained Burns & McDonnell to complete the Phase II SO_2 compliance study that is the subject of this report.

PURPOSE

The purpose of the Phase II SO_2 compliance study was to evaluate options for compliance with the SO_2 emission limitations which will become effective for the Lakeside and Dallman generating stations in the year 2000. The six options covered by the previous CWLP study in 1996 were revisited, and four additional options that had been identified by CWLP for evaluation were studied. In addition, Burns & McDonnell was to identify and evaluate up to four additional options which, in its opinion, would be feasible additions to the range of compliance optiuons previously identified. The purpose of the study was to perform technical and economic evaluation of all options, for the purpose of determining the preferred option.

Burns & McDonnell was tasked with assessing the specific modifications required for implementation of the individual options at each coal-fired generating unit at the Lakeside and Dallman generating stations. In doing so, our purpose was to identify the new and modified equipment which would be necessary to maintain safe and reliable operation of the plants. Burns & McDonnell has considerable experience with both coal switching and FGD retrofit projects for Clean Air Act compliance, and our goal was to bring this experience to bear in the assessment and evaluation of the compliance options for CWLP.

SCOPE

The scope of the study included the following tasks:

1. An initial meeting at Dallman station with CWLP staff to discuss the 10 options identified by CWLP for consideration in the study, and to clarify the scope and assumptions to be used for the study parameters.

2. Identification of the four additional options to complement those identified by CWLP.

3. A meeting at CWLP to finalize the list of options to be evaluated in the study.

4. Assessment of the equipment modifications and additions required for, and the operational effects of, the implementation of each option at each unit.

5. Performance of a Kepner-Tregoe (K-T) decision analysis to screen and rank each option with regard to its ability to meet the needs and wants of CWLP. Burns & McDonnell facilitated this participative decision analysis process at a meeting at CWLP's Dallman station. This allowed input from CWLP's staff with regard to the technical and operational factors judged to be most important to the decision-making process.

6. Preparation of cost estimates for the implementation of each option at each unit. Estimates prepared included identification of expected capital costs as well as assessment of equipment performance and operating cost effects.

7. Development of an economic evaluation matrix, in spreadsheet format, for use in the economic analysis of the various options.

8. Performance of "sidebar" evaluations of possible variations in the definition of certain options. These limited-scope studies included:
   - Location of off-site storage for PRB coal.
   - Requirement for SO_2 removal efficiency improvement for the Dallman Unit 33 FGD system.

9. Preparation of this final report.

10. Presentation of the results of the study at a meeting with CWLP.

PART III
COMPLIANCE OPTIONS

PART III

COMPLIANCE OPTIONS

CWLP and Burns & McDonnell developed the compliance options evaluated in this study. Ten options were presented by CWLP as the basis for study. One of the initial tasks of this study was to review these ten options and consider revisions or additions to the base list of options. A maximum of four additional options were to be added for the study.

BASE COMPLIANCE OPTIONS

The following ten compliance options were identified by CWLP for this study. The option descriptions define the type of coal that would be burned in each unit, changes in the operation of the Dallman Unit 33 scrubber and include the addition of scrubber to Dallman Units 31 and 32.

1. Add scrubber to Dallman Units 31 and 32, burn 100% Turris coal in all units.
2. Add scrubber to Dallman Units 31 and 32, burn Turris coal in Dallman units and burn Exxon Monterrey coal in Lakeside units (6 and 7).
3. Burn Exxon Monterrey coal in Lakeside units, burn Turris coal in Dallman units.
4. Burn Exxon Monterrey coal in Dallman Units 31, 32 and Lakeside units, burn Turris coal in Dallman Unit 33.
5. Burn Exxon Monterrey coal in Dallman Units 31 and 32, burn Turris coal in Dallman Unit 33 and Lakeside units.
6. Burn 100% Turris coal in all Dallman and Lakeside units.
7. Burn 100% Powder River Basin (PRB) coal in Dallman units, burn Exxon Monterrey coal in Lakeside units, shutdown Dallman Unit 33 scrubber.
8. Burn PRB coal in Dallman Units 31 and 32, burn Turris coal in Dallman Unit 33, and burn Exxon Monterrey coal in Lakeside units.
9. Burn 100% PRB coal in Dallman units, burn Turris coal in Lakeside units, and shutdown Dallman Unit 33 scrubber.
10. Burn PRB coal in Dallman Units 31 and 32, burn Turris coal in Dallman Unit 33 and in Lakeside units.

ADDITIONAL OPTIONS

Following review of these ten options, Burns & McDonnell identified four additional options, which were submitted to CWLP on September 2, 1998. The additional options were initially defined as follows:

11. Burn Exxon Monterey coal in Units 31 and 32, and in the Lakeside units, and add scrubbers to Unit 31 and 32.

12. No new scrubber, burn a blend of PRB and Exxon Monterey coals in Units 31 and 32, Turris coal in Unit 33 and Exxon Monterey coal in Lakeside.

13. No new scrubber, burn Exxon Monterey coal in Lakeside, Turris coal in Units 31 and 32, and a blend of PRB and Exxon Monterey coals in Unit 33. Unit 33 scrubber remains in service.

14. No new scrubber, burn Turris coal in Units 31 and 32 and in Lakeside, and burn 100% PRB coal in Unit 33. Unit 33 scrubber remains in service.

Burns & McDonnell prepared a description of the coal and FGD status, potential new coal handling equipment that could be required, Dallman Unit 33 FGD system modifications and boiler modifications for each of the ten base options and the four additional options. CWLP and Burns & McDonnell subsequently discussed the options at a meeting on September 11, 1998 at the Dallman Station. Several changes were made to the additional options, based on input received from CWLP personnel.

FINAL STUDY COMPLIANCE OPTIONS

The options agreed on by CWLP and Burns & McDonnell for further evaluation in the study are indicated on Table III-1. Option 12 is not listed as it was eliminated during the K-T analysis of the options because it was determined that blending of the PRB coal was not required, which made Option 12 the same as Option 8. Table III-1 identifies the coal burned in each of the Dallman and Lakeside units for each option.

Options 1 and 2 include the addition of a new FGD system to Dallman Units 31 and 32. Figures IV-2 and IV-3 indicate the scope of the FGD system. In addition, as requested by CWLP a new ball mill would be added to provide additional limestone grinding capacity for the new FGD systems. Options 7 and 9 would involve taking the Dallman Unit 33 scrubber out of service. Blanking plates would be installed in the ductwork to provide a permanent bypass of the scrubber.

Modifications of the units burning alternate coals would potentially be required to provide for acceptable operation. Table III-1 lists changes that might be needed to the coal feed systems, boiler air system, coal grinding and storage, the boilers and the ash handling systems.

Special coal handling features were also assumed to be required for the options involving units burning alternative coals. Based on experience gained by CWLP during a test burn of the Exxon Monterey coal performed in November 1996, the analysis includes a feed system to provide limestone to the boiler with the coal. The limestone is required to control slagging due to the high ash fusion temperatures of the Monterey coal. PRB coal was assumed to require the addition of dust collection systems and enclosure of the existing truck unloading hopper because of high potential for dusting. Because it may not be feasible to provide rail delivery of PRB coal to the Dallman plant site, off-site coal storage was evaluated. Upgrade of the existing hammermill crushers for Dallman Unit 31 and 32 may also be required to handle PRB coal.

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* * * * * PC #1 * * * * *

TABLE III - 1

PHASE II SO_2 COMPLIANCE OPTIONS

Dallman and Lakeside Stations

OPTIONS	1	2	3	4	5	6	7	8	9	10	11	13	14
COAL													
Lakeside 7 & 8	Turris	Monterey	Monterey	Monterey	Turris	Turris	Monterey	Monterey	Turris	Turris	Monterey	Monterey	Turris
Dallman 31 & 32	Turris	Turris	Turris	Monterey	Monterey	Turris	PRB	PRB	PRB	PRB	PRB	Turris	PRB
Dallman 33	Turris	Turris	Turris	Turris	Turris	Turris	PRB	Turris	PRB	Turris	PRB	PRB/Turris	PRB
FGD SYSTEM													
Lakeside 7 & 8	None	None	None	None	None	None	None	None	None	None	None	None	None
Dallman 31 & 32	Add FGD System / Install 3rd ball mill	Add FGD System / Install 3rd ball mill	None	None	None	None	None	None	None	None	None	None	None
Dallman 33	On	On	On	On	On	On	Off / Install permanent bypass	On	Off / Install permanent bypass	On	On	On	On
POTENTIAL UNIT MODIFICATIONS													
Lakeside 7 & 8	None	None	None	None	None	None	None	None	None	None	None	None	None
Dallman 31 & 32	None	None	None	None	None	None	Raise coal feeder leveling bar; add split dampers, alternate (hot) PA source, modulate PA volume damper	Raise coal feeder leveling bar; add split dampers, alternate (hot) PA source, modulate PA volume damper	Raise coal feeder leveling bar; add split dampers, alternate (hot) PA source, modulate PA volume damper	Raise coal feeder leveling bar; add split dampers, alternate (hot) PA source, modulate PA volume damper	Raise coal feeder leveling bar; add split dampers, alternate (hot) PA source, modulate PA volume damper	None	Raise coal feeder leveling bar; add split dampers, alternate (hot) PA source, modulate PA volume damper
Dallman 33	None	None	None	None	None	None	Add electronic coal weigh system; raise coal feeder leveling bar; add mill inerting and wash nozzles;add bunker inerting, add water lances and pump skid, overdilute with water when pulling ash. Scour ash handling system often with bottom ash.	None	Add electronic coal weigh system; raise coal feeder leveling bar; add mill inerting and wash nozzles;add bunker inerting, add water lances and pump skid, overdilute with water when pulling ash. Scour ash handling system often with bottom ash.	None	Add electronic coal weigh system; raise coal feeder leveling bar; add mill inerting and wash nozzles;add bunker inerting, add water lances and pump skid, overdilute with water when pulling ash. Scour ash handling system often with bottom ash.	Add electronic coal weigh system; raise coal feeder leveling bar; add mill inerting and wash nozzles;add bunker inerting, add water lances and pump skid, overdilute with water when pulling ash. Scour ash handling system often with bottom ash.	Add electronic coal weigh system; raise coal feeder leveling bar; add mill inerting and wash nozzles;add bunker inerting, add water lances and pump skid, overdilute with water when pulling ash. Scour ash handling system often with bottom ash.
COAL HANDLING MODIFICATIONS													
Limestone feed system													
Lakeside 7 & 8	N/A	Add	Add	Add	N/A	N/A	Add	Add	N/A	N/A	Add	Add	N/A
Dallman 31 & 32	N/A	N/A	N/A	Add	Add	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dallman 33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PRB coal handling package*													
Lakeside 7 & 8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dallman 31 & 32	N/A	N/A	N/A	N/A	N/A	N/A	Add	Add	Add	Add	Add	N/A	Add
Dallman 33	N/A	N/A	N/A	N/A	N/A	N/A	Add	N/A	Add	N/A	Add	Add	Add
Two coal pile operation													
Lakeside 7 & 8	No	No	No	No	No	No	No	No	No	No	No	No	No
Dallman 31 & 32	No	No	No	Yes	Yes	No	No	Yes	No	Yes	No	Yes	No
Dallman 33	No	No	No	Yes	Yes	No	No	Yes	No	Yes	No	Yes	No
Off-site Coal Storage													
Lakeside 7 & 8	No	No	No	No	No	No	No	No	No	No	No	No	No
Dallman 31 & 32	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dallman 33	No	No	No	No	No	No	Yes	No	Yes	No	Yes	No	Yes
Hammermill													
Lakeside 7 & 8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dallman 31 & 32	No Change	No Change	No Change	No Change	No Change	No Change	Upgrade	Upgrade	Upgrade	Upgrade	Upgrade	No Change	Upgrade
Dallman 33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*(Includes dust collection system for existing coal hdlg system, enclosure of existing truck hopper and misc. chute and conveyor upgrades)

Electronic Filing - Received, Clerk's Office, November 21, 2008
* * * * * PC #1 * * * * *

PART IV
SCOPE OF MODIFICATIONS

PART IV

SCOPE OF MODIFICATIONS REQUIRED

Burns & McDonnell reviewed the existing systems and equipment at the Lakeside and Dallman generating stations to determine the modifications required for the implementation of each Phase II SO_2 compliance option. Burns & McDonnell engineers who specialize in the respective disciplines of coal handling, coal combustion and air pollution control provided input to this review and assessment. Data gathered and observations made during visits to the plant site were considered. Discussions with CWLP personnel provided additional insight into the feasibility of the required modifications and their effects on operation of the coal handling system, boilers, electrostatic precipitators and FGD system.

The following sections provide a discussion of the important factors considered by each discipline in the assessment of the modifications required. The basis for the estimates of the costs of the modifications for each option is described. Where the modifications would result in equipment performance degradation or increased operation and maintenance costs, the basis for the estimation of those costs is stated.

COAL HANDLING AND STORAGE

The coal switch options under consideration as part of the Phase II SO_2 compliance planning for the Lakeside and Dallman stations include:

- Switching from Turris coal to medium sulfur Illinois coal (from the Exxon Monterey mine) for the cyclone boilers at Lakeside and Dallman; and
- Switching to low sulfur Wyoming Powder River Basin (PRB) coal in units 1, 2 and/or 3 at the Dallman station.

Because CWLP has conducted a test burn of Monterey coal in one unit each at Lakeside and Dallman, and because of the physical similarity between the Turris and Monterey coals, the modifications required to switch to Monterey coal are well established, and minimal in extent.

Consequently, the majority of the assessment effort was directed at the modifications required to receive, store, transport, unload, convey and crush the PRB coal for use at Dallman station. A switch to PRB coal was not considered by CWLP for Lakeside due to the impending retirement of the units in 2011.

Handling PRB Coals – General Considerations

There are three major impacts on coal handling operations when dealing with Power River Basin (PRB) coals:

- Spontaneous combustion
- Fugitive dusting
- Higher burn rates

Spontaneous combustion can occur with most coals. The problem can be significant with PRB coal. Many utilities find they must either burn PRB coal or compact it in long term storage within 14 to 21 days of receipt, to minimize the risk of spontaneous combustion depending on the weather conditions. Putting PRB coal into storage requires good stockpiling techniques. The coal should be spread into thin layers and compacted. Rubber tire dozers with additional ballast can be used to provide the required compaction pressures. The cost of a rubber tired dozer was not included in the cost estimates for this study because of the high cost and because it would not be needed often. Building the pile could be performed using rented equipment or by subcontracting this work.

A common characteristic of PRB coals is the large amount of fugitive dust created when it is handled. The coal particles continually break down with loss of moisture and handling. Most PRB coal handling systems use several types of both active and passive dust control. Dust that isn't controlled is typically cleaned up with water wash down and vacuum systems.

Because PRB coals have a lower BTU value than the Turris coal currently used at Dallman, additional coal must be burned to provide the same heat input to the boilers. At CWLP, it is estimated that approximately 25 percent more PRB coal would be burned in the boilers (assuming the same unit ratings). This translates into longer operating hours for the coal handling system.

Receiving PRB Coal

Three alternatives were considered for receiving rail shipments of PRB coal from Wyoming. Technical aspects of these alternatives are discussed below. Additional information regarding the estimated scope and cost of development of the three alternatives is presented in Appendix D.

Railcar Unloading at Dallman: CWLP currently does not have any reliable way to receive rail delivered coal at the Dallman and Lakeside power plants. The Lakeside track hopper is abandoned and the

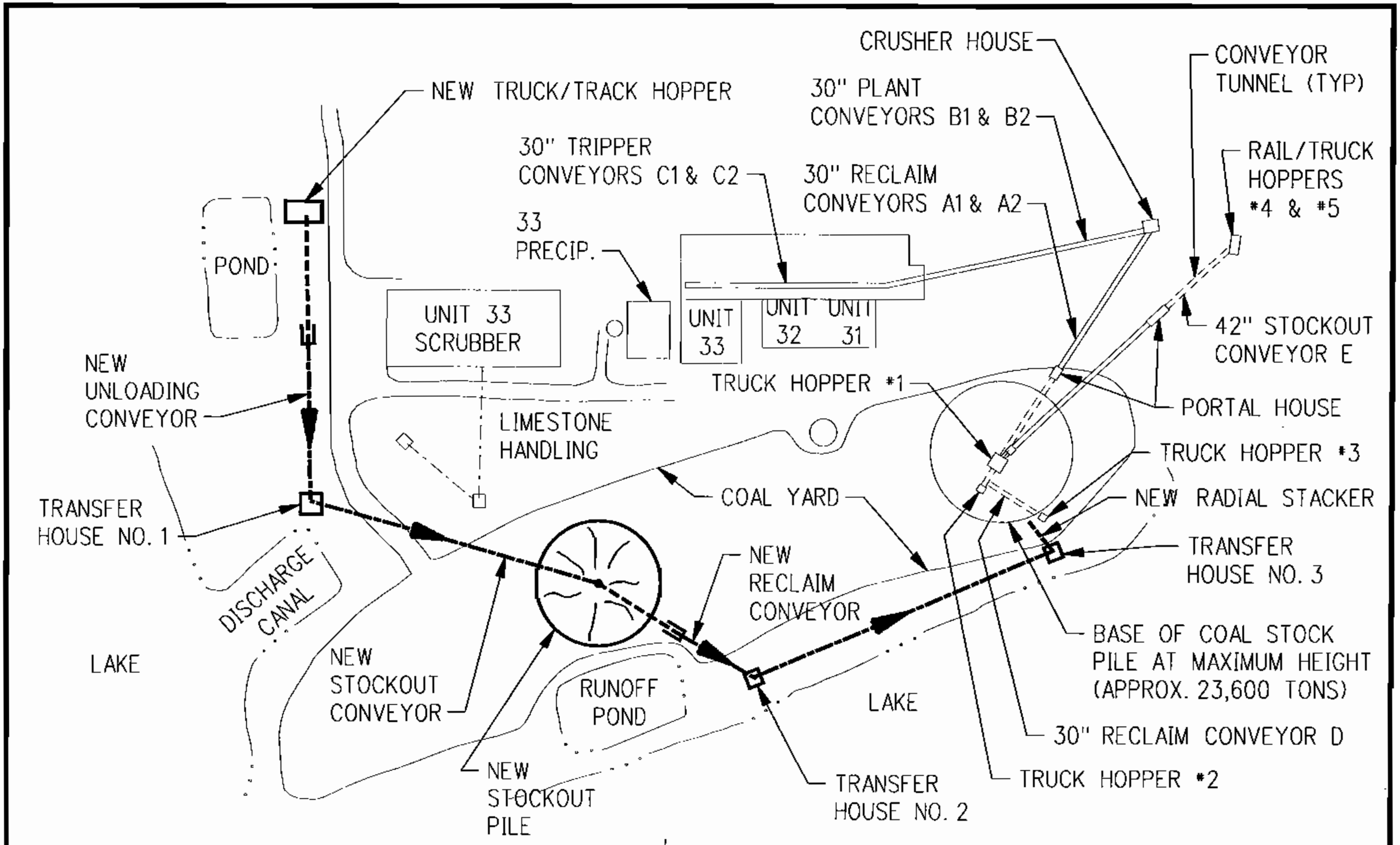
Dallman hopper no longer has rail sidings connected to it. The plant site is not large enough for any type of true unit train coal deliveries.

With major modifications to the existing rail sidings, limited rail unloading could be restored at Dallman for delivery of PRB coals. The location of the existing Dallman track/truck hopper on the east side of the plant would only allow short strings of railcars to be unloaded. Unloading railcars on the existing hopper would interfere with truck unloading activities used by some of the other options (where some Turris coal is still burned at Dallman). For this reason, the cost estimates for this study were based on a new track hopper and storage sidings on the west side of Dallman. See Figure IV-1 for a diagram of this arrangement.

Under the PRB rail delivery to Dallman alternative, PRB "unit trains" would be delivered to a Springfield railyard and then broken up for delivery to Dallman. It should be possible to handle strings of 10-20 cars for delivery at Dallman. The new track hopper would have a stockout conveyor that would build a new pile in the western part of the Dallman coal yard.

Off-Site Rail Delivery: Two alternatives to on-site rail delivery were identified by CWLP for consideration during this study. The first alternative would use the existing bottom dump unloading system operated by Pawnee Transportation, near Pawnee, Illinois. This unloading system currently receives and unloads trains for Dominion Energy's Kincaid station. The system can unload rapid-discharge hopper cars at a rate of 1200 TPH. They generally take all day to unload a unit train. No coal thaw facilities are currently installed. Only limited area is now available for on-site (Pawnee) coal storage.

A second alternative would be for CWLP to develop a new rail unloading/truck loadout facility. A tentative site, Curran, was identified southwest of Springfield. The Curran site was visited by Burns & McDonnell and CWLP and appears to be an industrial park with rail sidings. Additional property may be available nearby that is currently in agricultural use. A new facility could be designed to unload either rotary dump or rapid discharge rail cars. An unloading rate of more than 3500 TPH should allow unloading times less than four hours, which should qualify for lower freight rates. The additional undeveloped area near the site may be large enough for storage for up to 60 days worth of PRB coal. The cost estimates for this study were based on installing a rotary rail car dump unloader at the site.



Burns & McDonnell

CITY LIGHT WATER & POWER
CITY OF SPRINGFIELD, ILLINOIS
V.Y. DALLMAN POWER PLANT
UNITS 31, 32 & 33
COAL HANDLING SYSTEM
DALLMAN 2 - COAL PILE
FIGURE IV-1

60-Day PRB Coal Storage

Due to the uncertainty of PRB coal deliveries, CWL&P directed that this study include storage of a 60-day supply of coal for the options using PRB coal. This reserve supply could be stored on-site or at either of the two off-site coal receiving terminals (Pawnee Transportation or Curran). Under the maximum PRB burn rate options (Nos. 7,9,11 & 14), approximately 238,000 tons would need to be in long term storage. Costs for this long-term coal storage are presented in Part V and in Appendix D.

The Pawnee Transportation unloading site does not appear to include land for long term storage of coal. If additional land is available, it would have to be developed for PRB coal storage. This would include a prepared pile base, coal pile runoff with treatment facility and possibly a pile watering system for fugitive dust control.

