

# Exhibit A

**BEFORE THE PUBLIC UTILITIES COMMISSION OF NEW HAMPSHIRE**

**CASE NUMBER: DE 11-250**

**IN THE MATTER OF THE PUBLIC SERVICE COMPANY OF NEW  
HAMPSHIRE INVESTIGATION OF MERRIMACK STATION  
SCRUBBER COSTS AND COST RECOVERY**

Direct Testimony of

**FRANK T. DIPALMA**

**AND**

**C. LARRY DALTON**

On Behalf of

The Staff of the New Hampshire Public Utilities Commission

DECEMBER 23, 2013

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**List of Exhibits**

EXHIBIT JCI 01 – Resume of Frank T. DiPalma

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EXHIBIT JCI 04 – Comparison of Cost Estimates for Clean Air Project, URS  
versus Sargent & Lundy

EXHIBIT JCI 05 – Clean Air Project Scope Changes

1                   **1. INTRODUCTION AND BACKGROUND**

2

3                   **Identification of Witness**

4

5           **Q.     Mr. DiPalma, please state your name and business address.**

6           A.     My name is Frank DiPalma. I work for Jacobs Consultancy Inc. (“Jacobs  
7           Consultancy”). My business address is 5995 Rogerdale Road, Houston, Texas  
8           77072.

9

10          **Q.     Mr. Dalton, please state your name and business address.**

11          A.     My name is Larry Dalton. I work for Jacobs Engineering Group Inc. (“Jacobs”).  
12          My business address is 1041 East Butler Road, Greenville, South Carolina 29607.

13

14          **Q.     Mr. DiPalma, what position do you hold at Jacobs Consultancy?**

15          A.     I am currently a Director in the Utilities Practice.

16

17          **Q.     Mr. Dalton, what position do you hold at Jacobs Engineering?**

18          A.     I am currently a Senior Power Engineer.

19

20          **Q.     Mr. DiPalma, what is your background and qualifications for your testimony  
21           in this proceeding?**

22          A.     I am a management consultant in the energy industry with over 30 years of  
23          experience assessing and working for electric and gas utilities. In addition to

24 Jacobs Consultancy, my consulting experience includes employment with Stone  
25 & Webster Consultants as Associate Director. My direct utility operating  
26 experience has been gained from being employed as an officer, manager or  
27 engineer for Public Service Electric & Gas Company and Mountaineer Gas  
28 Company. My expertise includes general and operations management,  
29 distribution engineering, business development, customer service, process  
30 engineering, project management, strategic planning, and regulatory compliance.  
31 As a management consultant in the energy industry, I have had numerous  
32 assignments where a utility's approach to project management on large  
33 construction projects was assessed.

34 Recent electric and gas industry project management-related assignments include:

- 35 • Spectra Energy - Performed a Critical Assessment Study of Project  
36 Execution for the New Jersey-New York Pipeline Expansion Project  
37 (2011).
- 38 • Public Service Electric and Gas Company - In connection with the State  
39 of New Jersey, Board of Public Utilities Mandated Management Audit  
40 (2010 - 2011).
- 41 • Fitchburg Gas and Light Company d/b/a Unitil - In connection with the  
42 Massachusetts Department of Public Utilities Mandated Management  
43 Audit (2010 - 2011).
- 44 • Puget Sound Energy - In connection with the Washington Utilities and  
45 Transportation Commission Review of Mandated Gas Safety Activities  
46 (2008-2009).

- 47 • Connecticut Department of Public Utility Control - Performed a technical  
48 evaluation of 11 proposals to build 500 MW of new peaking generation  
49 units in Connecticut (2008).
- 50 • Spectra Energy - Management and technical review of the Gas Pipeline  
51 Project Management and Delivery Process (2007-2008).
- 52 • Yankee Gas Services - In connection with the Connecticut Department of  
53 Public Utility Control Mandated Management Audit (2007-2008).