The proposed Curran site would require all the same features listed above for the Pawnee Transportation site in addition to a railcar unloader and rail. It is anticipated that the 60 days pile and its runoff pond could be developed inside the proposed rail loop.

For storage at the Dallman plant site, part of the 60-day supply at maximum burn rate could be stored in the existing coal yard. It is estimated that approximately 150,000 to 175,000 tons could be stored in the existing Dallman coal yard located south of the plant. A potential location for additional storage could be developed across the plant's discharge canal. This area would need to be cleared and developed similar to the other offsite storage areas. The PRB coal would be reclaimed by a wheel loader into trucks for delivery to Dallman as required. A conveyor reclaim system could be considered in the future.

Hammer Mill Upgrades

It is generally recommended that cyclone boilers using PRB fuels use a 97.5% passing 4-mesh coal size. This is usually a finer grind than is used with bituminous coals. The existing Pennsylvania Crusher reversible hammer mills can be adjusted for the finer grind, however there are usually higher horsepower requirements (horsepower per ton per hour) to obtain this operation. The finer grind requirements will shorten hammer and cage life. Pennsylvania Crusher has developed a "fine grind kit" for retrofitting older hammer mills crushing PRB coals. The new cage system is designed to prolong cage/screen bar life when making the finer grinds. Grinding PRB coal may limit the crusher capacity when fine grinding. Typical grinds with bituminous coals use approximately 1½ to 2 horsepower per ton per hour. When fine grinding

PRB coals, this will climb to the 3-4 horsepower per ton per hour range. In some cases, the original hammer mill design (generally shaft size) may allow the use of a larger motor. In other cases, a complete hammer mill and motor replacement is required.

The existing hammer mills have 500 HP motors and are rated at 225 TPH, which is very close to the 2 horsepower per ton per hour "rule." It is possible that the switch to a finer grind of PRB coal will reduce the hammer mill capacity. To offset this, the feed rate to the mill could be reduced to obtain the higher horsepower per ton ratios needed. This would increase the time required to fill the bunkers. If maintaining the current throughput is desired, the spare mill could be operated to maintain capacity while achieving the finer grind. The only upgrade included in the cost estimates for this study was the addition of a fine grind kit for each crusher.

Dust Collection

Burns & McDonnell recommends dust collection systems be installed as part of any new coal handling system. Dust collection is even more important when dealing with PRB coals, due to their tendency to break down faster than most other coals. This study includes the cost of dust collection addition for the options burning PRB coal.

Two of the most critical areas at Dallman are the crusher house and the tripper bay. The crusher house does not have any active dust collection and it is understood has been a continuous source of fugitive emissions. The tripper bay does have existing dust collection systems but they are frequently out of service. The indoor location of the existing collectors is no longer desirable due to the problem of a deflagration release inside the powerhouse structures.

Enclosure Of Truck Dumping Operations

The existing truck dumping operations at both Lakeside and Dallman are done in the open. There are no buildings around these areas. At Dallman, trucks can dump in the truck hopper for stockout on Conveyor E or directly onto the storage pile. At Lakeside, trucks dump directly onto the storage area.

The Turris coal is partially washed and is not a large dust problem when first received. Should PRB coals be received, this could change substantially due to the generally higher silt content found in PRB coals. An enclosure probably would be required to maintain current fugitive dust emission levels, and was included in the study cost estimates. Dust collection and/or wet suppression is often used to further reduce unloading emissions.

Coal Handling Washdown and Vacuum Systems

Any dust inside the coal handling system that the active dust control systems do not capture will eventually have to be cleaned up. Most coal handling systems are equipped with at least a partial water wash down system.

A typical system will have a header pipe along the conveyor with hose stations at approximately 100 feet intervals. Hoses are usually 1½ inch diameter, though some plants use fire hoses. "Start at the top, wash to the bottom" is the usual procedure. Water systems all have one big drawback in northern climates - freezing. For this reason, many PRB coal users also install a vacuum system along the conveyors and inside buildings.

One vacuum system that works well for many users is a rigid vacuum pipe in conveyors and buildings with vacuum hose stations at 50-100ft intervals and on each floor in buildings. Rather than use dedicated vacuum producers at each building, many utilities use a truck or trailer mounted vacuum producer. This can be driven or towed to the required building or conveyor. The vacuum systems are not as neat or as easy to use as water wash down, but they solve the freezing problems in the winter.

Limestone Addition for Monterey Coal

Previous CWLP test burns with the low sulfur Monterey coal demonstrated the need for the addition of 1½% by weight of limestone to blend in the coal for use in any of the cyclone boilers (Lakeside and Dallman 31/32). A storage silo and feed system would be needed for this purpose. At Lakeside, this would be done by relocating the existing unused sorbent silo to a location near the coal conveyors. A new weigh feeder would meter the already crushed limestone onto the coal belts prior to the crushing. This would allow for some blending of the limestone into the coal prior to bunkering. Limestone would be delivered by bulk tanker and unloaded pneumatically directly into the limestone silo.

Handling Two Coals at Dallman

Many of the SO_2 compliance options involving fuel switching (4,5,8,10, & 13) would use two types of coal for fueling the Dallman Station. Any of these options will present a number of challenges to the existing coal handling system including:

- There is only one unloading hopper and stockout conveyor, the E-belt.
- The two main reclaim hoppers are located under the main stock pile
- The only "remote" reclaim hopper ("D") is on the extreme east end of the coal yard and has only limited stockpile capacity over and around it.
- The existing coal yard is long and narrow. Its growth is limited by the Springfield Lake and the plant structure.

The first requirement for a two-coal receiving scenario would be to build a second truck dump hopper and a new stockout conveyor. The second unloading/stockout system could be built in the southwest corner of the coal yard. Coal trucks could be routed around the west side of Dallman to reduce traffic on the east side. Having two separate unloading and stockout locations would allow simultaneous delivery of two types of coal.

Reclaim from the second stockpile has a number of alternatives. The least expensive approach, based on capital required, would be to doze coal from the second pile to the "D" reclaim hopper. This would be a long distance for everyday dozing. A coal scraper or a Raygo carry dozer may be more practical than a conventional dozer with a coal blade.

A more automated system would add a reclaim hopper and conveyor to transport the coal back to the "D" reclaim hopper. Both above ground and below ground conveying systems could be used to tie into the existing 1A/B or D conveyors. The reclaim hoppers could be arranged similar to the existing layout with both under pile and outside of pile hoppers. The reclaimed coal could be discharged onto a small radial stacker that would discharge into the "D" reclaim hopper. The radial stacker could be swung out of the way when not in use. This system was included in the cost estimates for this study. Figure IV-1 provides a diagram showing the equipment which would be required to implement the scheme for handling two coals at the Dallman station.

COMBUSTION SYSTEMS AND EQUIPMENT

For purposes of this study, the combustion systems and equipment at the Lakeside and Dallman stations were reviewed to determine the extent of modifications required to accommodate the coal switches being considered as options for Phase II SO_2 compliance. A total of 13 areas of concern were identified for evaluation of the adequacy of the existing equipment and systems. In each area, the existing equipment capacities were reviewed. Calculations were performed to determine the relative need for equipment upgrades or replacement.

The results of this assessment are displayed in Table IV-1. The table shows the determination of modifications required, if any, for each boiler under the condition dictated by each of the 14 compliance options described in Part III. Note that because there is no coal switch for any unit under Options 1 and 6, there will be no need to make any modifications. Similarly, some options involve coal switches for two or more of the five boilers, but no change in the coal burned for the remaining boilers.

The following sections describe the considerations involved in the assessment of equipment adequacy and the need for modifications in each of the areas of concern shown on the tabulation. They are presented in the same order as displayed on Table IV-1.

Forced Draft Fans

FD Fan capacity is primarily determined by the quantity of heat release, or carbon burned. Switching to a coal with a higher or lower heating value (HHV) will change the coal flow as required to maintain a constant carbon input, but will not—in itself—change air flow. Air flow is matched to carbon input. However, switching to a coal with a higher moisture content will deteriorate boiler efficiency, requiring additional carbon input (fuel flow) and a proportional increase in air flow. The only fuel in this study which would affect the FD Fan capacity is the switch to PRB coal. The increased moisture introduced into the furnace by the switch to PRB coal will deteriorate boiler efficiency approximately one percent and thus increase FD Fan capacity requirement by approximately this same amount. Thus, no change in FD Fan capacity or head is required. The degradation in unit heat rate due to the increased moisture content of the coal is addressed in the economic analysis presented in Part V.

TABLE IV-1
POTENTIAL UNIT IMPACTS / MODIFICATIONS
Dallman and Lakeside Stations

	Concern	General Description of Concern	Options 1 & 6			Options 2, 3 & 4		
			Lakeside 7/8	Dallman 31/32	Dallman 33	Lakeside 7/8	Dallman 31/32	Dallman 33
1	FD Fan Capacity or Head	Increase in moisture decreases boiler efficiency, increasing both fuel and air requirement. Moisture also increases flue gas volume.	No Change	No Change	No Change	No Change	No Change	No Change
2	ID Fan Capacity or Head *(Unit 33 only)*	Same as FD Fan, plus an additional concern about increasing flue gas temperature with PRB if furnace is not adequately cleaned.	n/a	n/a	No Change	n/a	n/a	No Change
3	Coal Feeder Capacity	Any reduction in HHV and/or boiler efficiency will require an increase in coal feed rate.	No Change	No Change	No Change	No Change	No Change	No Change
4	Coal Mill Capacity *(Unit 33 only)*	Same basis as Coal feeder.	n/a	n/a	No Change	n/a	n/a	No Change
5	Exhauster Capacity or Head *(Unit 33 only)*	Same basis as coal Coal Feeder. In addition, PRB coal requires higher PA/Fuel ratio, increasing both capacity and head requirements.	n/a	n/a	No Change	n/a	n/a	No Change
6	Coal Pipe Size *(Unit 33 only)*	The increase in PA flow (See Exhausters) increases coal pipe velocity. Normally try for a maximum of 5000fpm.	n/a	n/a	No Change	n/a	n/a	No Change
7	Mill Inerting *(Unit 33 only)*	PRB coal requires mill inerting.	n/a	n/a	No Change	n/a	n/a	No Change
8	Mill Wash Nozzles *(Unit 33 only)*	PRB coal requires mill washing on shutdown.	n/a	n/a	No Change	n/a	n/a	No Change
9	Cyclone Modifications *(Units 31/32 only)*	PRB coal in a cyclone requires certain cyclone modifications for successful firing.	n/a	No Change	n/a	n/a	No Change	n/a
10	Cyclone Slag Fluxing Agent *(Units 7/8 & 31/32 only)*	Monterey coal requires the addition of limestone as a fluxing agent in 31/32.	No Change	No Change	n/a	Add limestone feed.	No Change (LS feed - Op 4)	n/a
11	Bunker Inerting	PRB coal requires bunker inerting.	n/a	No Change	No Change	n/a	No Change	No Change
12	Furnace Cleaning	PRB coal requires waterlances to clean furnace waterwalls.	n/a	No Change	No Change	n/a	No Change	No Change
13	Ash Handling System	PRB coal ash solidifies when moistened. Wet conveying systems require special treatment.	n/a	No Change	No Change	n/a	No Change	No Change

	Concern	Option 5			Options 7 & 11			Option 8		
		Lakeside 7/8	Dallman 31/32	Dallman 33	Lakeside 7/8	Dallman 31/32	Dallman 33	Lakeside 7/8	Dallman 31/32	Dallman 33
1	FD Fan Capacity or Head	No Change	No Change	No Change	No Change	No Change *(1% cap. incr.)*	No Change *(1% cap. incr.)*	No Change	No Change *(1% cap. incr.)*	No Change
2	ID Fan Capacity or Head *(Unit 33 only)*	n/a	n/a	No Change	n/a	n/a	No Change *(2% cap. incr.)*	n/a	n/a	No Change
3	Coal Feeder Capacity	No Change	No Change	No Change	No Change	Raise leveling bar.	Add electronic weigh system & raise leveling bar.	No Change	Raise leveling bar.	No Change
4	Coal Mill Capacity *(Unit 33 only)*	n/a	n/a	No Change	n/a	n/a	No Change *(4 mills for MCR)*	n/a	n/a	No Change
5	Exhauster Capacity or Head *(Unit 33 only)*	n/a	n/a	No Change	n/a	n/a	Upgrade exhausters *(4 mills for MCR) (Max. head increase of 24%.)*	n/a	n/a	No Change
6	Coal Pipe Size *(Unit 33 only)*	n/a	n/a	No Change	n/a	n/a	No Change *(Velocity increases to 5560 fpm.)*	n/a	n/a	No Change
7	Mill Inerting *(Unit 33 only)*	n/a	n/a	No Change	n/a	n/a	Add mill inerting.	n/a	n/a	No Change
8	Mill Wash Nozzles *(Unit 33 only)*	n/a	n/a	No Change	n/a	n/a	Add mill wash nozzles.	n/a	n/a	No Change
9	Cyclone Modifications *(Units 31/32 only)*	n/a	No Change	n/a	n/a	Add split dampers, alternate (hot) PA source, & modulate PA volume damper.	n/a	n/a	Add split dampers, alternate (hot) PA source, & modulate PA volume damper.	n/a
10	Cyclone Slag Fluxing Agent *(Units 7/8 & 31/32 only)*	No Change	Add limestone feed.	n/a	Add limestone feed.	No Change	n/a	Add limestone feed.	No Change	n/a
11	Bunker Inerting	n/a	No Change	No Change	n/a	Add bunker inerting.	Add bunker inerting.	n/a	Add bunker inerting.	No Change
12	Furnace Cleaning	n/a	No Change.	No Change	n/a	Add waterlances & pump skid.	Add waterlances & pump skid.	n/a	Add waterlances & pump skid.	No Change
13	Ash Handling System	n/a	No Change.	No Change	n/a	Overdilute with water when pulling ash. Scour with bottom ash often.	Overdilute with water when pulling ash. Scour with bottom ash often.	n/a	Overdilute with water when pulling ash. Scour with bottom ash often.	No Change

	Concern	Options 9 & 14			Option 10			Option 12	Option 13		
		Lakeside 7/8	Dallman 31/32	Dallman 33	Lakeside 7/8	Dallman 31/32	Dallman 33	Eliminated	Lakeside 7/8	Dallman 31/32	Dallman 33
1	FD Fan Capacity or Head	No Change	No Change *(1% cap. incr.)*	No Change *(1% cap. incr.)*	No Change	No Change *(1% cap. incr.)*	No Change		No Change	No Change	No Change *(1% cap. incr.)*
2	ID Fan Capacity or Head *(Unit 33 only)*	n/a	n/a	No Change *(2% cap. incr.)*	n/a	n/a	No Change		n/a	n/a	No Change *(2% cap. incr.)*
3	Coal Feeder Capacity	No Change	Raise leveling bar.	Add electronic weigh system & raise leveling bar.	No Change	Raise leveling bar.	No Change		No Change	No Change	Add electronic weigh system & raise leveling bar.
4	Coal Mill Capacity *(Unit 33 only)*	n/a	n/a	No Change *(4 mills for MCR)*	n/a	n/a	No Change		n/a	n/a	No Change *(3 mills for MCR)*
5	Exhauster Capacity or Head *(Unit 33 only)*	n/a	n/a	Upgrade exhausters *(4 mills for MCR) (Max. head increase of 24%.)*	n/a	n/a	No Change		n/a	n/a	Upgrade exhausters *(3 mills for MCR) (Max. head increase of 24%.)*
6	Coal Pipe Size *(Unit 33 only)*	n/a	n/a	No Change *(Velocity increases to 5560 fpm.)*	n/a	n/a	No Change		n/a	n/a	No Change *(Velocity increases to 5560 fpm.)*
7	Mill Inerting *(Unit 33 only)*	n/a	n/a	Add mill inerting.	n/a	n/a	No Change		n/a	n/a	Add mill inerting.
8	Mill Wash Nozzles *(Unit 33 only)*	n/a	n/a	Add mill wash nozzles.	n/a	n/a	No Change		n/a	n/a	Add mill wash nozzles.
9	Cyclone Modifications *(Units 31/32 only)*	n/a	Add split dampers, alternate (hot) PA source, & modulate PA volume damper.	n/a	n/a	Add split dampers, alternate (hot) PA source, & modulate PA volume damper.	n/a		n/a	No Change	n/a
10	Cyclone Slag Fluxing Agent *(Units 7/8 & 31/32 only)*	No Change	No Change	n/a	No Change	No Change	n/a		Add limestone feed.	No Change	n/a
11	Bunker Inerting	n/a	Add bunker inerting.	Add bunker inerting.	n/a	Add bunker inerting.	No Change		n/a	No Change	Add bunker inerting.
12	Furnace Cleaning	n/a	Add waterlances & pump skid.	Add waterlances & pump skid.	n/a	Add waterlances & pump skid.	No Change		n/a	No Change	Add waterlances & pump skid
13	Ash Handling System	n/a	Overdilute with water when pulling ash. Scour with bottom ash often.	Overdilute with water when pulling ash. Scour with bottom ash often.	n/a	Overdilute with water when pulling ash. Scour with bottom ash often.	No Change		n/a	No Change	Overdilute with water when pulling ash. Scour with bottom ash often.

Induced Draft Fan Capacity or Head (Unit 33 only)

The ID Fan capacity is influenced by the same parameters discussed above for FD Fan capacity. In addition, the increase in fuel moisture mentioned above will result in an increase in flue gas volume because of the additional moisture. For PRB coal this increase is estimated to require a two percent increase in capacity. This should not require any modification to the existing fans.

Coal Feeder Capacity

All five units use coal feeders manufactured by the Stock Equipment Company. The Monterey coal is similar to the Turris coal, and thus will not require a change in feeder capacity. However, the PRB coal heating value is quite low (8,375 Btu/lb compared to 10,500Btu/lb for Turris coal), requiring a significant increase in coal mass feed rate. The coal feeders for Units 31 and 32 have already been converted to employ an electronic weigh system. With the electronic weigh system, the leveling bar can simply be raised to increase the capacity of the coal feeder. On unit 33, however, the feeder control system has not been upgraded. Thus, to accommodate PRB coal a modification will be required to increase the leveling bar position. Conversion to the electronic weigh system for all four feeders has also been assumed.

Bowl Mill Capacity

The boiler for Unit 33 utilizes pulverized coal combustion. Coal pulverization is achieved with four bowl-type pulverizers. Currently, on Turris coal, one mill is available as a spare, even at full load operation. The effective mill capacity is affected by the coal grindability, moisture, and feed size. The combination of these factors indicate that the mill capacity is entirely adequate for all coals except PRB coal. For PRB coal, calculations indicate that all four mills must be operated to attain the firing rates necessary for full load operation. This mode of operation will decrease the reliability of the combustion system for Unit 33. Consequently, Burns & McDonnell identified Option 13, which allows blending of PRB coal and Turris coal as required to maintain full load on only three mills.

Exhauster Capacity and Head

Conversion to PRB coal would significantly affect the requirement for the exhausters which serve each bowl mill. The exhauster capacity requirements for Unit 33 are affected by the change in required coal flow, the change in primary air to fuel ratio, and the change in mill exit temperature. Head is affected by the resultant change in coal pipe velocity. At maximum mill coal capacity the expected increase in air-to-fuel ratio, accounting for the expected decrease in mill exit temperature, is calculated to result in a change in coal pipe velocity from 5,000 feet per minute to 5,560 feet per minute. This corresponds to a 24 percent increase in head requirements. For purposes of this study, Burns & McDonnell has assumed that the capacity of the four existing exhausters can be upgraded via mechanical modifications to provide the additional flow and head. Any additional capacity increase requirement will necessitate placing an additional mill and exhauster in service. If CWLP proceeds with a PRB coal conversion for Unit 33, a test burn of PRB coal would be recommended to confirm the adequacy of this assumption.

Coal Pipe Size

The Unit 33 pulverized coal pipes are 18 inches outside diameter, and adequately large to convey the PRB coal to the furnace. The coal pipe velocity, assuming an initial design maximum velocity of 5,000 feet per minute, is estimated to increase to 5,560 feet per minute. This should be within acceptable operating limits.

Mill Inerting and Mill Wash

Experience has shown that inerting systems should be added to coal pulverizers in association with conversion to PRB coal, for consideration of prevention of fire and explosion. Mill inerting and mill wash nozzles both are assumed to be required for each option involving use of PRB coal in Unit 33.

Cyclone Modifications

Firing PRB coal in a cyclone-fired furnace requires special precautions and techniques. The cyclone modifications for Units 31 and 32 include the addition of split dampers, the ducting of primary air to a hotter source, and remote modulation of the PA volume damper. The split damper restricts secondary air flow at the burner end of the cyclone in an attempt to retain the coal and slag in the system as long as possible. The hotter primary air will help to prevent cooling of the fire at the burner end of the cyclone. Modulation of the primary air dampers helps maintain the proper secondary to primary air ratio at all cyclone loads.

Cyclone Slag Fluxing Agent

Previous tests by CWLP have indicated that limestone fluxing agent is required to burn Monterey coal in Units 31 and 32. The costs of this modification are included under the coal handling system evaluation.

Bunker Inerting

One of the characteristics of PRB coal is its tendency to spontaneously combust, and the most likely place for this to happen is in the coal storage bunkers. A CO_2 inerting system can be retrofit to each bunker to quench a fire if one should arise.

Furnace Cleaning

PRB coal contains an unusually high percentage of calcium, magnesium, and sodium in the ash. These minerals deposit on the furnace water walls in a white film, and reflect a large portion of the radiant heat energy. Normal air or steam sootblowers are not effective at removing this reflective coating. Water lances, however, are effective in removing these deposits. For Unit 33 Burns & McDonnell estimates the requirement for an addition of 10 water lances and one pump skid. For Units 31 and 32 , five water lances and one pump skid have been included in the modifications required.

Ash Handling System Operation

The alkaline chemical constituents of PRB coal ash make it susceptible to formation of cementitious deposits in wet ash handling systems. In some cases PRB coal conversions have required the conversion to dry ash handling. However, with the configuration of the existing ash sluice system at Dallman, it should be possible to avoid problems by proper operation and sequencing of the system. Use of increased water to ash ratios in the sluice system will minimize the chance for hard deposits to form in the pipelines. Periodic cycling of the system to sluice 100 percent bottom ash will provide a scouring action on the pipe which should also prevent the buildup of scale in the lines. No physical modifications to the system will be required to accomplish this operational sequencing. Therefore, no costs have been assigned to the ash system as part of the cost estimates for the PRB coal switching options.

AIR POLLUTION CONTROL EQUIPMENT

The Phase II SO_2 compliance options identified for this study, as described in Part III, include several which include the retrofit of flue gas desulfurization (FGD) systems to Dallman Units 31 and 32. In addition, options 7 and 9 are based on shutting off the existing FGD system for Unit 33 in conjunction with a switch to PRB coal. Finally, all the options that include coal switching to PRB coal have the potential to adversely affect the performance of the existing electrostatic precipitators (ESPs). To assess the modifications required for each of these options, Burns & McDonnell reviewed available information on the existing FGD system and ESPs, and consulted with CWLP personnel. The results of that assessment are described below for each topic.

Retrofit FGD Systems for Units 31 & 32

In order to take advantage of the existence of the FGD system on Unit 33, the FGD process for application to Units 31 and 32 would be the same, namely the wet limestone process with forced oxidation to produce a gypsum byproduct. The use of an identical process allows the sharing of some common equipment and systems. In the case of the vacuum filters, the systems installed for Unit 33 have sufficient capacity to allow for the additional requirements of the FGD systems for Units 31 and 32 without modification. For limestone grinding, the existing Unit 33 systems will require upgrading to increase capacity so that the combined needs of the scrubbing systems for the three boilers can be met without compromising system reliability. The addition of a third wet grinding mill equal in capacity to the existing Unit 33 mills has been assumed as the basis for the study.

Figure IV-2 shows the conceptual flow diagram for the retrofit FGD systems, and indicates the interfaces with the existing systems for Unit 33. Based on preferences as dictated by CWLP for this study, each boiler will be provided with a separate SO_2 absorber. A possible arrangement of the absorbers and auxiliary equipment is shown on Figure IV-3. The retrofit FGD systems are assumed to utilize the existing chimney liners. Costs for alloy "wallpapering" of the liners have been included in the cost estimate. Details of the cost estimate, indicating the scope assumed for the FGD retrofit, are tabulated in Appendix E.

Shutting Off the Unit 33 FGD System

Options 7 and 9 are based on the assumption that the Unit 33 FGD system can be shut off if the boiler is switched to burn 100 percent PRB coal. With regard to this, it is assumed that blanking plates will be installed in the ductwork to isolate the FGD system flow path from the main flue gas flow path. It is assumed that the FGD system would be "abandoned in place". No cost for demolition of the FGD absorbers or related equipment is included.

A consequence of shutting off the FGD system is that the current location of the opacity monitors would no longer be workable. It is assumed that the scope of Options 7 and 9 include relocation of the opacity monitor to the stack.

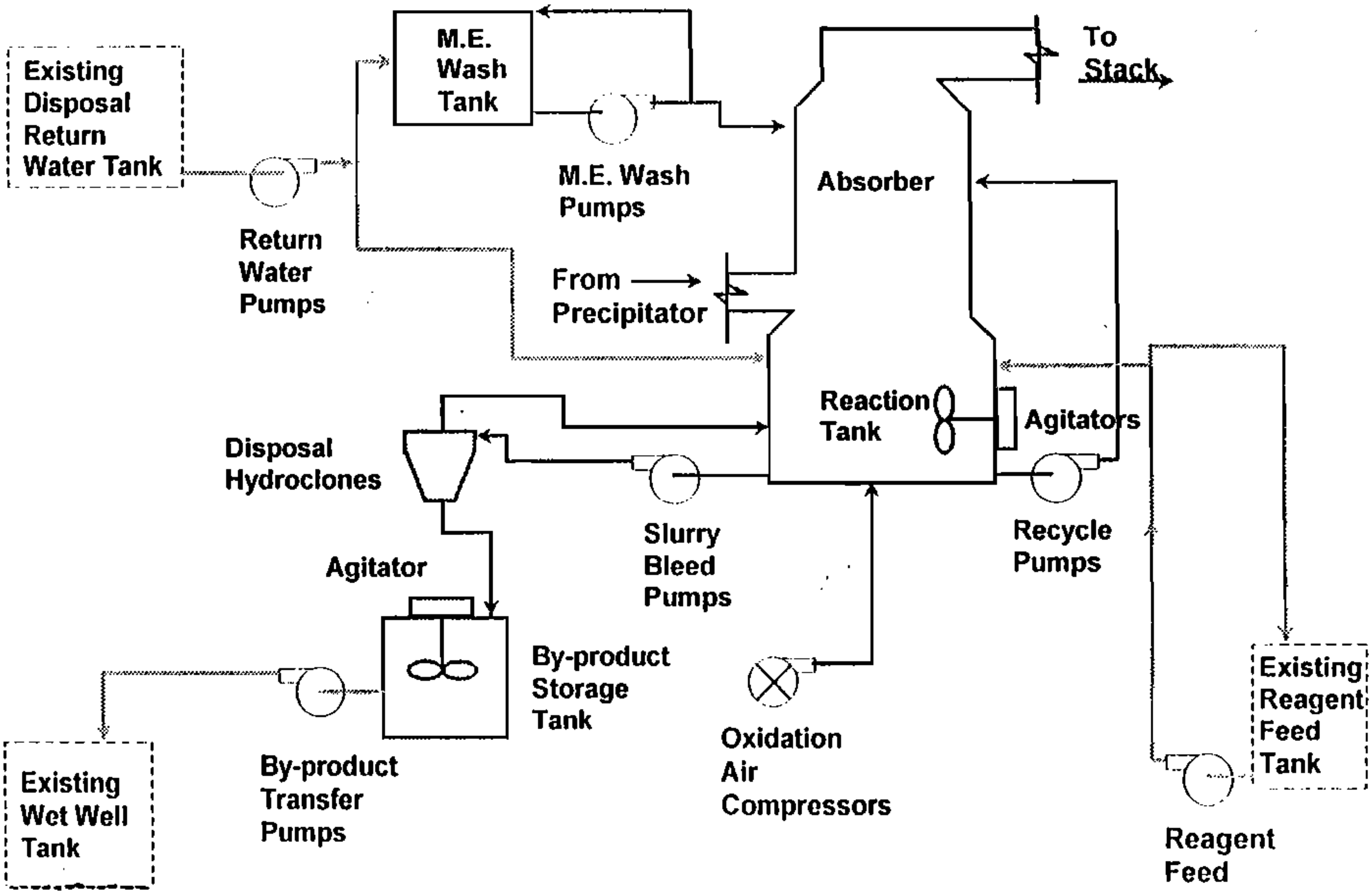


Figure IV-2-Preliminary FGD System Flow Diagram
Dallman Station Units 31 & 32

spr1295

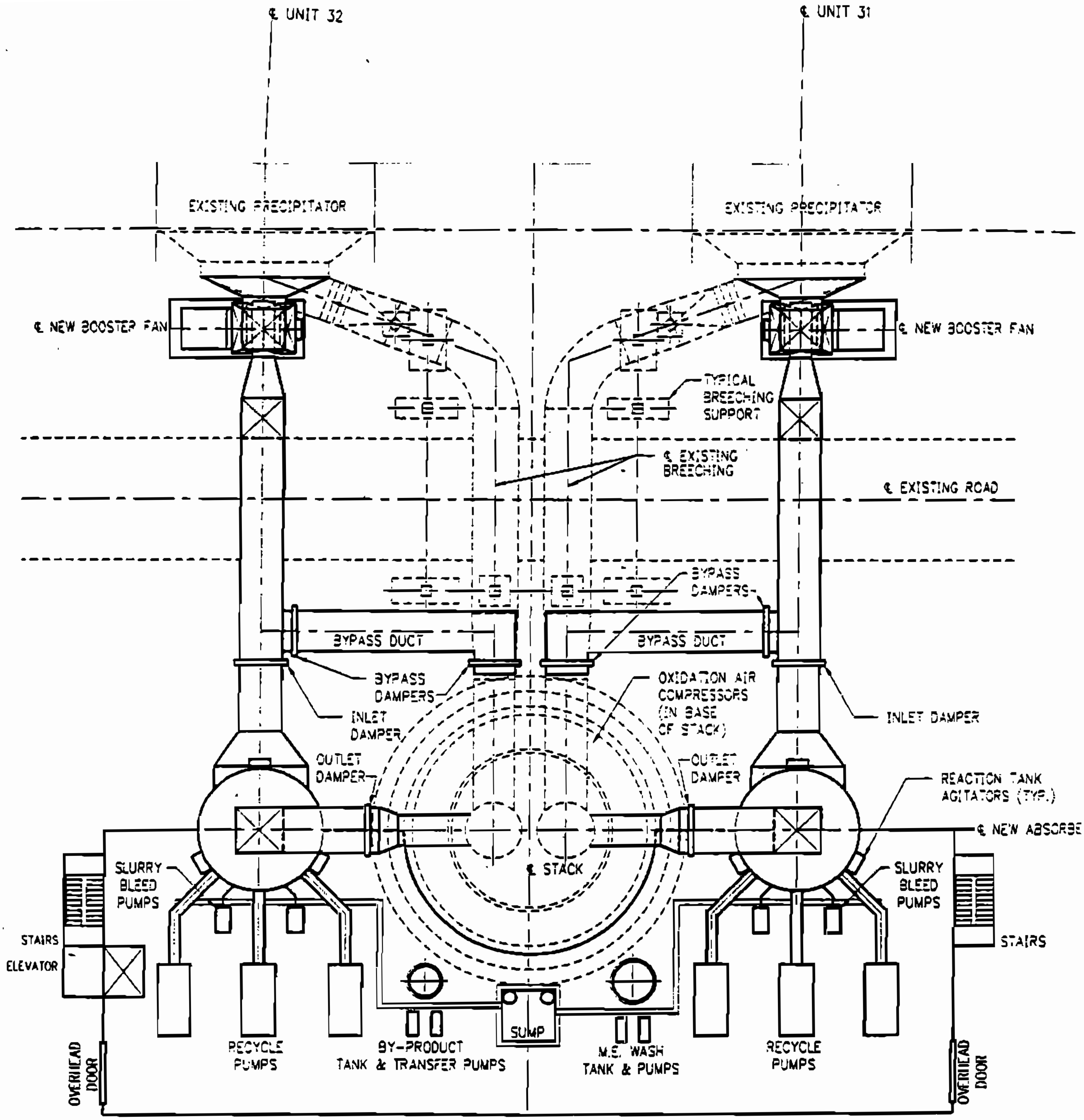


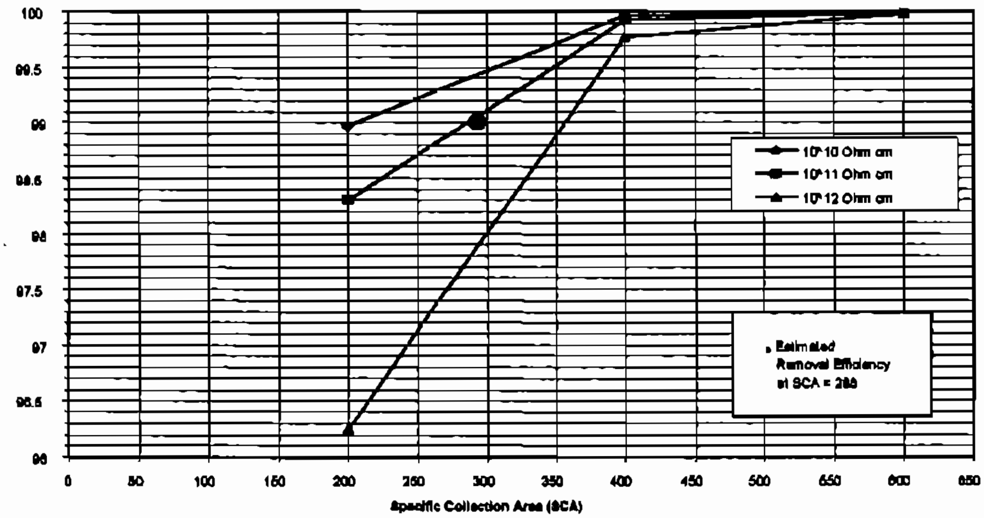
Figure IV-3-FGD System Plot Plan
Dallman Units 31 & 32

Impact of Fuel Switching on Precipitator Performance

A graphical approach was used to estimate the performance of the Dallman unit's electrostatic precipitators while the boilers are firing PRB coal. This approach used the data generated by two computer programs as input. The first program was run to estimate the ash resistivity of the PRB coal fly ash. This program (RESIST) uses the elemental composition of the ash, the ultimate fuel analysis and data describing the operating conditions at the precipitator inlet to calculate three resistivity factors. The combination of these resistivity factors yields the bulk resistivity of the ash. A value of $1x10^{11}$ Ohm-cm was selected as a representative resistivity value for these fuels. A second program, developed for the United States Environmental Protection Agency (USEPA) and known as ESPMV3, was used to generate a series of curves showing the relationship of removal efficiency to Specific Collection Area (SCA) and ash resistivity.

The performance of the precipitators was estimated by superimposing the design SCA values to a point on the SCA/Resistivity plot. Refer to Figure IV-4. This point is located where the estimated ash resistivity line ($1x10^{11}$ Ohm-cm) intersects the line rising vertically from the X-axis representing the design SCA. The removal efficiency is read from the Y-axis. The results of the analysis showed that both units (SCA approximately 290) in good condition could be expected to have a removal efficiency of approximately 99% on ash with a bulk ash resistivity of $1x10^{11}$ Ohm-cm. A removal percentage of near 99% will be required to maintain particulate emissions below 0.1 lb/MBtu as required by the emission limits applied to these units. It should be noted that the design SCA should be considered as marginal for opacity and particulate emissions compliance on PRB coal. Factors such as increased gas flow, elevated precipitator inlet temperature, ash particle size and fly ash / bottom ash split have significant influence on precipitator performance. If conversion to PRB coal is to proceed, it is strongly recommended that an extended test burn be performed to confirm the suitability of these precipitators under the 100% PRB firing operating conditions. In order to achieve continuous compliance under all operating conditions, it may be necessary to add flue gas conditioning to each unit.

Figure IV-4
Estimated Electrostatic Precipitator Performance - PRB Coal



Electronic Filing - Received, Clerk's Office, November 21, 2008
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PART V
COMPLIANCE OPTION SCREENING

PART V

COMPLIANCE OPTION SCREENING

Following identification and agreement on the compliance options for this study, Burns & McDonnell performed a screening of each option to determine the relative suitability of each option to meet CWLP's Phase II compliance requirements. CWLP's previous Phase II compliance studies identified the technical advantages and disadvantages of particular options and estimated the compliance costs for each option and for each unit. As described in Part II, costs were estimated for each of the compliance options. In addition, a benefit / risk evaluation of each option was done and a Kepner-Tregoe (K-T) analysis was performed to determine the preferred option according to CWLP's assessment of each options relative fulfillment of identified significant criteria.

K-T DECISION ANALYSIS

A K-T analysis of the Phase II SO2 compliance options was used to compare the ability of each option to meet CWLP's required and desired technical objectives. From a technical standpoint, the K-T analysis provides a systematic approach to decision making and problem analysis. The relative costs of the options were not considered when the K-T analysis was performed.

Burns & McDonnell prepared a suggested list of technical criteria for the K-T analysis. These criteria were discussed with CWLP and the K-T analysis performed during a meeting at the Dallman Station on September 22, 1998.

"Musts" Criteria

Technical objectives for the compliance options were defined either as "Musts" or as "Wants". The "Must" criteria were those aspects the option has to meet to be considered viable. If an option didn't meet all of the "Must" criteria were established during the study, it was eliminated from further consideration.

Based on input received from CWLP, Burns & McDonnell included the following "Must" criteria on the K-T chart used to perform the analysis: "Maintain space for NO_x controls to be added at a later date". CWLP believes that some type of NO_x controls may have to be added to the units because of future regulatory mandate and desires to maintain the flexibility to be able to do this with minimal impact to the existing plant. Additional criteria discussed, but not included in the analysis were the requirement for the option to meet the terms of the existing Turris coal contract, meeting the SO_2 allowance cap for the plant and providing and maintaining safe operating conditions at the plant. Although it does appear that some of the options would not meet the Turris coal contract, CWLP directed that this not be considered a requirement for this study. It was discussed that utilities that have changed coal supplies may have faced a contract issue with their original supplier to make the change. The coal contract and the allowance cap were also noted to be related to economics and therefore would not be suitable to be considered in the K-T analysis. Safety was not specifically listed as a technical criteria because it was agreed that this requirement would be included in any option that is implemented.

"Wants" Criteria

Technical criteria that were deemed to be desirable but not mandatory were identified and classified as "Wants". Each of the "Wants" was assigned a numerical weight to reflect its relative importance as compared to the other "Wants" criteria. Each option was then scored on its ability to meet each "Want" criteria. The option judged to meet the criteria the best was given a score of 10 with the other options scored relative to the best option. A weighted score for each option was then calculated for each criteria by multiplying the weight of the option by the judged score. The weighted scores were then added for each option to arrive at the overall option score. The highest overall score identified the best option on the basis of technical merit.

The following "Wants" criteria were suggested by Burns & McDonnell and were based on input received from CWLP and Burns & McDonnell's experience:

- "Minimize reliance on SO_2 allowance market" - This criteria provided a measure of the dependence on the external allowance market for each option. If an option does not meet the allowance quantity received by CWLP for the plant, one alternative would be to purchase allowances to cover the extra emissions. This could be costly depending on the market or could restrict additional growth at the site.

- "Minimize PRB coal handling problems at Dallman" - Because several of the options involve multiple coal sources, this criteria was included to access the increased difficulty that could be encountered as compared to the current operation at the plant with only one coal source.

- "Ease of operation" - This criteria was included in the analysis to indicate the impact of changes on the overall ease of operating the plant given the potential modifications that might be required for a particular option.

- "Reduction of air toxics to aid in meeting future regulatory requirements" - Future emission regulations may contain requirements to limit the emission of air toxics such as mercury and arsenic. The impact of the quality of the coal source and the potential for removal of a certain percentage of these emissions was accessed by the judging of this criteria.

- "Minimize congestion on the plant site" - This criteria was included to measure the relative congestion that might be added to the site from modifications required by each option.
- "Minimize vehicle traffic" - With some of the changed coal source options considered, a result would be a higher coal burn rate and therefore more trucks required to come on the site and deliver coal. This criteria was used to assess this impact on the plant.
- "Minimal impact on boiler reliability" - Because changing the coal burned in the boiler could have an impact on the reliability of the boiler and related auxiliary equipment, this criteria was included. Some existing equipment might operate successfully with a switch in the fuel used, but because of the fuel change experience a shorter life or increased maintenance.

Following discussion of the "Wants", it was decided to change the wording of the second item to read "Minimize coal handling problems" to reflect the global coal handling issues including the transportation, transloading and off-site storage of PRB coal. The remaining "Wants" were agreed to and used to perform the K-T analysis.

K-T Analysis Results

Following agreement on the "Must" and "Wants" criteria to be used for the K-T analysis, the evaluation of each option was performed by CWLP and Burns & McDonnell.

The options added to investigate blends of coals, Option 12 and 13, were reviewed. These options had initially been added to reflect the possibility that blending may be required to allow PRB coal to be burned. After further review it was determined that PRB can probably be burned in the cyclone boilers without blending. If the coal is not blended Option 12 becomes the same as Option 8. It was therefore agreed that Option 12 would be eliminated from further consideration in the study.

The "Must" criteria were reviewed for each option. It was agreed that all of the options met the criteria for maintaining space for NO_x controls to be added at a later date. The "Wants" criteria were then reviewed to determine a weight to assign to each one for use in scoring of the options. The "Wants" weights were determined by a consensus of the CWLP personnel attending the analysis meeting and are as listed below:

WANTS CRITERIA	WEIGHT
Minimize reliance on SO_2 allowance market	40
Minimize PRB coal handling problems at Dallman	20
Ease of operation	7
Reduction of air toxics to aid in meeting future regulatory requirements	1
Minimize congestion on the plant site	1
Minimize vehicle traffic	1
Minimal impact on boiler reliability	30
TOTAL OF WEIGHTS	100

The "Wants" criteria scores agreed to by consensus of the group performing the K-T analysis are indicated on Table V-1 that is included in Appendix B of this report. It was decided during the K-T analysis meeting that the criteria "Minimize reliance on SO_2 allowance market" would be adjusted following the meeting based on the calculated allowances required for each option. The effect on the K-T analysis due to this adjustment is indicated on Table V-1a - Final K-T Analysis Matrix, included in Appendix B. The details of the adjustment made are shown on Table V-3. Table V-2 was used during the analysis to identify the scope of unit modifications that would be expected for each option.

The highest scoring option based on the analysis of the "Wants" criteria for both the original and final K-T analysis was Option 1. Option 2 was the next highest scoring option.

Option 2 and 11 received the highest score for the "Minimize reliance on SO_2 allowance market" because they both result in excess allowances. Option 6 received the low score for this criteria due to the high number of allowances that would have to be purchased to operate under the conditions of this option.

For the "Minimize coal handling problems" criteria, Options 1 and 6 received a score of 10 because only one type of coal would have to be handled on the plant site and no off-site storage or handling of coal is required. Options 7, 9, 11, and 13 received the lowest scores because they involve several types of coal being burned in the units.

Option 6 received the highest score for "Ease of operation". This option reflects the current conditions and operation of the Dallman and Lakeside units. Options 8 and 13 received the lowest score because multiple types of coal are burned, unit modifications would be required, and coal handling changes would be required.

The "Reduction of air toxics to aid in meeting future regulatory requirements" criteria was scored the highest for options 1 and 2 because they involve the addition of FGD systems to Dallman Units 31 and 32. Options 7 and 9 received the lowest scores for this criteria, due to the condition that the Dallman Unit 33 FGD system is shut down.

Option 9 received the highest score for the "Minimize congestion on the plant site" criteria, because the Dallman Unit 33 FGD system would be shut down. Option 13 received the lowest score for this criteria because of the use of three types of coal.