54 In addition, my expertise includes periodically providing expert utility-related  
55 testimony. Recently, I have testified during hearings related to the following:

- 56 • Exelon Corporation and Constellation Energy Group, Inc. Merger for the  
57 Maryland Public Service Commission (2011).
- 58 • First Energy Corp. and Allegheny Energy, Inc. Merger for the Maryland  
59 Public Service Commission (2010).
- 60 • The replacement of approximately 70,000 Rockford Eclipse meter shut-off  
61 valves, currently in South Jersey Gas Company's distribution system  
62 (2010).
- 63 • The potential impacts on Baltimore Gas and Electric in connection with  
64 Electricité de France's purchase of half of Constellation Energy Group's  
65 Nuclear Holdings for the Maryland Public Service Commission (2009).
- 66 • The proposed merger of Exelon and PSEG for the New Jersey Board of  
67 Public Utilities regarding reliability and safety of the electric delivery  
68 business (2005).

69 I have also assisted others in the preparation of testimony. While both at  
70 Mountaineer Gas and PSEG, I helped prepare testimony in the following areas:  
71 specific capital initiatives or projects to be included in rate base, operations, and  
72 maintenance programs to be recovered as expense, rate case preparation, and  
73 documentation, and appliance service costs.

74 I am a graduate of New Jersey Institute of Technology with a degree in  
75 Mechanical Engineering, and Fairleigh Dickinson University with a Master's in  
76 Business Administration.

77 A copy of my résumé, which includes a list of electric and gas utility clients and  
78 commission requested assessments, is attached to this testimony as EXHIBIT JCI  
79 01.

80

81 **Q. Mr. Dalton, what is your background and qualifications for your testimony**  
82 **in this proceeding?**

83 A. I am a Mechanical Engineer who has spent most of my career designing power  
84 plants. I have had extensive experience in utility, industrial, waste-to-energy, and  
85 institutional plants. Assignments vary in levels of involvement and run from  
86 conceptual studies through detailed design, commissioning, and start-up. Some  
87 projects are for only one phase, but a vast majority of the projects with which I  
88 have been involved have included the full scope, from concept to start-up, and in  
89 many cases, beyond. I am presently engaged in engineering studies for several  
90 pulp and paper mill power plants, some of which I have been performing  
91 engineering work in for nearly 40 years. My experience includes engineering the

92 plants from fuel receipt through discharge of solid, liquid, and gaseous streams,  
93 with particular emphasis on air pollution control systems. Every power plant has  
94 some type, or types, of environmental aspects, the control of which may  
95 encompass many technologies. I have studied and designed essentially every type  
96 of pollution control, including mechanical separation, electrostatic precipitation,  
97 wet and dry scrubbing, and fabric filtration.

98 Recent power plant assignments include:

- 99 • NewPage Corporation – Biron, WI/Duluth, MN/Esanaba, MI/Luke,  
100 MD/Rumford, ME/Wisconsin Rapids, WI/Wickliffe, KY - Prepared  
101 studies and estimates to determine the alternatives available for  
102 decreasing emissions to allow compliance with upcoming federal  
103 regulations. Studies covered 15 boilers that burn a wide variety of fuels,  
104 including coal, biomass, oil, gas, tire derived fuel, industrial sludge, and  
105 off-gasses from pulping operations (2011-2012).
- 106 • Covanta – Worked on design of a waste-to-energy plant in Dublin,  
107 Ireland. This plant, located on the River Liffey in downtown Dublin, will  
108 burn municipal garbage from the greater Dublin area to divert it from  
109 landfills and produce power as a by-product (2009-2010).
- 110 • Rayonier – Jesup, GA:
  - 111 o Prepared a study and estimate, followed by implementation of
  - 112 modifications to combustion and pollution control systems on two
  - 113 chemical recovery boilers. Project increased combustion



114 efficiency and increased the capability of the electrostatic  
115 precipitator in order to decrease emissions (2011).

116 o Prepared a study and estimate for a new biomass boiler and  
117 turbine generator to replace existing aged equipment. The new  
118 installation, including pollution control equipment will decrease  
119 emissions and comply with upcoming federal regulations for  
120 industrial boilers (2011).