The highest scoring option for the "Minimize vehicle traffic" criteria was Option 6, which is the current operating scenario and involves only one type of coal. Options 11 and 14 received the lowest scores because PRB coal is burned in the Dallman units, which would involve more truck deliveries. The Dallman Unit 33 scrubber is operating for these options also, which would involve limestone deliveries.

Option 6 also received the highest score for the "Minimal impact on boiler reliability". It was estimated that no unit modifications would be required for this option, while the next highest option, option 1 would involve some changes due to the addition of FGD systems to Dallman Units 31 and 32. The lowest scoring option for this criteria is Option 11 because the type of coal burned would change for all units.

ECONOMIC ANALYSIS

Following the completion of the K-T analysis, development of capital and operating costs for each option were developed. The costs were input to spreadsheets developed to allow rapid assessment of the effect of changes in the value of key assumption parameters on the "Total Evaluated Cost" of each option. The summary spreadsheet results are displayed on Table V-4. The details for each option are presented in Tables V-4a through V-4m, corresponding to the 13 options that remained after the K-T analysis.

Interpretation of Results

As shown on the "Economic Analysis Summary" sheets, the values in the outlined "data entry boxes" represent the inputs for the key variables on which that particular printout is based. The key variables are:

- Allowance price (Range evaluated was $100 to $300)
- CEMS bias factor (This is the effective ratio of total annual SO_2 emissions reported to the U.S. EPA by the continuous emission monitoring system to the apparent value based on the fuel analysis and the Unit 33 removal efficiency. Based on 1996 data, this ratio is 1.137 composite for the five coal-fired units. The data for 1997 is similar.)
- Unit 33 SO_2 removal efficiency. (Base assumption for the study is 90%).

Other "variables" for which text entry boxes have been included on the summary spreadsheet include the unit capacity factors and the delivered price of PRB coal. These were incorporated into the electronic version of these spreadsheets to facilitate sensitivity analyses. However, it should be noted that, at CWLP's direction, the basis for this study was a 80% capacity factor for Dallman 3, 70% for Dallman 1 and 2 , and 50% for the Lakeside units. As displayed on the tables, this represents a total net generation of 2,409,000 MWh for the coal-fired units. Also, the $24.25/ton price for PRB coal (equivalent to $1.45 per million Btu) represents the best estimate available at this time of the actual price CWLP would pay to purchase and ship PRB coal from Wyoming, transload it to trucks at Pawnee Transportation, and truck it to the plant site. Other assumptions used in the study are listed in Appendix A.

The result of the economic analysis for each option is expressed as "Total Evaluated Cost", expressed as $/MWh. It should be noted, however, that this is not equivalent to the true power production cost. A lack of valid data on fixed O & M costs for the plant prevented the analysis of complete production costs.

The economic analysis was done on a "zero banking of allowances" basis. This means that any shortfall in allowances compared to annual CEMS-biased emissions was made up by purchasing the necessary allowances at the indicated price. Similarly, any surplus of allowances was converted to cash by assuming they would be sold at the indicated price.

The summary sheet provides an indication of the total tonnage of each type of coal burned at the plant based on the specified input data and assumptions. While this data allows CWLP to make a rapid determination of the extent to which a given option is in compliance with the terms of CWLP's coal supply contract with the Turris Coal Company, the reader is advised that no costs or penalties which may result from violation of this contract have been included in the economic analysis presented here.

Finally, note that the "Modification O & M" cost is not zero for Option 6, which is the base case representing the current situation. The "modification cost" reflects the projected operation and maintenance costs for the Unit 33 FGD system. It was necessary to include this factor in the economic analysis of each option because the existing FGD system plays a major role in the total SO_2 emissions from the Lakeside/Dallman complex, and because some options include the shutdown of this FGD system. Therefore, to provide a valid comparison, all cases, including the base case or "Status Quo", must include the FGD O & M cost.

Trends Observed

Review of the tabulated results indicates that the FGD retrofit options (Option 1 and 2) are among the lowest-cost options on a $/MWh "total evaluated cost" basis. However, these same two options represent by far the most capital-intensive options.

The "status quo" case (Option 6), which has zero capital cost but maximum allowance expenditure, is seen to be the lowest cost option on a "total evaluated cost" basis only for cases in which the allowance price is near $100, the bottom of the range established for this study.

Options 11, 13, and 14, in which the Unit 33 scrubber is still operated after that unit has switched to PRB coal, represent some of the highest "evaluated cost" options.

Table V-4 [100]
Economic Analysis Summary
Phase II SO_2 Compliance Options

The Analysis Displayed Below is Based on:

Allowance Price of	100	$/ton
CEMS Bias Factor of	1.137	times the fuel-based expected SO_2 emissions
Unit 33 FGD removal of	90%	for the cases where it is in service
PRB coal price (delivered to the plant) of	24.25	$/ton, or 1.448 $/MBtu @ 8375 Btu/lb

Unit Capacity Factors Used Are:

Dallman 3	80.0%
Dallman 2	70.0%
Dallman 1	70.0%
Lakeside 7/8	50.0%
Lakeside 6/7	50.0%
Resulting in Net Generation of	2,409,000 MWH

Cost of Debt = 6%
Book Life (from 2000):
Dallman = 20 years
Lakeside = 12 years

Option	Description*	Annual Tons Coal Burned by Type: Turris	PRB	Monterey	SO_2 Emitted Tons	Allowance Balance Tons	Fuel Cost Annual $	Capital Cost $	Carrying Charge $/yr	Modification O & M $/yr	Total Fuel, Capital and O & M Cost: $/yr	$/MWh	Allowance Expenditure $/yr	Total Evaluated Cost: $	$/MWh
1	100% Turris; FGD on D1 & D2	1,314,705	0	0	17,055	(4,963)	28,923,509	24,450,000	2,131,662	4,400,477	35,455,649	14.72	496,281	35,951,930	14.92
2	Monterey @ Lakeside; FGD on D1 & D2	1,149,779	0	169,410	9,670	2,422	29,699,799	24,543,000	2,142,755	4,432,242	36,274,795	15.06	(242,239)	36,032,558	14.96
3	Monterey @ Lakeside; No FGD retrofit	1,149,779	0	169,410	41,762	(29,690)	29,699,799	93,000	11,093	2,869,811	32,580,702	13.52	2,969,030	35,549,733	14.76
4	Option 3 with Monterey @ D1 & D2	645,028	0	687,908	19,181	(7,089)	32,076,220	5,315,000	467,301	2,967,029	35,510,551	14.74	708,858	36,219,409	15.04
5	Option 4 with Turris at Lakeside	809,954	0	518,498	26,566	(14,474)	31,299,931	5,193,000	452,749	2,935,265	34,687,945	14.40	1,447,378	36,135,323	15.00
6	100% Turris; No FGD retrofit (status quo)	1,314,705	0	0	49,168	(37,076)	28,923,509	0	0	2,838,047	31,761,556	13.18	3,707,551	35,469,107	14.72
7	Monterey @ LS; PRB @D1,2&3; FGD off	0	1,465,630	169,410	15,375	(3,283)	39,946,193	9,205,670	805,577	902,532	41,654,302	17.29	328,271	41,982,572	17.43
8	Monterey @ LS; PRB @D1&2; Turris @D3	645,028	643,393	169,410	13,122	(1,030)	34,197,558	10,923,472	955,343	3,252,067	38,404,968	15.94	103,018	38,507,986	15.99
9	Option 7 with Turris @ LS; FGD off	164,926	1,465,630	0	22,760	(10,668)	39,169,903	9,112,670	794,484	870,766	40,835,155	16.95	1,066,791	41,901,946	17.39
10	Turris @ LS & D3; PRB @ D1 & D2	809,954	643,393	0	20,507	(8,415)	33,421,269	10,830,472	944,250	3,220,303	37,585,822	15.60	841,538	38,427,360	15.95
11	Option 7 with D3 FGD On	0	1,465,630	169,410	9,460	2,632	39,946,193	9,105,670	796,858	3,559,328	44,302,379	18.39	(263,230)	44,039,148	18.28
13	Option 3 with 80/20 PRB/Turris blend @D3	660,741	623,959	169,410	39,013	(26,921)	34,071,959	10,413,758	910,903	3,097,205	38,080,067	15.81	2,692,072	40,772,140	16.92
14	Option 9 with D3 FGD On	164,926	1,465,630	0	16,845	(4,753)	39,169,903	9,012,670	785,766	3,527,563	43,483,232	18.05	475,290	43,958,522	18.25

*Note: D3 FGD is On except where noted

Table V-4 [200]
Economic Analysis Summary
Phase II SO_2 Compliance Options

The Analysis Displayed Below is Based on:

Allowance Price of	200	$/ton
CEMS Bias Factor of	1.137	times the fuel-based expected SO_2 emissions
Unit 33 FGD removal of	90%	for the cases where it is in service
PRB coal price (delivered to the plant) of	24.25	$/ton, or 1.448 $/MBtu @ 8375 Btu/lb

Unit Capacity Factors Used Are:

Dallman 3	80.0%
Dallman 2	70.0%
Dallman 1	70.0%
Lakeside 7/8	50.0%
Lakeside 6/7	50.0%

Resulting in Net Generation of 2,409,000 MWH

Cost of Debt = 6%
Book Life (from 2000):
Dallman = 20 years
Lakeside = 12 years

Option	Description*	Annual Tons Coal Burned by Type: Turris	PRB	Monterey	SO_2 Emitted Tons	Allowance Balance Tons	Fuel Cost Annual $	Capital Cost $	Carrying Charge $/yr	Modification O & M $/yr	Total Fuel, Capital and O & M Cost: $/yr	$/MWh	Allowance Expenditure $/yr	Total Evaluated Cost: $	$/MWh
1	100% Turris; FGD on D1 & D2	1,314,705	0	0	17,055	(4,963)	28,923,509	24,450,000	2,131,662	4,400,477	35,455,649	14.72	992,563	36,448,212	15.13
2	Monterey @ Lakeside; FGD on D1 & D2	1,149,779	0	169,410	9,670	2,422	29,699,799	24,543,000	2,142,755	4,432,242	36,274,795	15.06	(484,476)	35,790,318	14.86
3	Monterey @ Lakeside; No FGD retrofit	1,149,779	0	169,410	41,782	(29,690)	29,699,799	93,000	11,093	2,869,811	32,580,702	13.52	5,938,061	38,518,763	15.99
4	Option 3 with Monterey @ D1 & D2	645,028	0	687,908	19,181	(7,089)	32,076,220	5,315,000	467,301	2,967,029	35,510,551	14.74	1,417,716	36,928,267	15.33
5	Option 4 with Turris at Lakeside	809,954	0	518,498	26,566	(14,474)	31,299,931	5,193,000	452,749	2,935,265	34,687,945	14.40	2,894,757	37,582,702	15.60
6	100% Turris; No FGD retrofit (status quo)	1,314,705	0	0	49,168	(37,076)	28,923,509	0	0	2,838,047	31,761,556	13.18	7,415,101	39,176,657	16.26
X7	Monterey @ LS; PRB @D1,2&3; FGD off	0	1,465,630	169,410	15,375	(3,283)	39,946,193	9,205,670	805,577	902,532	41,654,302	17.29	656,541	42,310,843	17.56
8	Monterey @ LS; PRB @D1&2; Turris @D3	645,028	643,393	169,410	13,122	(1,030)	34,197,558	10,923,472	955,343	3,252,067	38,404,968	15.94	206,036	38,611,004	16.03
X9	Option 7 with Turris @ LS; FGD off	164,926	1,465,630	0	22,760	(10,668)	39,169,903	9,112,670	794,484	870,768	40,835,155	16.95	2,133,582	42,968,737	17.84
10	Turris @ LS & D3; PRB @ D1 & D2	809,954	643,393	0	20,507	(8,415)	33,421,269	10,830,472	944,250	3,220,303	37,585,822	15.60	1,683,077	39,268,898	16.30
X11	Option 7 with D3 FGD On	0	1,465,630	169,410	9,460	2,632	39,946,193	9,105,670	796,858	3,559,328	44,302,379	18.39	(526,461)	43,775,918	18.17
13	Option 3 with 80/20 PRB/Turris blend @D3	660,741	623,959	169,410	39,013	(26,921)	34,071,959	10,413,758	910,903	3,097,205	38,080,067	15.81	5,384,145	43,464,212	18.04
14	Option 9 with D3 FGD On	164,926	1,465,630	0	16,845	(4,753)	39,169,903	9,012,670	785,766	3,527,563	43,483,232	18.05	950,580	44,433,812	18.44

*Note: D3 FGD is On except where noted

Table V-4 [300]
Economic Analysis Summary
Phase II SO_2 Compliance Options

The Analysis Displayed Below is Based on:			
Allowance Price of	300	$/ton	
CEMS Bias Factor of	1.137	times the fuel-based expected SO_2 emissions	
Unit 33 FGD removal of	90%	for the cases where it is in service	
PRB coal price (delivered to the plant) of	24.25	$/ton, or	1.448 $/MBtu @ 8375 Btu/lb

Unit Capacity Factors Used Are:	
Dallman 3	80.0%
Dallman 2	70.0%
Dallman 1	70.0%
Lakeside 7/8	50.0%
Lakeside 6/7	50.0%
Resulting in Net Generation of	**2,409,000 MWH**

Cost of Debt = 6%
Book Life (from 2000):
Dallman = 20 years
Lakeside = 12 years

		Annual Tons Coal Burned by Type			SO_2 Emitted	Allowance Balance	Fuel Cost Annual	Capital Cost	Carrying Charge	Modification O & M	Total Fuel, Capital and O & M Cost		Allowance Expenditure	Total Evaluated Cost	
Option	Description*	Turris	PRB	Monterey	Tons	Tons	$	$	$/yr	$/yr	$/yr	$/MWh	$/yr	$	$/MWh
1	100% Turris; FGD on D1 & D2	1,314,705	0	0	17,055	(4,963)	28,923,509	24,450,000	2,131,662	4,400,477	35,455,649	14.72	1,488,844	36,944,493	15.34
2	Monterey @ Lakeside; FGD on D1 & D2	1,149,779	0	169,410	9,670	2,422	29,699,799	24,543,000	2,142,755	4,432,242	36,274,795	15.06	(726,717)	35,548,079	14.76
3	Monterey @ Lakeside; No FGD retrofit	1,149,779	0	169,410	41,782	(29,690)	29,699,799	93,000	11,093	2,869,811	32,580,702	13.52	8,907,091	41,487,793	17.22
4	Option 3 with Monterey @ D1 & D2	645,028	0	687,908	19,181	(7,089)	32,076,220	5,315,000	467,301	2,967,029	35,510,551	14.74	2,126,574	37,637,125	15.62
5	Option 4 with Turris at Lakeside	809,954	0	518,498	26,566	(14,474)	31,299,931	5,193,000	452,749	2,935,265	34,687,945	14.40	4,342,135	39,030,080	16.20
6	100% Turris; No FGD retrofit (status quo)	1,314,705	0	0	49,168	(37,076)	28,923,509	0	0	2,838,047	31,761,556	13.18	11,122,652	42,884,208	17.80
7	Monterey @ LS; PRB @D1,2&3; FGD off	0	1,465,630	169,410	15,375	(3,283)	39,946,193	9,205,670	805,577	902,532	41,654,302	17.29	984,812	42,639,113	17.70
8	Monterey @ LS; PRB @D1&2; Turris @D3	645,028	643,393	169,410	13,122	(1,030)	34,197,558	10,923,472	955,343	3,252,067	38,404,968	15.94	309,054	38,714,022	16.07
9	Option 7 with Turris @ LS; FGD off	164,926	1,465,630	0	22,760	(10,668)	39,169,903	9,112,670	794,484	870,768	40,835,155	16.95	3,200,372	44,035,528	18.28
10	Turris @ LS & D3; PRB @ D1 & D2	809,954	643,393	0	20,507	(8,415)	33,421,269	10,830,472	944,250	3,220,303	37,585,822	15.60	2,524,615	40,110,437	16.65
11	Option 7 with D3 FGD On	0	1,465,630	169,410	9,460	2,632	39,946,193	9,105,670	796,858	3,559,328	44,302,379	18.39	(789,691)	43,512,688	18.06
13	Option 3 with 80/20 PRB/Turris blend @D3	660,741	623,959	169,410	39,013	(26,921)	34,071,959	10,413,758	910,903	3,097,205	38,080,067	15.81	8,076,217	46,156,285	19.16
14	Option 9 with D3 FGD On	164,926	1,465,630	0	16,845	(4,753)	39,169,903	9,012,670	785,766	3,527,563	43,483,232	18.05	1,425,870	44,909,102	18.64

*Note: D3 FGD is On except where noted

APPENDIX A
STUDY BASIS AND ASSUMPTIONS

APPENDIX A
STUDY BASIS AND ASSUMPTIONS

Unit Ratings	D3	D2	D1	L7/8	L6/7
Net ratings MW	175	75	75	30	30
Capacity factor,%	80	70	70	50	50
Heat rate (Btu/kWh) on Turris	11045	11452	11596	13199	13159
Heat rate (Btu/kWh) on Monterey	n/a	11484	11628	13235	13195
Heat Rate (Btu/kWh) on PRB	11230	11643	11790	n/a	n/a

Power usage					
Station service (excl. FGD), %	7.0	7.0	7.0	n/a	n/a
% increase in above due to PRB	35	35	35	n/a	n/a

Power cost for aux power is equal to fuel cost for the respective unit, in $/mmBtu

SO_2 emission factor = 95% of potential emission based on %S and HHV
CEM Bias Factor = 1.317 (used only to determine allowance requirements)

FGD Assumptions	
Unit 31/32 FGD capital cost =	$163/kW(net)
Unit 31/32 fixed FGD O&M =	$6.825/kW-yr
Unit 33 fixed FGD O&M cost =	$12.00/kW-yr
Unit 31/32 FGD aux power =	2.0% of gross MW generation for the unit
Unit 31/32 aux power cost =	fuel cost for the respective unit, $/mmBtu
Unit 33 FGD aux power =	2.5% of gross MW generation for the unit
Unit 33 aux power cost =	fuel cost for the respective unit, $/mmBtu
Limestone Utilization =	95.0%
Limestone Purity (% $CaCO_3$) =	95.4%
Limestone cost =	$12.16/ton
Gypsum Purity (%$CaSO_4 \bullet 2H_2O$)=	95%
Gypsum Moisture, % =	13%
Gypsum sale price =	$3.00/ton
Blanking plate cost for Options 7 & 9	$50,000
Relocation of COMS (Options 7 & 9)	$50,000

Coal Assumptions

HHV for Turris (Btu/lb)	10,500
%S for Turris	3.1%
Price for Turris (delivered)	$22.00/ton
HHV for Monterey (Btu/lb)	10,250
%S for Monterey	1.0
Price for Monterey (delivered)	$26.00/ton
HHV for PRB (Btu/lb)	8,375
%S for PRB	0.37
Price for PRB (delivered)	$24.25/ton (includes $3.0 transload plus truck haul)
Blend % for option 13 (PRB/Turris)	80%/20% (mass basis)

Fluxing limestone blend ratio for Monterey =	1.5% of coal feed rate, mass basis
Fluxing limestone delivered cost =	$12.50/ton

Economic Assumptions

Book life, Dallman	20 years (year 2000 is year No. 1)
Book life, Lakeside	12 years (year 2000 is year No. 1)
Cost of money	6.00%
Tax rate	0.0%
Inflation	Not included

Alowance Price Range (one allowance = 1 ton SO_2)	$100 to $300 each

CITY WATER, LIGHT AND POWER
ENVIRONMENTAL EMISSIONS WORKSHEET
1997 ACTUAL GENERATION DATA, CEM AND ESTIMATED EMISSIONS DATA
New Emissions Factors

		COAL-FIRED STEAM UNITS						COMBUSTION TURBINES					
ITEM	UNITS	Dallman 3	Dallman 2	Dallman 1	Lakeside Gen 7/Blr 8	Lakeside Gen 6/Blr 7	Coal Unit TOTAL	UNITS	Factory GT	Reynolds GT	Interstate GT	GT TOTAL	GRAND TOTAL
Nominal Net Rating	MW	175	75	75	30	30	385	MW	18	15	115	148	533
Capacity Factor	%	70.8%	64.1%	61.9%	49.2%	48.7%	64.3%	%	1.22%	0.71%	4.35%	3.60%	47.46%
Net Generation	MWH	1,084,642	420,828	406,412	129,419	127,872	2,169,173	MWH	1,923	927	43,784	46,634	2,215,807
Fuel Burn	Tons Coal	572,005	229,759	225,001	81,422	80,197	1,188,384	Gallons Oil	202,211	114,225	438,135	754,571	2,697,526
Fuel Burn								Dth. Gas			485,330	485,330	
Net Heat Rate	BTU/KWH	11,045	11,452	11,596	13,199	13,159	11,466	BTU/KWH	14,514	17,006	12,465	12,640	11,491
Heat Input*	MMBTU	11,968,374	4,809,689	4,709,239	1,705,297	1,679,755	24,872,354	MMBTU	27,905	15,763	545,793	589,461	25,461,815
Coal Heat content	BTU/lb	10,462	10,467	10,465	10,472	10,473	10,465						
Fuel Sulfur Content	%	3.13%	3.13%	3.13%	3.13%	3.13%	3.13%	%	0.24	0.24	0.24	0.04	
Raw SO2 Emission Rate**	#/ton coal	118.94	118.94	118.94	118.94	118.94	118.94	#/1000 Gal.	0.0335	0.0335		0.0335	
SO2 Cleanup Efficiency	%	84.7%	0.0%	0.0%	0.0%	0.0%	40.7%	%	0.0%	0.0%		0.0%	
Net SO2 Emission Rate	#/ton coal	18.24	118.94	118.94	118.94	118.94	70.48	#/1000 Gal.	0.0335	0.0335		0.033	
NOx Emission Rate	#/ton coal	14.4	33.8	33.8	33.8	33.8	24.5	#/1000 Gal.	0.0050	0.0028		0.004	
Paticulate Emission Rate	#/ton coal	0.7704	0.1541	0.1541	0.1541	0.1541	0.4506	#/1000 Gal.	0.0004	0.0002		0.000	
CO Emission Rate	#/ton coal	0.5	0.5	0.5	0.5	0.5	0.5	#/1000 Gal.	0.0003	0.0002		0.000	
VOM Emission Rate	#/ton coal	0.07	0.07	0.07	0.07	0.07	0.07	#/1000 Gal.	0.0003	0.0002		0.000	
Pb Emission Rate	#/ton coal	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	#/1000 Gal.	0.000000	0.000000		0.000000	
PM10 Emission Rate**	#/ton coal	0.004770	0.001049	0.001049	0.001049	0.001049	0.002840	#/1000 Gal.	0.0003	0.0002		0.000	
CO2 Emission Rate	#/ton coal	4,321	4,250	4,249	4,252	4,252	4,284	#/1000 Gal.	22.908	22.908		22.908	
Raw SO2 Emission Rate	#/MMBTU	5.6845	5.6818	5.6828	5.6790	5.6786	5.6829	#/MMBTU	0.2424	0.2424	0.2424	0.0428	
Net SO2 Emission Rate	#/MMBTU	0.8717	5.6818	5.6828	5.6790	5.6786	3.3677	#/MMBTU	0.242	0.242	0.008	0.043	
NOx Emission Rate	#/MMBTU	0.6882	1.6146	1.6149	1.6138	1.6137	1.1689	#/MMBTU	0.036	0.020	0.125	0.698	
Paticulate Emission Rate	#/MMBTU	0.0368	0.0074	0.0074	0.0074	0.0074	0.0215	#/MMBTU	0.003	0.002	0.037	0.061	
CO Emission Rate	#/MMBTU	0.0239	0.0239	0.0239	0.0239	0.0239	0.0239	#/MMBTU	0.002	0.001	0.249	0.048	
VOM Emission Rate	#/MMBTU	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	#/MMBTU	0.003	0.001	0.021	0.017	
Pb Emission Rate	#/MMBTU	0.000507	0.000507	0.000507	0.000507	0.000507	0.000507	#/MMBTU	0.000003	0.000002	0.000051	0.000058	
PM10 Emission Rate	#/MMBTU	0.000228	0.000050	0.000050	0.000050	0.000050	0.000136	#/MMBTU	0.002	0.001	0.037	0.0293	
CO2 Emission Rate	#/MMBTU	206.5	203.0	203.0	203.0	203.0	204.7	#/MMBTU	166.000	166.000	166.000	166.000	

CALCULATED EMISSIONS

POLLUTANT	UNITS	Dallman 3	Dallman 2	Dallman 1	Lakeside Gen 7/Blr 8	Lakeside Gen 6/Blr 7	Coal Unit TOTAL	UNITS	Factory GT	Reynolds GT	Interstate GT	GT TOTAL	GRAND TOTAL
SO2	Tons	5,216.53	13,683.77	13,380.81	4,842.17	4,769.32	41,880.86	Tons	0.9900	0.5590	2.3050	3.8540	41,884.71
NOx	Tons	4,118.44	3,882.93	3,802.52	1,376.03	1,355.33	14,536.83	Tons	9.8780	5.5800	34.0370	49.4950	14,586.33
Particulates	Tons	220.34	17.70	17.33	6.27	6.18	267.77	Tons	0.8630	0.4880	10.1810	35.3880	303.16
SUBTOTAL	Tons	9,555.30	17,584.40	17,200.66	6,224.47	6,130.82	56,685.47	Tons	11.7310	6.6270	46.5230	88.7370	56,774.20
CO	Tons	143.00	57.44	56.25	20.36	20.05	297.10	Tons	0.6790	0.3840	67.9500	69.0130	366.11
VOM	Tons	20.02	8.04	7.88	2.85	2.81	41.59	Tons	0.6880	0.3880	5.8250	6.9010	48.49
Pb	Tons	3.03	1.22	1.19	0.43	0.43	6.31	Tons	0.0008	0.0005	0.0140	0.0153	6.32
PM10	Tons	1.36	0.12	0.12	0.04	0.04	1.69	Tons	0.5380	0.3040	10.1810	11.0230	12.71
CO2	Tons	1,235,734.62	488,183.43	477,987.76	173,087.65	170,495.13	2,545,488.59	Tons	2,316.12	1,308.33	45,300.79	48925.2462	2,594,413.83
TOTAL Except CO2	Tons	9,722.72	17,631.22	17,266.10	6,248.15	6,154.15	57,032.15		13.6368	7.7035	130.4930	175.6893	57,207.84

* Based on coal burn only.
** Based on 9.54% average coal ash content

Karl Kohlrus
08/28/98

SUMMARY OF CWLP ALLOWANCE ALLOCATIONS

	2000-2009	2010 thereafter
Dallman 3	5,169	5,208
Dallman 2	1,569	1,570
Dallman 1	1,377	1,388
Lakeside 7	2,539	633
Lakeside 8	1,438	326
TOTAL	12,092	9,125

1996 CEM vs UNIT EFFICIENCY DATA

ITEM	UNITS	Dallman 3	Dallman 2	Dallman 1	Lakeside Gen 7/Blr 8	Lakeside Gen 6/Blr 7	Lakeside TOTAL	Coal Unit TOTAL
Heat Input (CEM)	MMBTU	13,899,898	5,338,498	5,192,441			2,186,656	26,617,493
Heat Input (Unit Efficiency)	MMBTU	11,804,067	4,992,489	4,576,125	952,942	1,085,690	2,038,632	23,411,313
Difference	MMBTU	2,095,831	346,009	616,316			148,024	3,206,180
Percent Difference	%	17.76%	6.93%	13.47%			7.26%	13.70%
SO2 (CEM)	Tons	6,187.4	15,160.7	14,130.6			6,044.1	41,522.8
SO2 (With Plant heat input)	Tons	5,254.5	14,178.1	12,453.4			5,634.9	36,521.2
SO2 Difference	Tons	932.9	982.6	1,677.2			409.2	5,001.6

EXHIBIT B

TYPICAL STEAM COAL QUALITY DATA

Turris Mine

Mine & Property Name	Elkhart Mining Area Niantic Property			Seam Name	Illinois No. 5
U.S. Coal District	10	County	Logan	State	Illinois

	Drill Core Data: Raw (A) (Dry)	Drill Core Data: Washed (B) @ 1.70 SP. GR. (Dry)		Projected Washed Product (C): Washed @ 1.71 SP. GR. "As Received"	
Proximate Analysis					
Moisture	- %	- %		18.6 %	
Ash	14.41%	11.59%		8.6 %	6.9 – 10.3% but ave. 8
Volatile	39.36%	39.57%		- %	
Fixed Carbon	46.23%	48.84%		- %	
BTU/Lb.	12,108	12,456		10,450	
Sulphur	4.20%	3.72%		2.70%	
Ultimate Analysis			MAF	As Rec'd	
Moisture	- %	- %		18.6	
Carbon	68.03%	69.58%	78.7	56.64	
Hydrogen	4.86%	5.07%	5.74	4.13	
Nitrogen	1.21%	1.36%	1.54	1.11	
Chlorine	0.09%	0.22%	0.25	.18	
Sulphur	4.20%	3.72%	4.21	3.03	
Ash	13.33%	11.59%		9.43	
Oxygen (Diff)	8.28%	8.52%	9.64	6.54	
		100.36			
Ash Mineral Analysis					
SiO2	32.12%	45.71%			
Al2O3	10.23%	12.61%			
Fe2O3	23.58%	19.00%			
TiO2	0.35%	0.78%			
CaO	14.81%	8.41%			
MgO	0.44%	0.71%			
Na2O	1.08%	1.12%			
K2O	1.37%	1.55%			
P2O5	1.11%	0.13%			
SO3	13.62%	8.7 %			
Undetermined	1.29%	1.26%			

Fusion Temperatures of Ash

	Raw (Reducing)	Raw (Oxidizing)	Washed @ 1.70 SP. GR. (Reducing)	Washed @ 1.70 SP. GR. (Oxidizing)
Initial Deformation	1923°F	2160°F	1940°F	2200°F
Hemispherical (H=1/2W)	2064°F	2328°F	2220°F	2360°F
Fluid	2150°F	2414°F	~~2360~~°F ✓ 2230 4/24/23	2560°F

Grindability = 56.8

T250 = 2180°F

Sulphur Form (Raw, Dry):	
Organic	1.94
Pyritic	2.20
SO2	0.06
Total	4.20

Typical Coal Quality

Average—As Received Basis

Mine: **CABALLO**

Location: Campbell County, Wyoming, near Gillette
Type of Coal: Subbituminous; crushed run-of-mine
Loading Capability: Burlington Northern Railroad
Chicago & North Western Transportation Company

Proximate Analysis, wt%

Total Moisture	29.90
Ash	5.31
Volatile Matter	31.36
Fixed Carbon	33.43
Sulfur	.37
Gross Calorific Value	
Btu/lb	8450
Kcal/kg	4,694

Ultimate Analysis, wt%

Total Moisture	29.90
Carbon	48.52
Hydrogen	3.40
Nitrogen	0.71
Chlorine	0.02
Sulfur	0.37
Ash	5.31
Oxygen	11.79

Ash Fusion Temperature	°F	°C
Reducing		
Initial Deformation	2135	1170
Softening, H = W	2165	1285
Hemispherical, H = ½ W	2280	1195
Fluid	2230	1220
Oxidizing		
Initial Deformation	2185	1195
Softening, H = W	2210	1210
Hemispherical, H = ½ W	2220	1215
Fluid	2295	1255

Ash Elements, wt% as Oxide

Phosphorus Pentoxide,	P_2O_5	0.93
Silicon Dioxide	SiO_2	34.53
Ferric Oxide,	Fe_2O_3	5.02
Aluminum Oxide,	Al_2O_3	17.98
Titanium Dioxide,	TiO_2	1.25
Calcium Oxide,	CaO	20.91
Magnesium Oxide,	MgO	3.75
Sulfur Trioxide,	SO_3	12.54
Potassium Oxide,	K_2O	0.41
Sodium Oxide,	Na_2O	1.58
Other		1.10

Sulfur Forms, wt%

Pyritic	0.06
Sulfate	0.01
Organic	0.30

Other Quality Factors

Equilibrium Moisture, wt%	28.4
Hardgrove Grindability Index, HGI	60
HGI Moisture, wt%	21.8
Base to Acid Ratio	0.59
Pounds SO_2 per Million Btu	0.88
Size	2 inches x 0

Exxon Coal and Minerals Company—Houston, Texas, U.S.A.—May 1, 1990

Typical Coal Quality

Average—As Received Basis

Mine:	**RAWHIDE**
Location:	Campbell County, Wyoming, near Gillette
Type of Coal:	Subbituminous; crushed run-of-mine
Loading Capability:	Burlington Northern Railroad

Proximate Analysis, wt%

Total Moisture	30.00
Ash	5.15
Volatile Matter	31.21
Fixed Carbon	33.54
Sulfur	.36
Gross Calorific Value	
Btu/lb	8300
Kcal/kg	4,611

Ultimate Analysis, wt%

Total Moisture	30.00
Carbon	48.07
Hydrogen	3.29
Nitrogen	0.69
Chlorine	0.01
Sulfur	0.36
Ash	5.15
Oxygen	12.44

Ash Fusion Temperature	°F	°C
Reducing		
Initial Deformation	2160	1185
Softening, H = W	2190	1200
Hemispherical, H = ½ W	2205	1210
Fluid	2225	1220
Oxidizing		
Initial Deformation	2205	1210
Softening, H = W	2225	1220
Hemispherical, H = ½ W	2240	1230
Fluid	2265	1240

Ash Elements, wt% as Oxide

Phosphorus Pentoxide,	P_2O_5	0.67
Silicon Dioxide	SiO_2	31.11
Ferric Oxide,	Fe_2O_3	5.75
Aluminum Oxide,	Al_2O_3	14.14
Titanium Dioxide,	TiO_2	1.00
Calcium Oxide,	CaO	24.12
Magnesium Oxide,	MgO	5.45
Sulfur Trioxide,	SO_3	14.18
Potassium Oxide,	K_2O	0.23
Sodium Oxide,	Na_2O	1.33
Other		2.02

Sulfur Forms, wt%

Pyritic	0.07
Sulfate	0.02
Organic	0.27

Other Quality Factors

Equilibrium Moisture, wt%	29.7
Hardgrove Grindability Index, HGI	59
HGI Moisture, wt%	21.5
Base to Acid Ratio	0.79
Pounds SO_2 per Million Btu	0.87
Size	2 inches x 0

STANDARD LABORATORIES, INC.
8413 Peabody Road (Shipping)
Freeburg , IL 62243-0039

Lab No. 9611-00048-2

Date Rec'd. 11/13/96

Date Sampled 11/08/96 to 11/08/96

Sampled By CLIENT

Date: 12/20/96

Sample ID: 961104802

CITY WATER, LIGHT AND POWER
DALLMAN POWER PLANT
ROOM 211, MUNICIPAL BLDG.
SPRINGFIELD, IL 62701
ATTN: GREGG FINIGAN

Remark: DALLMAN POWER PLANT - MONTEREY COAL
DRY BASIS MERCURY 0.07 UG/G

PROXIMATE ANALYSIS		As Received		Dry Basis	CWLP #
Moisture	D3302	*****		*****	
Ash	D3174	*****		10.83	11.12
Volatile	D3175	*****		37.39	
Fixed Carbon	D3172	*****		51.78	
BTU	D1989	*****		12475	12393
MAF-BTU	D1989		13990		13943
Total Sulfur	D4239	*****		1.18	1.20

ULTIMATE ANALYSIS		Weight % As Received	Dry Basis
% Moisture	D3302	*****	*****
% Carbon	D5373	*****	71.57
% Hydrogen	D5373	*****	4.72
% Nitrogen	D5373	*****	1.53
% Chlorine	D2361	*****	0.12
% Sulfur	D4239	*****	1.18
% Ash	D3174	*****	10.83
% Oxygen (Diff.)	D3176	*****	10.05

SULFUR FORMS			
Pyritic	D2492	*****	*****
Sulfate	D2492	*****	*****
Organic	D2492	*****	*****
Total Sulfur	D4239	*****	1.18 1.20

WATER SOLUBLE			
Na2O	ASME1974	*****	*****
K2O	ASME1974	*****	*****
Chlorine	ASME1974	*****	*****
Alkalies as Na2O	ASME197	*****	*****

FUSION TEMP. OF ASH D1857	Reducing	Oxidizing
I.D.	2160	2380
H=W	2170	2400
H=1/2W	2200	2425
Fluid	2260	2515

GRINDABILITY INDEX D409 ***** @ ***** % Moist.
GRIND INDEX UNCONDITIONED ***** @ ***** % Moist.

FREE SWELLING INDEX D720 *****

Apparent Specific Gravity of Coal ModIC7113 *****

Equilibrium Moisture D1412 *****

MINERAL ANALYSIS D3682 %		Ignited Basis
Phos. Pentoxide,	P2O5	0.27
Silica,	SiO2	54.94
Ferric Oxide,	Fe2O3	9.32
Alumina,	Al2O3	19.36
Titania,	TiO2	1.12
Lime,	CaO	5.46
Magnesia,	MgO	1.20
Sulfur Trioxide,	SO3	3.33
Potassium Oxide,	K2O	2.44
Sodium Oxide,	Na2O	1.58
Barium Oxide,	BaO	0.05
Strontium Oxide,	SrO	0.05
Manganese Dioxide,	MnO2	0.05
Undetermined		0.8[illegible]
Type of Ash	ASME1974	Bituminous
Silica Value	ASME1974	77.4[illegible]
T250 Deg	B&W	262[illegible]
Base/Acid Ratio	ASME1974	0.2[illegible]
lb Ash/mm BTU		****
lb SO2/mm BTU		1.8
Fouling Index	ASME1974	****
Slagging Index	ASME1974	****

Respectfully Submitted, Richard L. Wilburn Jr.
Richard L. Wilburn

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APPENDIX B
K-T ANALYSIS

TABLE V-1
ORIGINAL K-T ANALYSIS MATRIX

OPTIONS	1	2	3	4	5	6	7	8	9	10	11	13	14
Coal													
Lakeside Units	Turris	Monterey	Monterey	Monterey	Turris	Turris	Monterey	Monterey	Turris	Turris	Monterey	Monterey	Turris
Dallman 31 & 32	Turris	Turris	Turris	Monterey	Monterey	Turris	PRB	PRB	PRB	PRB	PRB	Turris	PRB
Dallman 33	Turris	Turris	Turris	Turris	Turris	Turris	PRB	Turris	PRB	Turris	PRB	PRB/Turris	PRB
Off-site Storage	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FGD System													
Dallman 31 & 32	Add	Add											
Dallman 33	On	On	On	On	On	On	Off	On	Off	On	On	On	On
Potential Unit Modifications	None	Add limestone feed system (LS 7&8)	Add limestone feed system (LS 7&8)	Add limestone feed system (LS 7&8) (Dallman 31/32)	Add limestone feed system (Dallman 31/32)	None	Add limestone feed system (LS 7&8) + Mod. 1 & 2	Add limestone feed system (LS 7&8) + Mod. 1	Modification 1 & 2 (Dallman 31/32, 33)	Modification 1 (Dallman 31/32)	Add limestone feed system (LS 7&8) + Mod. 1 & 2	Add limestone feed system (LS 7&8) + Mod. 2	Modification 1 & 2 (Dallman Units 31/32, 33)
MUSTS													
Maintain space for NOx controls to be added at a later date	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

WANTS	Wgt	1 Score	1 Wt'd Score	2 Score	2 Wt'd Score	3 Score	3 Wt'd Score	4 Score	4 Wt'd Score	5 Score	5 Wt'd Score	6 Score	6 Wt'd Score	7 Score	7 Wt'd Score	8 Score	8 Wt'd Score	9 Score	9 Wt'd Score	10 Score	10 Wt'd Score	11 Score	11 Wt'd Score	13 Score	13 Wt'd Score	14 Score	14 Wt'd Score
Minimize reliance on SO2 allowance market	40	9	360	10	400	3	120	5	200	4	160	2	80	8	320	7	280	7	280	9	360	10	400	6	240	8	320
Minimize coal handling problems	20	10	200	9	180	9	180	7	140	8	160	10	200	2	40	3	60	2	40	4	80	2	40	4	80	2	40
Ease of operation	7	9	63	8	56	9	63	6	42	6	42	10	70	4	28	2	14	5	35	4	28	3	21	2	14	4	28
Reduction of air toxics to aid in meeting future regulatory requirements.	1	10	10	10	10	5	5	5	5	5	5	5	5	0	0	5	5	0	0	5	5	5	5	5	5	5	5
Minimize congestion on the plant site	1	5	5	4	4	6	6	5	5	6	6	7	7	8	8	4	4	10	10	5	5	7	7	3	3	9	9
Minimize vehicle traffic	1	8	8	8	8	9	9	9	9	9	9	10	10	7	7	6	6	7	7	6	6	5	5	6	6	5	5
Minimal impact on boiler reliability	30	9	270	7	210	8	240	7	210	8	240	10	300	2	60	5	150	3	90	6	180	1	30	5	150	2	60
TOTAL - WANTS SCORE	100		916		868		623		611		622		672		463		519		462		664		508		498		467

TABLE V-1a
FINAL K-T ANALYSIS MATRIX

OPTIONS		1		2		3		4		5		6		7		8		9		10		11		13		14	
Coal																											
Lakeside Units		Turris		Monterey		Monterey		Monterey		Turris		Turris		Monterey		Monterey		Turris		Turris		Monterey		Monterey		Turris	
Dallman 31 & 32		Turris		Turris		Turris		Monterey		Monterey		Turris		PRB		PRB		PRB		PRB		PRB		Turris		PRB	
Dallman 33		Turris		Turris		Turris		Turris		Turris		Turris		PRB		Turris		PRB		Turris		PRB		PRB/Turris		PRB	
Off-site Storage		No		No		No		No		No		No		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
FGD System																											
Dallman 31 & 32		Add		Add																							
Dallman 33		On		On		On		On		On		On		Off		On		Off		On		On		On		On	
Potential Unit Modifications (see attached table for description of Mod. 1 & 2)		None		Add limestone feed system (LS 7&8)		Add limestone feed system (LS 7&8)		Add limestone feed system (LS 7&8) (Dallman 31/32)		Add limestone feed system (Dallman 31/32)		None		Add limestone feed system (LS 7&8) + Mod. 1 & 2		Add limestone feed system (LS 7&8) + Mod. 1		Modification 1 & 2 (Dallman 31/32, 33)		Modification 1 (Dallman 31/32)		Add limestone feed system (LS 7&8) + Mod. 1 & 2		Add limestone feed system (LS 7&8) + Mod. 2		Modification 1 & 2 (Dallman Units 31/32, 33)	
MUSTS																											
Maintain space for NOx controls to be added at a later date		YES		YES		YES		YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
WANTS	**Wgt**	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score	Score	Wt'd Score
Minimize reliance on SO2 allowance market*	40	8	320	10	400	2	80	8	320	6	240	0	0	9	360	9	360	7	280	7	280	10	400	3	120	8	320
Minimize coal handling problems	20	10	200	9	180	9	180	7	140	8	160	10	200	2	40	3	60	2	40	4	80	2	40	4	80	2	40
Ease of operation	7	9	63	8	56	9	63	6	42	6	42	10	70	4	28	2	14	5	35	4	28	3	21	2	14	4	28
Reduction of air toxics to aid in meeting future regulatory requirements.	1	10	10	10	10	5	5	5	5	5	5	5	5	0	0	5	5	0	0	5	5	5	5	5	5	5	5
Minimize congestion on the plant site	1	5	5	4	4	6	6	5	5	6	6	7	7	8	8	4	4	10	10	5	5	7	7	3	3	9	9
Minimize vehicle traffic	1	8	8	8	8	9	9	9	9	9	9	10	10	7	7	6	6	7	7	6	6	5	5	6	6	5	5
Minimal impact on boiler reliability	30	9	270	7	210	8	240	7	210	8	240	10	300	2	60	5	150	3	90	6	180	1	30	5	150	2	60
TOTAL - WANTS SCORE	100		876		868		583		731		702		592		503		599		462		584		508		378		467

*Revised based on calculated allowance purchase requirements.

kttablef.xls 10/6/98

TABLE V-2
UNIT MODIFICATION REFERENCE SHEET

	Concern	General Description of Concern	Potential Modification: Modification 1 Dallman 31/32	Potential Modification: Modification 2 Dallman 33
1	FD Fan Capacity or Head	Increase in moisture decreases boiler efficiency, increasing both fuel and air requirement. Moisture also increases flue gas volume.	No Change *(1% cap. Incr.)*	No Change *(1% cap. Incr.)*
2	ID Fan Capacity or Head *(Unit 33 only)*	Same as FD Fan, plus an additional concern about increasing flue gas temperature with PRB if furnace is not adequately cleaned.	n/a	No Change *(2% cap. Incr.)*
3	Coal Feeder Capacity	Any reduction in HHV and/or boiler efficiency will require an increase in coal feed rate.	Raise leveling bar.	Add electronic weigh system & raise leveling bar.
4	Coal Mill Capacity *(Unit 33 only)*	Same basis as Coal feeder.	n/a	No Change *(3 mills for MCR)*
5	Exhauster Capacity or Head *(Unit 33 only)*	Same basis as coal Coal Feeder. In addition, PRB coal requires higher PA/Fuel ratio, increasing both capacity and head requirements.	n/a	No Change *(3 mills for MCR- 3 for Opt 13) (Max head incr. of 24%.)*
6	Coal Pipe Size *(Unit 33 only)*	The increase in PA flow (See Exhausters) increases coal pipe velocity. Normally try for a maximum of 5000fpm.	n/a	No Change *(Velocity increases to 5560 fpm.)*
7	Mill Inerting *(Unit 33 only)*	PRB coal requires mill inerting.	n/a	Add mill inerting.
8	Mill Wash Nozzles *(Unit 33 only)*	PRB coal requires mill washing on shutdown.	n/a	Add mill wash nozzles.
9	Cyclone Modifications *(Units 31/32 only)*	PRB coal in a cyclone requires certain cyclone modifications for successful firing.	Add split dampers, alternate (hot) PA source, & modulate PA volume damper.	n/a
10	Cyclone Slag Fluxing Agen *(Units 7/8 & 31/32 only)*	Monterey coal requires the addition of limestone as a fluxing agent in 31/32.	No Change	n/a
11	Bunker Inerting	PRB coal requires bunker inerting.	Add bunker inerting.	Add bunker inerting.
12	Furnace Cleaning	PRB coal requires waterlances to clean furnace waterwalls.	Add waterlances & pump skid.	Add waterlances & pump skid.
13	Ash Handling System	PRB coal ash solidifies when moistened. Wet conveying systems require special treatment.	Overdilute with water when pulling ash. Scour with bottom ash often.	Overdilute with water when pulling ash. Scour with bottom ash often.