121 • Domtar:

122 o Espanola, ON – Prepared a study and estimate to install a wet  
123 scrubber for pollution control to replace an inadequately sized  
124 electrostatic precipitator (2011).

125 o Plymouth, NC – Assisted in preparation of an estimate, followed  
126 by design and installation of gas burning capability on a biomass  
127 fired boiler. (2011- 2012).

128 • Marafiq – Yanbu, Saudi Arabia:

129 o Served as Owner’s Engineer in the design of two new 250 MW oil  
130 fired units in the industrial city on the Black Sea. Activities  
131 included review of turnkey contract documents, including process  
132 and instrument diagrams, calculations, and operations descriptions,  
133 to ensure compliance with the specification (2010-2011).

134 o Served as Owner’s Engineer in preparation of an estimate and  
135 turnkey specification for the supply of three 250 MW oil fired  
136 units in the industrial city on the Black Sea. Activities included

137 preparation of plant layout, process and instrument diagrams,  
138 equipment list, and specification. Also included were evaluation  
139 of proposals, attendance at contractor proposal reviews, and  
140 selection of successful contractor (2010).

- 141 • Progress Energy – Raleigh, NC:
  - 142 o Alliance Manager and lead Power Engineer for over 200 ongoing
  - 143 plant projects for all of its fleet. Typical projects include ash
  - 144 systems modifications, installation of new electrostatic
  - 145 precipitators, acting as Owner’s Engineer on installation of flue gas
  - 146 desulfurization systems, and coal systems upgrades (1994-2011).
  - 147 o Assisted in site selection and development of eight new
  - 148 combustion turbine plants in North Carolina, South Carolina, and
  - 149 Georgia. Combined capacity of the plants total over 6,000 MW
  - 150 (1997-2004).
- 151 • Connecticut Peaking Generation Units, Connecticut Department of Public  
152 Utility Control – Performed Technical Evaluation of 11 proposals to  
153 build 500 MW of new peaking generation units (2008).
- 154 • University of Pennsylvania – Served as the technical lead in a project to  
155 assist the University in a dispute with its supplier concerning cost of  
156 utilities. The process involved the development of a hypothetical power  
157 plant to produce the University’s steam and chilled water. (2006-2007).
- 158 • University of Massachusetts – Amherst, MA:

- 159                   o Prepared a study and estimate for the installation of a biomass  
160                   steam generator at the Amherst campus. Various types of  
161                   combustion systems were considered; including grate fired and  
162                   fluidized bed boilers and gasification technology (2009-2010).  
163                   o Prepared a design-build specification for the installation of a  
164                   biomass steam generator at the Amherst campus. The  
165                   specification was structured so that the bidders could propose  
166                   alternative technologies for the steam generator.

167                   A copy of my résumé, which includes a list of clients, is attached to this testimony  
168                   as EXHIBIT JCI 02.

169

170   **Q. Please describe the activities of Jacobs Engineering and Jacobs Consultancy.**

171   A. Jacobs Engineering Group Inc. is one of the world's largest and most diverse  
172   providers of professional technical services with more than 70,000 employees  
173   worldwide. Jacobs offers a full-spectrum support to industrial, commercial, and  
174   government clients across multiple markets and geographies. Services include  
175   scientific and specialty consulting as well as all aspects of engineering and  
176   construction and operations and maintenance. Our global network includes more  
177   than 200 offices in over 25 countries.

178

179   **Q. What is the purpose of your joint testimony in this proceeding?**

180   A. The New Hampshire Public Utilities Commission (Commission) on January 26,  
181   2010, contracted Jacobs Consultancy to monitor the progress of the Public Service

182 of New Hampshire (PSNH) Clean Air Project at its Merrimack Station coal-fired  
183 electric generating plant. PSNH was installing a wet scrubber at Merrimack  
184 Station to comply with state environmental requirements.<sup>1</sup>

185

186 **Q. What was Jacobs' Scope of Work with respect to monitoring the Clean Air**  
187 **Project progress?**

188 A. Jacobs' Scope of Work was threefold:

189 1) Due diligence on completed portions of the project.