Table V-3
Adjustment of K-T Analysis Scores for Reliance on SO_2 Allowance Market

Option	Allowance Purchase	Normalized	Scaled	"Best = 10" Basis	Rounded Score	Score from 9/22/98 Meeting
1	4963	7596	1.91	8.09	8	9
2	-2422	211	0.05	9.95	10	10
3	29690	32323	8.14	1.86	2	3
4	7089	9722	2.45	7.55	8	5
5	14474	17107	4.31	5.69	6	4
6	37076	39709	10.00	0.00	0	2
7	3283	5916	1.49	8.51	9	8
8	1030	3663	0.92	9.08	9	7
9	10668	13301	3.35	6.65	7	7
10	8415	11048	2.78	7.22	7	9
11	-2632	1	0.00	10.00	10	10
13	26921	29554	7.44	2.56	3	6
14	4753	7386	1.86	8.14	8	8

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APPENDIX C
DALLMAN UNIT 33 SO_2 REMOVAL IMPROVEMENTS

APPENDIX C
DALLMAN UNIT 33 SO_2 REMOVAL IMPROVEMENTS

The basis for this study is the assumption that the Dallman Unit 33 FGD system can consistently achieve 90% SO_2 removal efficiency. However, it is desirable to obtain higher removal efficiency after the onset of Phase II on January 1, 2000. This appendix briefly addresses the alternatives for increasing the removal efficiency performance to 95%.

Options Available

There are several principal means of improving the removal efficiency of a wet limestone FGD system:

1. Increase the gas flow through the absorber (decrease the percent bypass)
2. Increase the liquid flow to the absorber (upgrade or add pumps) to increase the L/G ratio
3. Increase the gas/liquid contact by modifying the spray headers and/or the trays
4. Increase the liquid phase alkalinity by raising the operating pH or by adding organic acid.

Considerations for Dallman Unit 33

Implementation of any of the first three alternatives listed above would result in an increase in the pressure drop across the absorber towers. Review of data from recent FGD operator log sheets indicates that the booster fans typically operate up to their maximum capability at full load conditions. The indicated position of the fan inlet dampers commonly reaches 99 to 100% on a typical day. This indicates that the fans or motors would need to be modified to handle the increased power demand that would occur under the higher ΔP operation.

Review of the booster fan curves and the fan motor data indicates that the fans are designed for two speed operation but are now fitted with single speed motors operating at the "low" design speed for the fan. The cost to change out the motors to ones capable of the higher speed, higher power operation is estimated to be \$120,000 per fan, or \$240,000 total. This capital cost would be accompanied by a constant higher power consumption due to the increased absorber ΔP.

For about half this capital cost, and with no accompanying ΔP increase, an organic acid addition system could be added to enhance the liquid phase alkalinity and easily achieve 95% removal efficiency. The additive could be used only when needed. Experience at other FGD systems producing wallboard grade gypsum shows that the additive usage is compatible with this application. Acceptance of this technique for efficiency enhancement by the utility industry and the gypsum wallboard industry leads Burns & McDonnell to recommend it as the preferred alternative for use at Dallman Unit 33.

APPENDIX D
OFFSITE PRB COAL UNLOADING AND STORAGE OPTIONS

PRB

UNIT		33
OPTIONS		7,9,11,13,14
DESCRIPTION		
Pawnee Transportation		
Clear site		
Prepare pile base		
Runoff collection system		
Treatment bldg & equip.		
Runoff pond		
Improve access road		
Improve site security		
TOTAL		
Curran Site		
Property (90 acre - $5000/acre		
Site prep		
Rail loop		
Rotary dumper		
Coal storage silos		
Truck loadout packages 3		
Truck scale		
Access roads		
Office/break building		
Tools/machinery		
Substation/switchgear, MCC, utilities		
(Pawnee cost items)		(Clear site for t[...] system, treatm[...]
TOTAL		
Dallman Storage		
Clear site		
Prepare pile base		
Runoff collection system		
Treatment bldg & equip.		
Runoff pond		
Improve access road		
Improve site security		
Site prep		
New rail sidings		
Rotary dumper unloader		
Switch engine		
TOTAL		

COST ESTIMATE
PRB Coal Storage Alternatives
Options 7,8,9,10,11,13,14

	DALLMAN			LAKESIDE		TOTAL
UNIT	**33**	**32**	**31**	**8**	**7**	
OPTIONS	7,9,11,13,14	7, 8, 9, 10, 11, 14		NONE		
DESCRIPTION						
Pawnee Transportation						
Clear site						$100,000
Prepare pile base						$100,000
Runoff collection system						$10,000
Treatment bldg & equip.						$50,000
Runoff pond						$20,000
Improve access road						$0
Improve site security						$0
TOTAL						$280,000
Curran Site						
Property (90 acre - $5000/acre						$450,000
Site prep						$220,000
Rail loop						$1,700,000
Rotary dumper						$10,000,000
Coal storage silos						$3,500,000
Truck loadout packages 3						$300,000
Truck scale						$120,000
Access roads						$50,000
Office/break building						$150,000
Tools/machinery						$50,000
Substation/switchgear, MCC, utilities						$200,000
(Pawnee cost items)	(Clear site for truck loading, prepare coal pile base, runoff collection system, treatment bldg, runoff pond)					$280,000
TOTAL						$17,020,000
Dallman Storage						
Clear site						$100,000
Prepare pile base						$100,000
Runoff collection system						$10,000
Treatment bldg & equip.						$50,000
Runoff pond						$20,000
Improve access road						$30,000
Improve site security						$60,000
Site prep						$100,000
New rail sidings						$800,000
Rotary dumper unloader						$10,000,000
Switch engine						$400,000
TOTAL						$11,670,000

APPENDIX E
COST ESTIMATES

Table V-4a
Option 1 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 1

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BASED SO_2 EMISSIONS TONS **
Dallman 3	175	80.0%	1,226,400	11,045	13,545,566	Turris	10,500	645,028	3.10%	5.6095	90.0%	0.5610	3,799	1.1370	4,320
Dallman 2	75	70.0%	459,900	11,452	5,266,775	Turris	10,500	250,799	3.10%	5.6095	95.0%	0.2805	739	1.1370	840
Dallman 1	75	70.0%	459,900	11,596	5,333,000	Turris	10,500	253,952	3.10%	5.6095	95.0%	0.2805	746	1.1370	850
Lakeside 7/8	30	50.0%	131,400	13,199	1,734,349	Turris	10,500	82,588	3.10%	5.6095	0.0%	5.6095	4,864	1.1370	5,531
Lakeside 6/7	30	50.0%	131,400	13,159	1,729,093	Turris	10,500	82,338	3.10%	5.6095	0.0%	5.6095	4,850	1.1370	5,514
TOTAL	385	71.4%	2,409,000	11,461	27,608,804			1,314,705				1.0866	15,000		17,055

UNIT	ALLOCATED ALLOWANCE	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	ANNUAL OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	5,169	849	$22.00	1.05	14,190,616		0	0	0	0	3,171,598	333,552	0	0	2,838,047	17,028,663	13.89	(169,859)	-0.14	16,858,804	13.75
Dallman 2	1,569	729	$22.00	1.05	5,517,574	12,225,000	0	0	12,225,000	1,065,831	916,429	136,896	0	0	779,533	7,362,937	16.01	(145,842)	-0.32	7,217,096	15.69
Dallman 1	1,377	527	$22.00	1.05	5,588,953	12,225,000	0	0	12,225,000	1,065,831	921,516	138,618	0	0	782,898	7,435,682	16.17	(105,330)	-0.23	7,330,352	15.94
Lakeside 7/8	2,539	(2,992)	$22.00	1.05	1,816,937		0	0	0	0			0	0	0	1,816,937	13.83	598,372	4.55	2,415,309	18.38
Lakeside 6/7	1,438	(4,076)	$22.00	1.05	1,811,430		0	0	0	0			0	0	0	1,811,430	13.79	815,220	6.20	2,626,651	19.99
TOTAL	12,092	(4,963)	$22.00	1.05	28,923,509	24,450,000	0	0	24,450,000	2,131,662	5,009,543	609,065	0	0	4,400,477	35,433,549	14.72	992,563	0.41	36,448,212	15.13

CWLP SO2 Allowance Allocation	12,092
Add'l tons SO_2 reduction needed	4,963
Additional % SO_2 reduction needed	29.10%

Unit 33 Tons Limestone	Unit 33 Tons Gypsum
58,950	111,184

Annual Tons Burned by Type

Turris	PRB	Monterey
1,314,705	0	0

OPTION 1

Table V-4b
Option 2 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 2

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BASED SO_2 EMISSIONS TONS **
Dallman 3	175	80.0%	1,226,400	11,045	13,545,566	Turris	10,500	645,028	3.10%	5.6095	90.0%	0.5610	3,799	1.1370	4,320
Dallman 2	75	70.0%	459,900	11,452	5,266,775	Turris	10,500	250,799	3.10%	5.6095	95.0%	0.2805	739	1.1370	840
Dallman 1	75	70.0%	459,900	11,596	5,333,000	Turris	10,500	253,952	3.10%	5.6095	95.0%	0.2805	746	1.1370	850
Lakeside 7/8	30	50.0%	131,400	13,235	1,739,079	Monterey	10,250	84,833	1.00%	1.8537	0.0%	1.8537	1,612	1.1370	1,833
Lakeside 6/7	30	50.0%	131,400	13,195	1,733,823	Monterey	10,250	84,577	1.00%	1.8537	0.0%	1.8537	1,607	1.1370	1,827
TOTAL	385	71.4%	2,409,000	11,465	27,618,265			1,319,189				0.6159	8,504		9,670

UNIT	ALLOCATED ALLOWANCE	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	5,169	849	$22.00	1.05	14,190,616		0	0	0	0	3,171,598	333,552	0	0	2,838,047	17,028,663	13.89	(169,859)	-0.14	16,858,804	13.75
Dallman 2	1,569	729	$22.00	1.05	5,517,574	12,225,000	0	0	12,225,000	1,065,831	916,429	136,896	0	0	779,533	7,362,937	16.01	(145,842)	-0.32	7,217,096	15.69
Dallman 1	1,377	527	$22.00	1.05	5,586,953	12,225,000	0	0	12,225,000	1,065,831	921,516	138,618	0	0	782,898	7,435,682	16.17	(105,330)	-0.23	7,330,352	15.94
Lakeside 7/8	2,539	706	$26.00	1.27	2,205,661		0	46,500	46,500	5,546			0	15,906	15,906	2,227,114	16.95	(141,270)	-1.08	2,085,844	15.87
Lakeside 6/7	1,438	(389)	$26.00	1.27	2,198,995		0	46,500	46,500	5,546			0	15,858	15,858	2,220,400	16.90	77,822	0.59	2,298,222	17.49
TOTAL	12,092	2,422	$22.51	1.08	29,699,799	24,450,000	0	93,000	24,543,000	2,142,755	5,009,543	609,065	0	31,764	4,432,242	36,274,795	15.06	(484,478)	-0.20	35,790,316	14.86

CWLP SO2 Allowance Allocation	12,092
Add'l tons SO_2 reduction needed	(2,422)
Additional % SO_2 reduction needed	-25.05%

Unit 33 Tons Limestone	Unit 33 Tons Gypsum
58,950	111,184

Annual Tons Burned by Type

Turris	PRB	Monterey
1,149,779	0	169,410

Table V-4c
Option 3 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 3

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BASED SO_2 EMISSIONS TONS **
Dallman 3	175	80.0%	1,226,400	11,045	13,545,588	Turris	10,500	645,026	3.10%	5.6095	90.0%	0.5610	3,799	1.1370	4,320
Dallman 2	75	70.0%	459,900	11,452	5,266,775	Turris	10,500	250,798	3.10%	5.6095	0.0%	5.6095	14,772	1.1370	16,796
Dallman 1	75	70.0%	459,900	11,596	5,333,000	Turris	10,500	253,952	3.10%	5.6095	0.0%	5.6095	14,958	1.1370	17,007
Lakeside 7/8	30	50.0%	131,400	13,235	1,739,079	Monterey	10,250	84,833	1.00%	1.8537	0.0%	1.8537	1,612	1.1370	1,833
Lakeside 6/7	30	50.0%	131,400	13,195	1,733,823	Monterey	10,250	84,577	1.00%	1.8537	0.0%	1.8537	1,607	1.1370	1,827
TOTAL	385	71.4%	2,409,000	11,465	27,618,265			1,319,189				2.6611	36,748		41,782
									CWLP SO2 Allowance Allocation						12,092
									Add'l tons SO_2 reduction needed						29,690
									Additional % SO_2 reduction needed						71.06%

UNIT	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	5,169	849	$22.00	1.05	14,190,616		0	0	0	0	3,171,598	333,552	0	0	2,838,047	17,028,663	13.89	(169,859)	-0.14	16,858,804	13.76
Dallman 2	1,569	(15,227)	$22.00	1.05	5,517,574		0	0	0	0			0	0	0	5,517,574	12.00	3,045,364	6.62	8,562,938	18.62
Dallman 1	1,377	(15,630)	$22.00	1.05	5,586,953		0	0	0	0			0	0	0	5,586,953	12.15	3,126,003	6.80	8,712,956	18.95
Lakeside 7/8	2,539	706	$26.00	1.27	2,205,661		0	46,500	46,500	5,546			0	15,906	15,906	2,227,114	16.95	(141,270)	-1.08	2,085,844	15.87
Lakeside 6/7	1,438	(389)	$26.00	1.27	2,198,995		0	46,500	46,500	5,546			0	15,858	15,858	2,220,400	16.90	77,822	0.59	2,298,222	17.49
TOTAL	12,092	(29,690)	$22.51	1.08	29,699,799	0	0	93,000	93,000	11,093	3,171,598	333,552	0	31,764	2,869,811	32,580,702	13.52	5,938,061	2.46	38,518,763	15.99
											Unit 33 Tons	Unit 33 Tons									
											Limestone	Gypsum									
											56,950	111,184									

Annual Tons Burned by Type

Turris	PRB	Monterey
1,149,779	0	169,410

Table V-4d
Option 4 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 4

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BASED SO_2 EMISSIONS TONS **
Dallman 3	175	80.0%	1,226,400	11,045	13,545,588	Turris	10,500	645,026	3.10%	5.6095	90.0%	0.5610	3,799	1.1370	4,320
Dallman 2	75	70.0%	459,900	11,484	5,281,492	Monterey	10,250	257,634	1.00%	1.8537	0.0%	1.8537	4,895	1.1370	5,566
Dallman 1	75	70.0%	459,900	11,626	5,347,717	Monterey	10,250	260,864	1.00%	1.8537	0.0%	1.8537	4,956	1.1370	5,635
Lakeside 7/8	30	50.0%	131,400	13,235	1,739,079	Monterey	10,250	84,833	1.00%	1.8537	0.0%	1.8537	1,612	1.1370	1,833
Lakeside 6/7	30	50.0%	131,400	13,195	1,733,823	Monterey	10,250	84,577	1.00%	1.8537	0.0%	1.8537	1,607	1.1370	1,827
TOTAL	385	71.4%	2,409,000	11,477	27,647,699			1,332,938				1.2203	16,869		19,181
									CWLP SO2 Allowance Allocation						12,092
									Add'l tons SO_2 reduction needed						7,089
									Additional % SO_2 reduction needed						36.96%

UNIT	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	5,169	849	$22.00	1.05	14,190,616		0	2,550,000	2,550,000	222,321	3,171,598	333,552	0	0	2,838,047	17,250,983	14.07	(169,859)	-0.14	17,081,125	13.93
Dallman 2	1,569	(3,997)	$26.00	1.27	6,698,477		0	1,321,500	1,321,500	115,214			0	48,306	48,306	6,861,998	14.92	799,332	1.74	7,661,330	16.66
Dallman 1	1,377	(4,258)	$26.00	1.27	6,782,471		0	1,321,500	1,321,500	115,214			0	48,812	48,812	6,946,597	15.10	851,690	1.85	7,798,287	16.96
Lakeside 7/8	2,539	706	$26.00	1.27	2,205,661		0	81,000	81,000	7,276			0	15,909	15,906	2,228,843	16.96	(141,270)	-1.08	2,087,573	15.89
Lakeside 6/7	1,438	(389)	$26.00	1.27	2,198,995		0	81,000	81,000	7,276			0	15,858	15,858	2,222,129	16.91	77,822	0.59	2,299,951	17.50
TOTAL	12,092	(7,089)	$24.06	1.16	32,078,220	0	0	5,315,000	5,315,000	467,301	3,171,598	333,552	0	128,963	2,967,029	35,510,551	14.74	1,417,716	0.59	36,928,267	15.33
											Unit 33 Tons	Unit 33 Tons									
											Limestone	Gypsum									
											56,950	111,184									

Annual Tons Burned by Type

Turris	PRB	Monterey
645,026	0	687,908

Table V-4e
Option 5 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 5

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS	CEMS Bias Factor	CEMS BASED SO_2 EMISSIONS TONS
Dallman 3	175	80.0%	1,226,400	11,045	13,545,568	Turris	10,500	645,026	3.10%	5.6095	90.0%	0.5610	3,799	1.1370	4,320
Dallman 2	75	70.0%	459,900	11,484	5,281,482	Monterey	10,250	257,634	1.00%	1.8537	0.0%	1.8537	4,895	1.1370	5,566
Dallman 1	75	70.0%	459,900	11,628	5,347,717	Monterey	10,250	260,864	1.00%	1.8537	0.0%	1.8537	4,956	1.1370	5,635
Lakeside 7/8	30	50.0%	131,400	13,199	1,734,349	Turris	10,500	82,588	3.10%	5.6095	0.0%	5.6095	4,864	1.1370	5,531
Lakeside 6/7	30	50.0%	131,400	13,159	1,729,093	Turris	10,500	82,338	3.10%	5.6095	0.0%	5.6095	4,850	1.1370	5,514
TOTAL	385	71.4%	2,409,000	11,473	27,638,236			1,328,452				1.6908	23,365		26,566
									CWLP SO2 Allowance Allocation						12,092
									Add'l tons SO_2 reduction needed						14,474
									Additional % SO_2 reduction needed						54.46%

UNIT	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	/MWH
Dallman 3	5,189	849	$22.00	1.05	14,190,616		0	2,550,000	2,550,000	222,321	3,171,598	333,552	0	0	2,836,047	17,250,983	14.07	(168,858)	-0.14	17,081,125	13.93
Dallman 2	1,569	(3,997)	$26.00	1.27	6,698,477		0	1,321,500	1,321,500	115,214			0	48,306	48,306	6,861,998	14.92	798,332	1.74	7,661,330	16.66
Dallman 1	1,377	(4,258)	$26.00	1.27	6,782,471		0	1,321,500	1,321,500	115,214			0	48,912	48,912	6,946,597	15.10	851,690	1.85	7,798,287	16.96
Lakeside 7/8	2,539	(2,992)	$22.00	1.05	1,816,937		0	0	0	0			0	0	0	1,816,937	13.83	598,372	4.55	2,415,309	18.38
Lakeside 6/7	1,438	(4,076)	$22.00	1.05	1,811,430		0	0	0	0			0	0	0	1,811,430	13.79	815,220	6.20	2,626,651	19.99
TOTAL	12,092	(14,474)	$23.56	1.13	31,289,931	0	0	5,193,000	5,193,000	452,749	3,171,598	333,552	0	97,218	2,935,265	34,687,945	14.40	2,594,757	1.20	37,582,702	15.60
											Unit 33 Tons	Unit 33 Tons									
											Limestone	Gypsum									
											58,950	111,164									