190 The Due Diligence Report, completed in June 2011, addressed portions of the  
191 New Hampshire Clean Air Project already completed. The report covered  
192 items such as technology selected, accuracy of estimate, cost and schedule  
193 with major deviations noted and detailed, and PSNH project controls.

194 2) Monitoring of the ongoing portion of the project.

195 Quarterly reports coupled with site visits focused on monitoring the progress  
196 of the New Hampshire Clean Air Project. The Quarterly Reports track the  
197 progress of the Scrubber Project, noting deviations from budget and schedule,  
198 and highlighting major project accomplishments. In total, three Quarterly  
199 Reports were completed.

200 3) Summarization of project completion.

201 The New Hampshire Clean Air Project Final Report, completed in August of  
202 2012, summarizes project completion. This report includes knowledge gained  
203 from the previous Due Diligence and Quarterly Reports, as well an overall

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<sup>1</sup> See RSA 125-O: 11, et seq.

204 assessment of the project's safety, program management, performance, costs,  
205 and ongoing power plant operation.

206

207 **Q. Can you summarize the approach that Jacobs utilized in carrying out this**  
208 **independent review?**

209 A. Jacobs employed a workflow process to accomplish the investigation in an  
210 efficient and concurrent approach that would uncover key issues concerning the  
211 Clean Air Project. Our team conducted its review using a process that consisted  
212 of four principal stages:

213 1) The project initiation stage - involved initial conference calls/meetings with  
214 the Commission and PSNH to provide us with a thorough understanding of  
215 expectations, as well as an orientation to PSNH's Clean Air Project.

216 2) The investigation, data gathering, and fact-finding stage - entailed a detailed  
217 review of PSNH's project management process to assess if essentials such as  
218 the appropriate project controls, systems, and processes were in place, and if  
219 PSNH properly executed its plans relative to the scrubber installation.

220 3) Our analysis stage - made use of both quantitative and qualitative assessment  
221 techniques. Data reviewed included documents requested and received,  
222 information gathered during interviews, and quarterly site visits.

223 4) The reporting stage - consisted of a report on the completed portion of the  
224 project as of June 2011, Quarterly Site Visit Reports, and a Final Report.

225

226 **Q. Who assisted you in this review?**

227 A. This independent investigation was performed under our direct supervision with  
228 the assistance of another Jacobs' employee, William Williams. A copy of his  
229 résumé is included in EXHIBIT JCI 03.

230

231 **Q. How is the remainder of your testimony organized?**

232 A. The next portion of our testimony, titled **SUMMARY OF FINDINGS**, presents  
233 an overview of our findings and conclusions with regard to the New Hampshire  
234 Clean Air Project at Merrimack Station.

235 The main body of our testimony, titled **SECTION DETAILS**, supports our  
236 findings and conclusions, and is organized into seven topic areas as follows:

237 **1) Project Initiation**

238 **2) Contracting Strategies**

239 **3) Market Cost Review**

240 **4) Technology**

241 **5) Project Estimates**

242 **6) Project Cost Controls**

243 **7) Performance**

244

245 **2. SUMMARY OF FINDINGS**

246

247 **Q. What is your overall opinion with regard to the New Hampshire Clean Air**  
248 **Project at Merrimack Station?**

249 A. The New Hampshire Clean Air Project at Merrimack Station was a well-defined  
250 and documented effort. The PSNH team conducted a thorough analysis of the  
251 technical requirements prior to initiating the project and followed its parent  
252 company's, Northeast Utilities, well-defined procedures to ensure compliance  
253 with both regulatory and business requirements. The selection process for  
254 establishing URS Corporation (URS) as Program Manager was a thorough and  
255 fruitful procedure followed by an equally thorough process for selecting  
256 equipment suppliers and contractors.

257 Given the size and complexity of the New Hampshire Clean Air Project at  
258 Merrimack Station, the construction approach functioned as planned. The various  
259 contractors worked well together, eventually achieving a better than average  
260 safety record. Throughout the project, PSNH exercised good oversight by  
261 properly controlling cost and schedule, as evidenced by the project being  
262 completed under budget and ahead of schedule.

263 The installation of the secondary wastewater treatment system was a necessary  
264 addition in order to reduce the liquids effluent to zero, resulting in nothing being  
265 discharged into the river; and reduce the solid effluent to a minimum amount that  
266 can be disposed of in licensed landfills.

267 Most importantly, based on early testing in 2012, there are indications that the  
268 Wet Flue Gas Desulphurization System could performed at or above the  
269 guaranteed mercury removal performance levels, and exceed the State mandated  
270 requirements.

271

272 **Q. What key assessments and conclusions support your overall opinion**  
273 **regarding the New Hampshire Clean Air Project?**

274 A. Our key assessments and conclusions supporting our overall opinion are as  
275 follows:

276 **Large Project Review Process** - Northeast Utilities and PSNH procurement, risk  
277 review, approval, and contracting strategy processes are well developed for  
278 projects of this size. Northeast Utilities' Large Project Review Process calls for  
279 numerous internal assessments, risk mitigation factors considerations, and  
280 approvals. PSNH determined the most appropriate contracting strategy,  
281 conducted a flue gas desulphurization installation cost comparison, and worked to  
282 understand market conditions and their impact on large construction projects.

283 **Cost Estimates** - Large projects typically go through a series of project estimate  
284 stages as they move from conceptual design through detailed engineering design  
285 and pre-construction design to construction, estimates reflect a better-defined  
286 scope of work enabling cost to be refined. PSNH's process for developing the  
287 project estimate chain follows this sequence with the initial conceptual estimate,  
288 the detailed Clean Air Project estimate, and the current estimate. The initial  
289 estimates of \$250M were developed based on existing flue gas desulphurization  
290 designs and installations, and did not contain any specific mercury or sulfur  
291 dioxide guarantees, PSNH costs, or site-specific needs. The later Clean Air  
292 Project estimate of \$457M was developed with the support of URS and contained  
293 a detailed estimate and actual proposal price, including mercury and sulfur  
294 dioxide guarantees, all PSNH costs, including AFUDC, as well as specific-site



295 needs. Jacobs was able to reconcile the 2005 and 2006 conceptual estimates and  
296 the 2008 detailed Clean Air Project estimates. Since the 2008 estimate, there  
297 have been several budget reductions and additions, and as a result, it is now  
298 estimated the project will become completed for \$421M,<sup>2</sup> approximately eight  
299 percent below budget.

300 **Project Schedule** - While the statute required a completion date of the mandated  
301 Clean Air Project in mid-2013, the detailed project schedule, published in June  
302 2008, projected an in-service date of mid-2012. When Jacobs reviewed the  
303 schedule and verified actual construction, it was evident the completion date  
304 shown in the schedule was reasonable and attainable.

305 **Project Management Approach** - Along with providing its own internal  
306 oversight, PSNH made use of two engineering firms to help manage the project.  
307 URS was employed as Program Manager and R.W. Beck as Independent  
308 Engineer. As the Program Manager, URS performed the engineering,  
309 procurement, and construction management role; and as Independent Engineer,  
310 R.W. Beck provided an independent third-party oversight of the engineering,  
311 procurement, and construction functions. PSNH's oversight role consisted of  
312 project manager, contract management, project schedule control, and project cost  
313 control. These established safeguards for project overview and control helped to  
314 ensure that the Clean Air Project was controlled and managed effectively.

315 **Construction Approach** - The coordination of the entire site construction  
316 interfaced well. Each of the contractors for the various project islands was

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<sup>2</sup> We are aware that a detailed audit of the costs was performed by the Commission Staff. Our project review was separate from that audit and, therefore, any dollar amounts discussed in our testimony are independent of the results of that audit.

317 responsible for all aspects within their scope and URS handled the Balance of  
318 Plant<sup>3</sup> construction coordination issues.

319 **Safety** - Safety performance was initially below what would be expected from a  
320 high quality project team. However, after the implementation of a Safety  
321 Recovery Plan, the project experienced a reduction in its recordable incident rate  
322 achieving acceptable levels of safety.