Annual Tons Burned by Type

Turris	PRB	Monterey
809,954	0	518,498

Table V-4f
Option 6 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 6

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS	CEMS Bias Factor	CEMS BASED SO_2 EMISSIONS TONS
Dallman 3	175	80.0%	1,226,400	11,045	13,545,568	Turris	10,500	645,026	3.10%	5.6095	90.0%	0.5610	3,799	1.1370	4,320
Dallman 2	75	70.0%	459,900	11,452	5,266,775	Turris	10,500	250,799	3.10%	5.6095	0.0%	5.6095	14,772	1.1370	16,796
Dallman 1	75	70.0%	459,900	11,596	5,333,000	Turris	10,500	253,952	3.10%	5.6095	0.0%	5.6095	14,958	1.1370	17,007
Lakeside 7/8	30	50.0%	131,400	13,199	1,734,349	Turris	10,500	82,588	3.10%	5.6095	0.0%	5.6095	4,864	1.1370	5,531
Lakeside 6/7	30	50.0%	131,400	13,159	1,729,093	Turris	10,500	82,338	3.10%	5.6095	0.0%	5.6095	4,850	1.1370	5,514
TOTAL	385	71.4%	2,409,000	11,461	27,608,804			1,314,705				3.1326	43,243		49,168
									CWLP SO2 Allowance Allocation						12,092
									Add'l tons SO_2 reduction needed						37,076
									Additional % SO_2 reduction needed						75.41%

UNIT	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	/MWH
Dallman 3	5,189	849	$22.00	1.05	14,190,616		0	0	0	0	3,171,598	333,552	0	0	2,838,047	17,028,663	13.89	(169,858)	-0.14	16,858,804	13.75
Dallman 2	1,569	(15,227)	$22.00	1.05	5,517,574		0	0	0	0			0	0	0	5,517,574	12.00	3,045,384	6.62	8,562,938	18.62
Dallman 1	1,377	(15,630)	$22.00	1.05	5,586,953		0	0	0	0			0	0	0	5,586,953	12.15	3,126,003	6.80	8,712,956	18.95
Lakeside 7/8	2,539	(2,992)	$22.00	1.05	1,816,937		0	0	0	0			0	0	0	1,816,937	13.83	598,372	4.55	2,415,309	18.38
Lakeside 6/7	1,438	(4,076)	$22.00	1.05	1,811,430		0	0	0	0			0	0	0	1,811,430	13.79	815,220	6.20	2,626,651	19.99
TOTAL	12,092	(37,076)	$22.00	1.05	28,923,309	0	0	0	0	0	3,171,598	333,552	0	0	2,838,047	31,761,556	13.18	7,415,101	3.08	39,176,657	16.26
											Unit 33 Tons	Unit 33 Tons									
											Limestone	Gypsum									
											58,950	111,164									

Annual Tons Burned by Type

Turris	PRB	Monterey
1,314,705	0	0

Table V-4g
Option 7 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 7

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU
Dallman 3	175	80.0%	1,226,400	11,230	13,772,472	PRB	8,375	822,237	0.37%	0.8394	0.0%	0.8394
Dallman 2	75	70.0%	459,900	11,643	5,354,616	PRB	8,375	319,679	0.37%	0.8394	0.0%	0.8394
Dallman 1	75	70.0%	459,900	11,790	5,422,221	PRB	8,375	323,715	0.37%	0.8394	0.0%	0.8394
Lakeside 7/8	30	50.0%	131,400	13,235	1,739,079	Monterey	10,250	84,833	1.00%	1.8537	0.0%	1.8537
Lakeside 6/7	30	50.0%	131,400	13,195	1,733,823	Monterey	10,250	84,577	1.00%	1.8537	0.0%	1.8537
TOTAL	385	71.4%	2,409,000	11,632	28,022,211			1,835,040				0.9651

UNIT	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BASED SO_2 EMISSIONS TONS **	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $
Dallman 3	5,760	1.1370	6,572	5,169	(1,403)	$24.25	1.45	19,939,251	100,000	410,000	4,082,031	4,592,031	400,364
Dallman 2	2,247	1.1370	2,555	1,569	(986)	$24.25	1.45	7,752,206		365,000	1,888,270	2,253,270	196,450
Dallman 1	2,276	1.1370	2,587	1,377	(1,210)	$24.25	1.45	7,850,081		365,000	1,902,369	2,267,369	197,880
Lakeside 7/8	1,612	1.1370	1,833	2,539	706	$26.00	1.27	2,205,661		0	46,500	46,500	5,546
Lakeside 6/7	1,607	1.1370	1,827	1,438	(389)	$26.00	1.27	2,198,995		0	46,500	46,500	5,546
TOTAL	13,522		15,375	12,092	(3,283)	$24.43	1.43	38,946,193	100,000	1,140,000	7,985,670	9,205,670	805,577
CWLP SO2 Allowance Allocation			12,092										
Add'l tons SO_2 reduction needed			3,283										
Additional % SO_2 reduction needed			21.35%										

UNIT	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3		0	468,512	0	468,512	20,828,116	16.98	280,646	0.23	21,108,763	17.21
Dallman 2			189,929	0	189,929	8,138,554	17.70	197,246	0.43	8,335,829	18.13
Dallman 1			192,327	0	192,327	8,240,088	17.92	242,097	0.53	8,482,185	18.44
Lakeside 7/8			0	15,906	15,906	2,227,114	16.95	(141,270)	-1.08	2,085,844	15.87
Lakeside 6/7			0	15,858	15,858	2,220,400	16.90	77,822	0.59	2,298,222	17.49
TOTAL	0	0	870,768	31,764	902,532	41,654,302	17.29	656,541	0.27	42,310,843	17.56
	Unit 33 Tons Limestone	Unit 33 Tons Gypsum									
	0	0									

Annual Tons Burned by Type

Turris	PRB	Monterey
0	1,465,630	169,410

Table V-4h
Option 8 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 8

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU
Dallman 3	175	80.0%	1,226,400	11,045	13,545,588	Turris	10,500	645,028	3.10%	5.6095	90.0%	0.5610
Dallman 2	75	70.0%	459,900	11,643	5,354,616	PRB	8,375	319,679	0.37%	0.8394	0.0%	0.8394
Dallman 1	75	70.0%	459,900	11,790	5,422,221	PRB	8,375	323,715	0.37%	0.8394	0.0%	0.8394
Lakeside 7/8	30	50.0%	131,400	13,235	1,739,079	Monterey	10,250	84,833	1.00%	1.8537	0.0%	1.8537
Lakeside 6/7	30	50.0%	131,400	13,195	1,733,823	Monterey	10,250	84,577	1.00%	1.8537	0.0%	1.8537
TOTAL	385	71.4%	2,409,000	11,538	27,798,327			1,457,631				0.8304

UNIT	FUEL BASED SO_2 EMISSIONS TONS **	CEMS *Bias Factor	CEMS BASED SO_2 EMISSIONS TONS **	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $
Dallman 3	3,799	1.1370	4,320	5,169	849	$22.00	1.05	14,190,616		0	2,550,000	2,550,000	222,321
Dallman 2	2,247	1.1370	2,555	1,569	(986)	$24.25	1.45	7,752,205		365,000	3,768,187	4,133,187	360,350
Dallman 1	2,276	1.1370	2,567	1,377	(1,210)	$24.25	1.45	7,850,081		365,000	3,782,285	4,147,285	361,579
Lakeside 7/8	1,612	1.1370	1,833	2,539	706	$26.00	1.27	2,205,661		0	46,500	46,500	5,546
Lakeside 6/7	1,607	1.1370	1,827	1,436	(389)	$26.00	1.27	2,198,995		0	46,500	46,500	5,546
TOTAL	11,541		13,122	12,092	(1,030)	$23.45	1.23	34,197,556	0	730,000	10,193,472	10,923,472	955,343
CWLP SO2 Allowance Allocation			12,092										
Add'l tons SO_2 reduction needed			1,030										
Additional % SO_2 reduction needed			7.85%										

UNIT	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	3,171,598	333,552	0	0	2,838,047	17,250,983	14.07	(169,858)	-0.14	17,081,125	13.93
Dallman 2			189,929	0	189,929	8,302,484	18.05	197,245	0.43	8,499,729	18.48
Dallman 1			192,327	0	192,327	8,403,987	18.27	242,097	0.53	8,646,085	18.80
Lakeside 7/8			0	15,906	15,906	2,227,114	16.95	(141,270)	-1.08	2,085,844	15.87
Lakeside 6/7			0	15,858	15,858	2,220,400	16.90	77,822	0.59	2,298,222	17.49
TOTAL	3,171,598	333,552	382,256	31,764	3,252,067	38,404,966	15.94	206,038	0.09	38,611,004	16.03
	Unit 33 Tons Limestone	Unit 33 Tons Gypsum									
	58,950	111,164									

Annual Tons Burned by Type

Turris	PRB	Monterey
645,028	643,393	169,410

Table V-4I
Option 9 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 9

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BIASED SO_2 EMISSIONS TONS **	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $
Dallman 3	175	80.0%	1,226,400	11,230	13,772,472	PRB	8,375	822,237	0.37%	0.8394	0.0%	0.8394	5,780	1.1370	6,572	5,169	(1,403)	$24.25	1.45	19,939,251
Dallman 2	75	70.0%	459,900	11,643	5,354,616	PRB	8,375	319,679	0.37%	0.8394	0.0%	0.8394	2,247	1.1370	2,555	1,569	(986)	$24.25	1.45	7,752,206
Dallman 1	75	70.0%	459,900	11,790	5,422,221	PRB	8,375	323,715	0.37%	0.8394	0.0%	0.8394	2,276	1.1370	2,587	1,377	(1,210)	$24.25	1.45	7,850,081
Lakeside 7/8	30	50.0%	131,400	13,199	1,734,349	Turris	10,500	82,588	3.10%	5.6095	0.0%	5.6095	4,864	1.1370	5,531	2,539	(2,992)	$22.00	1.05	1,816,937
Lakeside 6/7	30	50.0%	131,400	13,159	1,729,093	Turris	10,500	82,336	3.10%	5.6095	0.0%	5.6095	4,850	1.1370	5,514	1,438	(4,078)	$22.00	1.05	1,811,430
TOTAL	385	71.4%	2,409,000	11,626	28,012,750			1,630,556				1.4292	20,018		22,780	12,092	(10,688)	$24.02	1.40	39,169,903

UNIT	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	100,000	410,000	4,082,031	4,592,031	400,354		0	488,512	0	488,512	20,828,116	16.98	280,646	0.23	21,108,763	17.21
Dallman 2		365,000	1,888,270	2,253,270	196,450			189,929	0	189,929	8,138,584	17.70	197,245	0.43	8,335,829	18.13
Dallman 1		365,000	1,902,369	2,267,369	197,680			192,327	0	192,327	8,240,088	17.92	242,097	0.53	8,482,185	18.44
Lakeside 7/8		0	0	0	0			0	0	0	1,816,937	13.83	598,372	4.55	2,415,309	18.38
Lakeside 6/7		0	0	0	0			0	0	0	1,811,430	13.79	815,220	6.20	2,626,651	19.99
TOTAL	100,000	1 140,000	7,872,670	9,112,670	794,484	0	0	870,768	0	870,768	40,835,185	16.95	2,133,582	0.89	42,968,737	17.84

CWLP SO2 Allowance Allocation	12,092
Add'l tons SO_2 reduction needed	10,688
Additional % SO_2 reduction needed	46.87%

Unit 33 Tons Limestone	Unit 33 Tons Gypsum
0	0

Annual Tons Burned by Type

Turris	PRB	Monterey
164,926	1,465,630	0

Table V-4J
Option 10 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 10

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BIASED SO_2 EMISSIONS TONS **	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $
Dallman 3	175	80.0%	1,226,400	11,045	13,545,586	Turris	10,500	645,028	3.10%	5.6095	90.0%	0.5610	3,799	1.1370	4,320	5,169	849	$22.00	1.05	14,190,818
Dallman 2	75	70.0%	459,900	11,643	5,354,616	PRB	8,375	319,679	0.37%	0.8394	0.0%	0.8394	2,247	1.1370	2,555	1,569	(986)	$24.25	1.45	7,752,205
Dallman 1	75	70.0%	459,900	11,790	5,422,221	PRB	8,375	323,715	0.37%	0.8394	0.0%	0.8394	2,276	1.1370	2,587	1,377	(1,210)	$24.25	1.45	7,850,081
Lakeside 7/8	30	50.0%	131,400	13,199	1,734,349	Turris	10,500	82,588	3.10%	5.6095	0.0%	5.6095	4,864	1.1370	5,531	2,539	(2,992)	$22.00	1.05	1,816,937
Lakeside 6/7	30	50.0%	131,400	13,158	1,729,093	Turris	10,500	82,336	3.10%	5.6095	0.0%	5.6095	4,850	1.1370	5,514	1,438	(4,076)	$22.00	1.05	1,811,430
TOTAL	385	71.4%	2,409,000	11,534	27,785,866			1,453,347				1.2982	18,036		20,507	12,092	(8,415)	$23.00	1.20	33,421,269

UNIT	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3		0	2,550,000	2,550,000	222,321	3,171,598	333,552	0	0	2,838,047	17,250,983	14.07	(169,859)	-0.14	17,081,125	13.93
Dallman 2		365,000	3,768,187	4,133,187	360,350			189,929	0	189,929	8,302,484	18.05	197,245	0.43	8,499,728	18.48
Dallman 1		365,000	3,782,285	4,147,285	361,579			192,327	0	192,327	8,403,987	18.27	242,097	0.53	8,646,085	18.80
Lakeside 7/8		0	0	0	0			0	0	0	1,816,937	13.83	598,372	4.55	2,415,309	18.38
Lakeside 6/7		0	0	0	0			0	0	0	1,811,430	13.79	815,220	6.20	2,626,651	19.99
TOTAL	0	730,000	10,100,472	10,830,472	944,250	3,171,598	333,552	382,256	0	3,220,303	37,585,822	15.60	1,683,077	0.70	39,268,898	16.30

CWLP SO2 Allowance Allocation	12,092
Add'l tons SO_2 reduction needed	8,415
Additional % SO_2 reduction needed	41.04%

Unit 33 Tons Limestone	Unit 33 Tons Gypsum
58,950	111,184

Annual Tons Burned by Type

Turris	PRB	Monterey
809,954	643,393	0

Table V-4k
Option 11 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 11

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/ KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/ MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/ MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BIASED SO_2 EMISSIONS TONS **
Dallman 3	176	80.0%	1,226,400	11,230	13,772,472	PRB	8,375	822,237	0.37%	0.6394	90.0%	0.0639	578	1.1370	657
Dallman 2	75	70.0%	459,900	11,643	5,354,616	PRB	8,375	319,679	0.37%	0.6394	0.0%	0.6394	2,247	1.1370	2,555
Dallman 1	75	70.0%	459,900	11,790	5,422,221	PRB	8,375	323,715	0.37%	0.6394	0.0%	0.6394	2,276	1.1370	2,587
Lakeside 7/8	30	50.0%	131,400	13,235	1,739,079	Monterey	10,250	84,833	1.00%	1.6537	0.0%	1.6537	1,612	1.1370	1,833
Lakeside 6/7	30	50.0%	131,400	13,195	1,733,823	Monterey	10,250	84,577	1.00%	1.6537	0.0%	1.6537	1,607	1.1370	1,827
TOTAL	385	71.4%	2,409,000	11,632	28,022,211			1,635,040				0.5938	8,320		9,460
									CWLP SO2 Allowance Allocation						12,092
									Add'l tons SO_2 reduction needed						(2,632)
									Additional % SO_2 reduction needed						-27.83%

UNIT	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	5,169	4,512	$24.25	1.45	19,939,251		$410,000	4,082,031	4,492,031	391,636	2,707,544	50,748	488,512	0	3,145,307	23,476,194	19.14	(902,355)	-0.74	22,573,836	18.41
Dallman 2	1,569	(986)	$24.25	1.45	7,752,205		$365,000	1,888,270	2,253,270	196,450		0	189,929	0	189,929	8,138,564	17.70	197,245	0.43	8,335,829	18.13
Dallman 1	1,377	(1,210)	$24.25	1.45	7,850,081		$365,000	1,902,369	2,267,369	197,680		0	192,327	0	192,327	8,240,088	17.92	242,097	0.53	8,482,185	18.44
Lakeside 7/8	2,539	706	$26.00	1.27	2,205,661		$0	46,500	46,500	5,546			0	15,906	15,906	2,227,114	16.95	(141,270)	-1.08	2,085,844	15.87
Lakeside 6/7	1,438	(389)	$26.00	1.27	2,198,995		$0	46,500	46,500	5,546			0	15,858	15,858	2,220,400	16.90	77,822	0.59	2,298,222	17.49
TOTAL	12,092	2,632	$24.43	1.43	39,946,193	0	1,140,000	7,965,670	9,105,670	796,858	2,707,544	50,748	870,768	31,764	3,559,328	44,302,379	18.39	(526,461)	-0.22	43,775,918	18.17
											Unit 33 Tons	Unit 33 Tons									
											Limestone	Gypsum									
											8,969	16,916									

Annual Tons Burned by Type

Turris	PRB	Monterey
0	1,465,630	169,410

Table V-4l
Option 13 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 13

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/ KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/ MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/ MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BIASED SO_2 EMISSIONS TONS **
Dallman 3	175	80.0%	1,226,400	11,193	13,727,085	PRB/Turris	8,800	779,949	0.92%	1.9864	90.0%	0.1986	1,363	1.1370	1,550
Dallman 2	75	70.0%	459,900	11,452	5,266,775	Turris	10,500	250,799	3.10%	5.6095	0.0%	5.6095	14,772	1.1370	16,796
Dallman 1	75	70.0%	459,900	11,596	5,333,000	Turris	10,500	253,952	3.10%	5.6095	0.0%	5.6095	14,958	1.1370	17,007
Lakeside 7/8	30	50.0%	131,400	13,235	1,739,079	Monterey	10,250	84,833	1.00%	1.6537	0.0%	1.6537	1,612	1.1370	1,833
Lakeside 6/7	30	50.0%	131,400	13,195	1,733,823	Monterey	10,250	84,577	1.00%	1.6537	0.0%	1.6537	1,607	1.1370	1,827
TOTAL	385	71.4%	2,409,000	11,540	27,799,772			1,454,110				2.4665	34,312		39,013
									CWLP SO2 Allowance Allocation						12,092
									Add'l tons SO_2 reduction needed						26,921
									Additional % SO_2 reduction needed						69.00%

UNIT	ALLOCATED ALLOWANCES	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $200 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	5,169	3,619	$23.60	1.35	18,562,776		410,000	7,360,758	7,770,758	677,490	2,621,305	119,695	363,830	0	3,065,440	22,305,707	18.19	(723,774)	-0.59	21,581,933	17.60
Dallman 2	1,569	(15,227)	$22.00	1.05	5,517,574		0	1,275,000	1,275,000	111,160		0	0	0	0	5,628,734	12.24	3,045,364	6.62	8,674,098	18.86
Dallman 1	1,377	(15,630)	$22.00	1.05	5,586,953		0	1,275,000	1,275,000	111,160		0	0	0	0	5,698,113	12.39	3,126,003	6.80	8,824,116	19.19
Lakeside 7/8	2,539	706	$26.00	1.27	2,205,661		0	46,500	46,500	5,546			0	15,906	15,906	2,227,114	16.95	(141,270)	-1.08	2,085,844	15.87
Lakeside 6/7	1,438	(389)	$26.00	1.27	2,198,995		0	46,500	46,500	5,546			0	15,858	15,858	2,220,400	16.90	77,822	0.59	2,298,222	17.49
TOTAL	12,092	(26,921)	$23.43	1.23	34,071,959	0	410,000	10,003,758	10,413,758	910,903	2,621,305	119,695	363,830	31,764	3,097,205	38,080,067	15.81	5,384,145	2.24	43,464,212	18.04
											Unit 33 Tons	Unit 33 Tons									
											Limestone	Gypsum									
											21,154	39,896									

NOTE: PRB/Turris blend is 80/20 by weight

Annual Tons Burned by Type

Turris	PRB	Monterey
660,741	623,959	169,410

Table V-4m
Option 14 Economic Analysis

CITY WATER, LIGHT AND POWER
PHASE II COMPLIANCE STUDY

OPTION 14

UNIT	NET MW	LOAD FACTOR	NET MWH	NET HEAT RATE BTU/KWH	TOTAL MMBTU	TYPE COAL BURNED IN BOILER	COAL HEATING VALUE BTU/LB	TOTAL TONS COAL BURNED	FUEL % S	RAW SO_2 RATE LBS/MMBTU	SO_2 CLEANUP EFFCY	NET SO_2 RATE LBS/MMBTU	FUEL BASED SO_2 EMISSIONS TONS **	CEMS Bias Factor	CEMS BIASED SO_2 EMISSIONS TONS **
Dallman 3	175	80.0%	1,226,400	11,230	13,772,472	PRB	8,375	822,237	0.37%	0.8394	90.0%	0.0839	578	1.1370	657
Dallman 2	75	70.0%	459,900	11,643	5,354,816	PRB	8,375	318,879	0.37%	0.8394	0.0%	0.8394	2,247	1.1370	2,555
Dallman 1	75	70.0%	459,900	11,790	5,422,221	PRB	8,375	323,715	0.37%	0.8394	0.0%	0.8394	2,276	1.1370	2,587
Lakeside 7/8	30	50.0%	131,400	13,199	1,734,349	Turris	10,500	82,588	3.10%	5.6095	0.0%	5.6095	4,864	1.1370	5,531
Lakeside 6/3	30	50.0%	131,400	13,159	1,729,083	Turris	10,500	82,338	3.10%	5.6095	0.0%	5.6095	4,850	1.1370	5,514
TOTAL	365	71.4%	2,409,000	11,628	28,012,750			1,630,856				1.0577	14,815		16,845
									CWLP SO2 Allowance Allocation						12,092
									Add'l tons SO_2 reduction needed						4,753
									Additional % SO_2 reduction needed						28.22%