323 **Program Manager** - PSNH had a relatively small staff available to manage the  
324 project. Consequently, PSNH decided to engage URS as the Program Manager  
325 for the project. URS did a competent job in its project management role and in  
326 providing essential plant engineering services.

327 **Project Performance** - PSNH was proactive in getting the project underway as  
328 soon as possible, and through good ongoing management by PSNH and URS, the  
329 project was completed a year ahead of schedule. A key factor in this aspect of  
330 project performance was PSNH's anticipation that there might be sizeable delays,  
331 either due to weather or due to interveners,<sup>4</sup> resulting in establishing a more than  
332 adequate initial schedule. PSNH reduced the budget by \$35M, for a final estimate  
333 of \$421M, due to higher productivity and lower commodity costs, which held  
334 change orders for the project to six percent of the final project estimate. URS set  
335 up an excellent commissioning team and processes early, involving all  
336 appropriate parties, resulting in a smooth commissioning process. Units were tied-  
337 in and operational 22 months earlier than mandated and 10 months ahead of  
338 PSNH's schedule.

---

<sup>3</sup> Balance of Plant is the sum of all equipment for safe operation as well as the technical coordination of all concerned parts of a power plant.

<sup>4</sup> Intervenors refer to any potential actions by outside groups that may interrupt the construction schedule.

339 **Project Scope Changes** - During the course of the Clean Air Project, nine project  
340 scope changes totaling \$42.7M were encountered. These changes included a  
341 limestone truck unloading system and scales, corrosion protection of the flue gas  
342 desulphurization vessel, acoustic study changes, and improved wastewater  
343 treatment systems. The improved wastewater treatment system consisted of  
344 an enhanced wastewater treatment system and a secondary wastewater  
345 treatment system.

346

### 347 **3. SECTION DETAILS**

348

#### 349 **1. Project Initiation**

350

351 **Q. Please describe the internal process that Northeast Utilities and its subsidiary**  
352 **PSNH used during project review and approval.**

353 A. Northeast Utilities has the policy that all procurements over \$5M are subjected to  
354 their Large Procurement Process and reviewed by their Risk Management  
355 Council.<sup>5</sup> The Large Procurement Process<sup>6</sup> objectives are to conduct risk analysis,  
356 ensure prudence/due diligence, provide lowest total cost, and manage “What If”  
357 scenarios. This allows for a structured and consistent approach to contracting for  
358 projects and standardizes the signoff and approval process and reporting  
359 requirements. In addition, it also establishes the participation of the core team,  
360 risk management, and the executive risk management panel. If, as in this case, the

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<sup>5</sup> DR JCI-023 NU Purchasing Policy Manual

<sup>6</sup> DR JCI-023 ERM Large Project Process

361 procurement exceeds \$25M, an Executive Risk Management Council review is  
362 also required. The Executive Risk Management Council,<sup>7</sup> along with the Risk and  
363 Capital Committee, has the responsibility for ensuring Northeast Utilities is  
364 prudently managing its principal enterprise-wide risks.

365 In addition, the Risk and Capital Committee will:

- 366 • Provide oversight for the development and implementation of Enterprise  
367 Risk Management and corporate Risk Management Policy.
- 368 • Provide oversight for the risk assessments prepared in accordance with  
369 the Risk Management Policy.
- 370 • Review and assess the risks associated with strategic projects and/or  
371 proposals and policy and investment decisions that expose Northeast  
372 Utilities to material financial, strategic, operational, or reputation risk.
- 373 • Review key risk topics that could materially affect the Company.
- 374 • Review the Northeast Utilities business and functional area risk and  
375 financial assessments of capital projects undertaken in accordance with  
376 the Risk and Capital Committee Project Approval Policy and Procedures  
377 and make recommendations to the Company's CEO for approval, if  
378 required.

379

380 **Q. Were any external studies conducted on PSNH's behalf?**

---

<sup>7</sup> DR JCI-023 Risk and Capital Committee Charter

381 A. Yes, PSNH contracted with R.W. Beck to conduct a Contracting Strategy Study  
382 and Power Advocate to study the market conditions associated with capital  
383 construction projects in general and retrofit scrubber projects in particular.

384

385 **2. Contracting Strategies**

386

387 **Q. Please describe the R.W. Beck Contracting Study in greater detail.**

388 A. PSNH has a relatively small staff and is aware that a project as large as the Clean  
389 Air Project at Merrimack Station would need a sizeable number of personnel and  
390 decided that outside project management help would be needed. PSNH retained  
391 R.W. Beck to provide contract strategy consulting engineering services associated  
392 with implementation of the project. In order to develop the contract strategy, R.W.  
393 Beck took into account:

- 394
- Realities of the current market for scrubber projects.
  - Influence of the current market conditions on contracting options.
- 395

396 The R.W. Beck Draft Study<sup>8</sup> reviewed four different contracting options.

397 The four options considered were:

- 398 1) Turnkey EPC Contract – Fixed Price Proposal<sup>9</sup>
- 399 2) Turnkey EPC Contract – Fixed Price After “Open Book”<sup>10</sup>
- 400 3) Alliance EPC Contract – Contractor and PSNH Share the Risk<sup>11</sup>

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<sup>8</sup> DR JCI-034 R.W. Beck Contracting Strategies Report Mercury Scrubber Project

<sup>9</sup> Fixed Price – means that the stated price is fixed for some portion of the work or piece(s) of equipment or materials throughout the term of the agreement, subject to adjustment based on change orders.

<sup>10</sup> Open Book is a method of procurement that allows each party to have access to the project cost information allowing all non-final pricing to be developed, as costs are known.

401 4) EPCM Contract - Contractor reimbursed for all costs plus fee<sup>12</sup>  
402 R.W. Beck recommended the EPCM contract as the best approach for the  
403 Merrimack Project and PSNH chose to contract with URS to be its EPCM  
404 contractor providing full program management services.

405

406 **3. Market Cost Review**

407

408 **Q. Please describe the Power Advocate, Inc. Study in greater detail.**

409 A. PSNH hired Power Advocate, Inc. in 2008 to conduct a thorough review  
410 of the market conditions associated with capital construction projects and retrofit  
411 scrubber projects. This study was updated in March 2009<sup>13</sup>. The study,  
412 specifically sought to assist in a review of URS' cost estimate to determine its  
413 reasonability by accurately comparing the cost of this project with other wet  
414 scrubber projects through a normalization of the dollars per kilowatt cost. It also  
415 considered the project's risk mitigation strategy in conjunction with the overall  
416 cost control technique in order to develop a comprehensive project cost  
417 management assessment. The updated study took into account the considerable  
418 opportunities for PSNH to capitalize on current favorable market conditions with  
419 un-awarded project subcontracts. For example, the foundations contract was

---

<sup>11</sup> An Alliance Contract is a relationship between two or more parties to pursue a set of agreed upon goals, or to meet a critical business need, while remaining independent organizations.

<sup>12</sup> Engineering, Procurement, Construction Management is a contract where the contractor is responsible for the design, procurement, construction, and management phases of a project. Typically, the contractor is reimbursed for all costs (direct and indirect) it incurs to perform the work, plus a fee (profit).

<sup>13</sup> DR JCI-031 Power Advocate, Merrimack Station Clean Air Project Cost Estimate Analysis March, 2009

420 executed in February 2009, at \$6 Million less than the URS 2008 estimate. The  
421 report evaluated the unique site-specific factors, including engineering, Balance  
422 of Plant, flue gas desulphurization, material handling considerations, and how  
423 these factors affect the overall project cost.

424 **Q. Please describe PSNH's approach to project management.**

425 A. Consistent with what is often done in the industry, PSNH decided to outsource  
426 the management of this large capital-intensive project. For the Merrimack  
427 Project, PSNH made use of two leading engineering firms to manage the project,  
428 with strong internal oversight. URS was selected as Program Manager, and R.W.  
429 Beck as Independent Oversight Engineer.