UNIT	ALLOCATED ALLOWANCE	ALLOWANCE BALANCE	FUEL PRICE $ PER TON	FUEL PRICE $ PER MMBTU	FUEL COST $	CAPITAL COST OF MODIFICATIONS: SCRUBBER	BOILER	COAL HANDLING	TOTAL	ANNUALIZED MODIFICATION CAPITAL COST $
Dallman 3	5,169	4,512	$24.25	1.448	19,938,251		410,000	4,082,031	4,492,031	391,836
Dallman 2	1,569	(986)	$24.25	1.448	7,752,205		365,000	1,888,270	2,253,270	196,450
Dallman 1	1,377	(1,210)	$24.25	1.448	7,850,061		365,000	1,902,369	2,267,369	197,680
Lakeside 7/8	2,539	(2,992)	$22.00	1.048	1,818,837		0	0	0	0
Lakeside 6/3	1,438	(4,076)	$22.00	1.048	1,811,430		0	0	0	0
TOTAL	12,092	(4,753)	$24.02	1.398	39,169,903	0	1,140,000	7,872,870	9,012,870	785,766

UNIT	FIRST YEAR OPERATING COST EFFECTS OF MODIFICATION: SCRUBBER O&M COST $	GYPSUM SALES $	BOILER COST $	COAL HANDLING $	TOTAL $	TOTAL ANNUAL FUEL, CAPITAL AND O & M COST $	$/MWH	ALLOWANCE EXPENDITURE $208 PER TON	$ PER MWH	TOTAL ANNUAL EVALUATED COST $	$/MWH
Dallman 3	2,707,544	50,748	488,512	0	3,145,307	23,476,194	19.14	(902,358)	-0.74	22,573,838	18.41
Dallman 2		0	189,929	0	189,929	8,138,584	17.70	197,248	0.43	8,335,829	18.13
Dallman 1		0	192,327	0	192,327	8,240,088	17.92	242,097	0.53	8,482,165	18.44
Lakeside 7/8			0	0	0	1,818,937	13.83	598,372	4.55	2,415,309	18.38
Lakeside 6/3			0	0	0	1,811,430	13.79	615,220	6.20	2,628,651	19.99
TOTAL	2,707,544	50,748	870,768	0	3,527,563	43,483,232	18.05	950,580	0.39	44,433,812	18.44

Unit 33 Tons Limestone	Unit 33 Tons Gypsum
6,959	16,916

Annual Tons Burned by Type

Turris	PRB	Monterey
164,926	1,465,830	0

FGD System Cost Estimate
Dallman Units 31 & 32

Item	TOTAL INSTALLED COST (1998$)
1. Absorber Module	
317LMN Shell	$1,846,500
Inlet Nozzles (C276)	$215,250
Mist Eliminators (FRP)	$209,500
M.E. Spray Headers (317LMN)	$135,000
Recycle Spray Headers (317LMN)	$350,300
Foundations	$77,900
2. Absorber Outlet Elbows (C.S.)	$189,000
3. Absorber Outlet Elbows & Ducts (C276 Wallpaper)	$505,000
4. Absorber Agitators	$307,000
5. Pumps	
Reagent Feed Pumps	$32,000
Recycle Pumps	$1,200,000
Slurry Bleed Pumps	$24,000
By-product Transfer pumps	$54,000
Return Water Pumps	$28,000
Mist Eliminator Wash Pumps	$32,000
Absorber Area Sump Pumps	$72,000
6. Tanks	
M.E. Wash Tank	$36,000
By-product Transfer Tank	$40,000
7. Recycle Pump Suction Valves	$262,500
8. Vertical Agitators	$28,000
9. Piping	
Reagent Feed Piping (FRP)	$130,000
Recycle Piping (FRP)	$800,000
Slurry Bleed Piping (FRP)	$30,000
Mist Eliminator Wash Piping (FRP)	$15,000
By-product Transfer Piping (FRP)	$65,000
Return Water Piping (FRP)	$75,000
Sump Pump Piping (FRP)	$25,000
Compressed Air Piping (C.S.)	$75,000
Fire Protection Water Piping	$80,000
Oxidation Air Piping	$185,000
10. Valves for Above Systems	$375,000
11. By-product Hydroclones	$60,000
12. Booster Fans	$1,000,000
Fan foundations	$42,000
13. Oxidation Air Compressors	$330,000
14. Elevator	$100,000
15. Instruments & Controls	$1,000,000
16. Electrical (10%)	$1,600,000
17. Civil	$500,000
18. Chimney	
Existing stack liner lining	$1,975,000
Column modifications	$100,000
19. Absorber building	$850,000
Building foundations	$278,500
20. Ductwork	$1,226,900
Foundations	$150,800
Demolition of existing	$183,900
21. Dampers	$540,000
22. Pipe rack to 33 FGD system	$227,700
23. Ball Mill w/ball charge, weigh feeder	$1,387,500
TOTAL	$19,071,250
Engineering (8%)	$1,525,700
Contingency (20%)	$3,814,250
GRAND TOTAL	$24,411,200
$/KW	$163

COST ESTIMATE SUMMARY
Unit Modifications

UNIT		TOTAL
OPTION 1		
Dallman 33		$0
Dallman 32		$0
Dallman 31		$0
Lakeside 8		$0
Lakeside 7		$0
OPTION 2		
Dallman 33		$0
Dallman 32		$0
Dallman 31		$0
Lakeside 8		$0
Lakeside 7		$0
OPTION 3		
Dallman 33		$0
Dallman 32		$0
Dallman 31		$0
Lakeside 8		$0
Lakeside 7		$0
OPTION 4		
Dallman 33		$0
Dallman 32		$0
Dallman 31		$0
Lakeside 8		$0
Lakeside 7		$0
OPTION 5		
Dallman 33		$0
Dallman 32		$0
Dallman 31		$0
Lakeside 8		$0
Lakeside 7		$0
OPTION 6		
Dallman 33		$0
Dallman 32		$0
Dallman 31		$0
Lakeside 8		$0
Lakeside 7		$0
OPTION 7		
Dallman 33		$410,000
Dallman 32		$365,000
Dallman 31		$365,000
Lakeside 8		$0
Lakeside 7		$0

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COST ESTIMATE SUMMARY

Unit Modifications

UNIT		TOTAL
OPTION 8		
Dallman 33		$0
Dallman 32		$365,000
Dallman 31		$365,000
Lakeside 8		$0
Lakeside 7		$0
OPTION 9		
Dallman 33		$410,000
Dallman 32		$365,000
Dallman 31		$365,000
Lakeside 8		$0
Lakeside 7		$0
OPTION 10		
Dallman 33		$0
Dallman 32		$365,000
Dallman 31		$365,000
Lakeside 8		$0
Lakeside 7		$0
OPTION 11		
Dallman 33		$410,000
Dallman 32		$365,000
Dallman 31		$365,000
Lakeside 8		$0
Lakeside 7		$0
OPTION 13		
Dallman 33		$410,000
Dallman 32		$0
Dallman 31		$0
Lakeside 8		$0
Lakeside 7		$0
OPTION 14		
Dallman 33		$410,000
Dallman 32		$365,000
Dallman 31		$365,000
Lakeside 8		$0
Lakeside 7		$0

COST ESTIMATE
UNIT MODIFICATIONS
Options 7,8,9,10,11,13,14

	DALLMAN			LAKESIDE		TOTAL
UNIT	**33**	**32**	**31**	**8**	**7**	
OPTIONS	7,9,11,13,14	7,8,9,10,11,14		NONE		
DESCRIPTION	MOD 2	MOD 1	MOD 1			
Modification 1						
Raise coal feeder leveling bar		$15,000	$15,000			$30,000
Cyclone						
Split dampers		$5,000	$5,000			$10,000
Alternate (hot) PA source		$25,000	$25,000			$50,000
Modulating PA volume damper		$20,000	$20,000			$40,000
Add coal bunker inerting		$100,000	$100,000			$200,000
Furnace - add waterlances and pump skid		$200,000	$200,000			$400,000
Modification 2						
Add electronic coal feeder weigh system & raise feeder leveling bar	$80,000					$80,000
Upgrade exhausters (4)	$60,000					
Add mill inerting	$200,000					$200,000
Add mill wash nozzles	$70,000					$70,000
Add coal bunker inerting	$240,000					$240,000
Furnace - add waterlances and pump skid	$800,000					$800,000
						$0
						$0
						$0
TOTALS	$410,000	$365,000	$365,000			$1,080,000
Option	7,9,11,14	8, 10	13			
Dallman 33	$410,000	$0	$410,000			
Dallman 32	$365,000	$365,000	$0			
Dallman 31	$365,000	$365,000	$0			
Lakeside 8	$0	$0	$0			
Lakeside 7	$0	$0	$0			

COST ESTIMATE SUMMARY
Coal Handling Modifications

UNIT		Limestone Addition	Two-coal Piles	PRB Coal Handling	Crusher Upgrade	Off-site Storage		TOTAL
OPTION 1								
Dallman 33								$0
Dallman 32								$0
Dallman 31								$0
Lakeside 8								$0
Lakeside 7								$0
OPTION 2								
Dallman 33		$0						$0
Dallman 32		$0						$0
Dallman 31		$0						$0
Lakeside 8		$46,500						$46,500
Lakeside 7		$46,500						$46,500
OPTION 3								
Dallman 33		$0						$0
Dallman 32		$0						$0
Dallman 31		$0						$0
Lakeside 8		$46,500						$46,500
Lakeside 7		$46,500						$46,500
OPTION 4								
Dallman 33		$0	$2,550,000					$2,550,000
Dallman 32		$46,500	$1,275,000					$1,321,500
Dallman 31		$46,500	$1,275,000					$1,321,500
Lakeside 8		$61,000	$0					$61,000
Lakeside 7		$61,000	$0					$61,000
OPTION 5								
Dallman 33		$0	$2,550,000					$2,550,000
Dallman 32		$46,500	$1,275,000					$1,321,500
Dallman 31		$46,500	$1,275,000					$1,321,500
Lakeside 8		$0	$0					$0
Lakeside 7		$0	$0					$0
OPTION 6								
Dallman 33								$0
Dallman 32								$0
Dallman 31								$0
Lakeside 8								$0
Lakeside 7								$0
OPTION 7								
Dallman 33		$0		$1,116,500	$0	$2,965,531		$4,082,031
Dallman 32		$0		$558,250	$120,000	$1,210,020		$1,888,270
Dallman 31		$0		$558,250	$120,000	$1,224,119		$1,902,369

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COST ESTIMATE SUMMARY
Coal Handling Modifications

UNIT		Limestone Addition	Two-coal Piles	PRB Coal Handling	Crusher Upgrade	Off-site Storage		TOTAL
Lakeside 8		$46,500		$0	$0	$0		$46,500
Lakeside 7		$46,500		$0	$0	$0		$46,500
OPTION 8								
Dallman 33		$0	$2,550,000	$0	$0	$0		$2,550,000
Dallman 32		$0	$1,275,000	$1,116,500	$120,000	$1,256,687		$3,768,187
Dallman 31		$0	$1,275,000	$1,116,500	$120,000	$1,270,785		$3,782,285
Lakeside 8		$46,500	$0	$0	$0	$0		$46,500
Lakeside 7		$46,500	$0	$0	$0	$0		$46,500
OPTION 9								
Dallman 33				$1,116,500	$0	$2,965,531		$4,082,031
Dallman 32				$558,250	$120,000	$1,210,020		$1,888,270
Dallman 31				$558,250	$120,000	$1,224,119		$1,902,369
Lakeside 8				$0	$0	$0		$0
Lakeside 7				$0	$0	$0		$0
OPTION 10								
Dallman 33			$2,550,000	$0	$0	$0		$2,550,000
Dallman 32			$1,275,000	$1,116,500	$120,000	$1,256,687		$3,768,187
Dallman 31			$1,275,000	$1,116,500	$120,000	$1,270,785		$3,782,285
Lakeside 8			$0	$0	$0	$0		$0
Lakeside 7			$0	$0	$0	$0		$0
OPTION 11								
Dallman 33		$0		$1,116,500	$0	$2,965,531		$4,082,031
Dallman 32		$0		$558,250	$120,000	$1,210,020		$1,888,270
Dallman 31		$0		$558,250	$120,000	$1,224,119		$1,902,369
Lakeside 8		$46,500		$0	$0	$0		$46,500
Lakeside 7		$46,500		$0	$0	$0		$46,500
OPTION 13								
Dallman 33		$0	$2,550,000	$2,233,000		$2,577,758		$7,360,758
Dallman 32		$0	$1,275,000	$0		$0		$1,275,000
Dallman 31		$0	$1,275,000	$0		$0		$1,275,000
Lakeside 8		$46,500	$0	$0		$0		$46,500
Lakeside 7		$46,500	$0	$0		$0		$46,500
OPTION 14								
Dallman 33				$1,116,500	$0	$2,965,531		$4,082,031
Dallman 32				$558,250	$120,000	$1,210,020		$1,888,270
Dallman 31				$558,250	$120,000	$1,224,119		$1,902,369
Lakeside 8				$0	$0	$0		$0
Lakeside 7				$0	$0	$0		$0

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COST ESTIMATE
LIMESTONE ADDITION SYSTEM
Options 2,3,5,7,8,11,13

	DALLMAN			LAKESIDE		TOTAL
UNIT	**33**	**32**	**31**	**8**	**7**	
OPTIONS	NONE	5		2,3,7,8,11,13		
DESCRIPTION						
Relocate LS silo		$10,500	$10,500	$10,500	$10,500	$21,000
Silo foundation		$5,000	$5,000	$5,000	$5,000	$10,000
Weigh feeder		$13,000	$13,000	$13,000	$13,000	$26,000
Field wiring		$9,000	$9,000	$9,000	$9,000	$18,000
Programming		$3,000	$3,000	$3,000	$3,000	$6,000
Misc. chutes		$4,000	$4,000	$4,000	$4,000	$8,000
Civil work - truck access		$2,000	$2,000	$2,000	$2,000	$4,000
TOTALS	$0	$46,500	$46,500	$46,500	$46,500	$93,000
Option	5	2,3,7,8,11,13				
Dallman 33	$0	$0				
Dallman 32	$46,500	$0				
Dallman 31	$46,500	$0				
Lakeside 8	$0	$46,500				
Lakeside 7	$0	$46,500				
	Note: Cost estimates on this table are for limestone addition to either Dallman 31 & 32 or Lakeside 7 & 8					

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COST ESTIMATE
LIMESTONE ADDITION SYSTEM
Option 4

	DALLMAN			LAKESIDE		TOTAL
UNIT	**33**	**32**	**31**	**8**	**7**	
OPTIONS	NONE	4		4		
DESCRIPTION						
Relocate LS silo		$10,500	$10,500			$21,000
Silo foundation		$5,000	$5,000			$10,000
Weigh feeder		$13,000	$13,000			$26,000
Field wiring		$9,000	$9,000			$18,000
Programming		$3,000	$3,000			$6,000
Misc. chutes		$4,000	$4,000			$8,000
Civil work - truck access		$2,000	$2,000			$4,000
Add new silo (erected) for Lakeside				$30,000	$30,000	$60,000
Field wiring (LS)				$9,000	$9,000	$18,000
Programing (LS)				$3,000	$3,000	$6,000
Misc. Chutes				$4,000	$4,000	$8,000
Civil				$2,000	$2,000	$4,000
New weigh feeder				$13,000	$13,000	$26,000
TOTALS		$46,500	$46,500	$61,000	$61,000	$215,000
Dallman 33	$0					
Dallman 32	$46,500					
Dallman 31	$46,500					
Lakeside 8	$61,000					
Lakeside 7	$61,000					

Note: Cost estimates on this table are for limestone addition to both Dallman Units 31 &32 and Lakeside Units 7 & 8

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COST ESTIMATE
Two Coal Piles
Options 4,5,8,10,13

	DALLMAN			LAKESIDE		TOTAL
UNIT	**33**	**32**	**31**	**8**	**7**	
OPTIONS	4, 5, 8, 10, 13			NONE		
Cost Split	50%	25%	25%			
DESCRIPTION						
Truck Hopper Foundation / Tunnel	$200,000	$100,000	$100,000			$400,000
Platework / Steel	$40,000	$20,000	$20,000			$80,000
Feeders (2)	$20,000	$10,000	$10,000			$40,000
Building	$40,000	$20,000	$20,000			$80,000
Dust Collection	$160,000	$80,000	$80,000			$320,000
Sump Pumps	$7,500	$3,750	$3,750			$15,000
Unloading conveyor	$100,000	$50,000	$50,000			$200,000
Transfer Tower #1	$60,000	$30,000	$30,000			$120,000
New driveway for unloading hopper	$50,000	$25,000	$25,000			$100,000
Dust Collection @ Transfer House (3)	$150,000	$75,000	$75,000			$300,000
Stockout Conveyor w/telechute	$437,500	$218,750	$218,750			$875,000
Wet suppression system	$60,000	$30,000	$30,000			$120,000
Reclaim Hopper Foundation & Tunnel	$250,000	$125,000	$125,000			$500,000
Platework / Steel	$40,000	$20,000	$20,000			$80,000
Feeders (2)	$20,000	$10,000	$10,000			$40,000
Dust collection system	$100,000	$50,000	$50,000			$200,000
Sump pumps	$7,500	$3,750	$3,750			$15,000
Reclaim conveyor no.1	$112,500	$56,250	$56,250			$225,000
Outside Reclaim Hopper Foundation & Tunnel	$75,000	$37,500	$37,500			$150,000
Platework / Steel	$20,000	$10,000	$10,000			$40,000
Feeder	$10,000	$5,000	$5,000			$20,000
Dust collection (ductwork)	$2,500	$1,250	$1,250			$5,000
Sump pumps	$7,500	$3,750	$3,750			$15,000
Reclaim conveyor no. 2	$40,000	$20,000	$20,000			$80,000
Transfer tower no.2	$60,000	$30,000	$30,000			$120,000
Relaim conveyor no. 3	$150,000	$75,000	$75,000			$300,000
Transfer tower no.3	$75,000	$37,500	$37,500			$150,000
Radial stacker	$75,000	$37,500	$37,500			$150,000

COST ESTIMATE
Two Coal Piles
Options 4,5,8,10,13

Misc. chute work	$40,000	$20,000	$20,000			$80,000
Field wiring	$125,000	$62,500	$62,500			$250,000
MCC	$15,000	$7,500	$7,500			$30,000
TOTALS	$2,550,000	$1,275,000	$1,275,000	$0	$0	$5,100,000
Dallman 33	$2,550,000					
Dallman 32	$1,275,000					
Dallman 31	$1,275,000					
Lakeside 8	$0					
Lakeside 7	$0					

COST ESTIMATE

PRB Coal Handling - Dallman

Options 7,8,9,10,11,13,14

	DALLMAN			LAKESIDE		TOTAL
UNIT	**33**	**32**	**31**	**8**	**7**	
OPTIONS	7, 8, 9, 10, 11, 13, 14			NONE		
Cost Split (for 3 unit cases	50%	25%	25%			
DESCRIPTION						
Dust Control Upgrade - Existing coal hdlg sys						
Truck hopper dust collection	$160,000	$80,000	$80,000			$320,000
Yard reclaim hopper dust collection	$132,500	$66,250	$66,250			$265,000
Crusher house dust collection	$212,500	$106,250	$106,250			$425,000
Tripper bay dust collection	$225,000	$112,500	$112,500			$450,000
Wet suppression for stockout	$60,000	$30,000	$30,000			$120,000
Foundations	$12,500	$6,250	$6,250			$25,000
Support decks	$20,000	$10,000	$10,000			$40,000
Field Wiring	$75,000	$37,500	$37,500			$150,000
Programming	$3,000	$1,500	$1,500			$6,000
Compressed air piping	$6,000	$3,000	$3,000			$12,000
MCC	$10,000	$5,000	$5,000			$20,000
Fire protection connections (5)	$5,000	$2,500	$2,500			$10,000
Truck hopper enclosure						
Foundations	$20,000	$10,000	$10,000			$40,000
Structural steel / siding	$100,000	$50,000	$50,000			$200,000
Misc conveyor system upgrades						
Conveyor leg replacement	$35,000	$17,500	$17,500			$70,000
Chute replacement	$40,000	$20,000	$20,000			$80,000
TOTALS	$1,116,500	$558,250	$558,250	$0	$0	$2,233,000
Option	7, 9, 11, 14	8, 10	13			
Dallman 33	$1,116,500	$0	$2,233,000			
Dallman 32	$558,250	$1,116,500	$0			
Dallman 31	$558,250	$1,116,500	$0			
Lakeside 8	$0	$0	$0			
Lakeside 7	$0	$0	$0			

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COST ESTIMATE

Crusher Upgrade - Dallman Units 31 32

Options 7,8,9,10,11,14

	DALLMAN			LAKESIDE		TOTAL
UNIT	**33**	**32**	**31**	**8**	**7**	
OPTIONS	NONE	7, 8, 9, 10, 11, 14		NONE		
Cost Split		50%	50%			
DESCRIPTION						
Fine grind kits (2)		$120,000	$120,000			$240,000
TOTALS	$0	$120,000	$120,000	$0	$0	$240,000
Option	7-11, 14					
Dallman 33	$0					
Dallman 32	$120,000					
Dallman 31	$120,000					
Lakeside 8	$0					
Lakeside 7	$0					

COST ESTIMATE
Off-site Storage - PRB Coal
Options 7,8,9,10,11,13,14

	DALLMAN			LAKESIDE		TOTAL
UNIT	**33**	**32**	**31**	**8**	**7**	
				NONE		
Cost Split	33%	33%	33%			
DESCRIPTION						
Pawnee Transportation						
Clear site						$100,000
Prepare pile base						$100,000
Runoff collection system						$10,000
Treatment bldg & equip.						$50,000
Runoff pond						$20,000
Improve access road						$0
Improve site security						$0
TOTALS	$93,333	$93,333	$93,333	$0	$0	$280,000
Dallman 31 & 32 only		$140,000	$140,000			
PRB Coal burned	Tons/yr	Tons/day	60 days coal	$/ton coal	60 pile cost	
Dallman 33	822,237	2,253	135,162	$21.25	$2,872,198	
Dallman 32	319,679	876	52,550	$21.25	$1,116,687	
Dallman 31	323,715	887	53,213	$21.25	$1,130,785	
Dallman 33 (80% blend)	657,790	1,802	108,130	$21.25	$2,297,758	
Option	7, 9, 11, 14	8, 10	13			
Dallman 33	$2,965,531	$0	$2,577,758			
Dallman 32	$1,210,020	$1,256,687	$0			
Dallman 31	$1,224,119	$1,270,785	$0			
Lakeside 8	$0	$0	$0			
Lakeside 7	$0	$0	$0			