430 URS established a typical project organization for this type project. They  
431 assigned a project manager whose functions centered on managing the  
432 engineering disciplines as the project scope was developed. As the design  
433 progressed and the construction activities on the project began in earnest, the  
434 project manager's role was focused more in the field. URS assigned a  
435 construction manager, who reports to the project manager, to handle the day-to-  
436 day construction activities. Reporting to the construction manager were various  
437 superintendents who provided the intimate coordination and monitoring required  
438 for a well-run project.

439 R.W. Beck was selected as an independent third-party oversight of the  
440 engineering, procurement, and construction of the Clean Air Project. They were  
441 tasked with conducting monthly site visits to review the final design for general  
442 compliance with contract guarantees, the progress of design for compliance with

443 the milestone schedule, the progress of the procurement specifications and  
444 procurement contracts and reports for general suitability regarding start-up and  
445 performance. They also consulted with project participants in advance of  
446 scheduled major inspection tests, start of important work phases, and reviewed the  
447 activities of the project to ensure that appropriate due diligence was performed,  
448 appropriate alternatives were considered, and actions taken were prudent<sup>14</sup>. They  
449 also prepared a monthly Independent Engineer's Report.

450

451 **4. Technology**

452

453 **Q. What did the Clean Power Act require PSNH to do?**

454 A. In 2002, the State of New Hampshire passed the New Hampshire Clean Power  
455 Act to address four pollutant emissions, sulfur dioxide (SO<sub>2</sub>), nitrogen oxide  
456 (NO<sub>x</sub>), mercury (Hg), and carbon dioxide (CO<sub>2</sub>). In 2005, Senate Bill - 128 was  
457 introduced requiring mercury emissions be reduced at the Merrimack Station  
458 plant to 24 pounds per year through a technology identified as Activated Carbon  
459 Injection. In 2006, The New Hampshire Clean Power Act was amended to require  
460 reduced mercury emissions by 80 percent using wet flue gas desulphurization  
461 technology no later than July 1, 2013.

462

463 **Q. Please describe in greater detail the viability of various mercury emission**  
464 **approaches.**

---

<sup>14</sup> DR JCI-035 Over-site Role of R.W. Beck



465 A. RSA 125-O:13, III required PSNH to conduct tests and implement as practicable  
466 mercury reduction control technologies or methods to achieve reductions, and  
467 then to report the results. Basically, there are two technologies available with  
468 potential to significantly reduce mercury emissions, activated carbon injection  
469 followed by a baghouse,<sup>15</sup> and wet flue gas scrubbing. PSNH performed pilot  
470 testing for the activated carbon injection approach for their units firing the  
471 specific coals that are used. The level of removal of mercury shown in these pilot  
472 tests were, as other tests in the industry have shown, below the level mandated by  
473 the New Hampshire Legislature.

474 When addressing sulfur emissions, there are alternatives compatible with the  
475 carbon injection process. This process involves a spray drier-type scrubber or a  
476 circulating fluidized bed-type scrubber. These alternatives are referred to as “dry”  
477 type scrubbing in that they introduce lime slurry into the flue gas stream to react  
478 with the sulfur compounds, which along with the mercury compounds, is then  
479 captured in the baghouse. While both of these dry-type scrubbing technologies  
480 would improve the sulfur removal, neither could achieve the specified mercury  
481 removal level.

482

483 **Q. Was the technology required by RSA 125-O:13, III correct for the**  
484 **application?**

485 A. PSNH did a thorough evaluation and was able to confirm the technology mandated  
486 by the Legislature was viable for the specified levels of mercury and sulfur

---

<sup>15</sup> Baghouse is a generic name for Air Pollution Control Equipment (APC) that is designed around the use of engineered fabric filter tubes, envelopes or cartridges in the dust capturing, separation or filtering process.

487 removal. In Jacobs' opinion, the technology required was correct for the  
488 application.

489 PSNH also initiated the practical enhancements needed to ensure success for the  
490 system. These enhancements included:

- 491 • Additional height to the absorber body to ensure adequate residence time  
492 for proper chemical reaction between scrubber fluid and mercury.
- 493 • Diameter of the absorber body was also expanded for enhanced residence  
494 time.
- 495 • Additional level of sprays in absorber body to ensure thorough contact  
496 with the flue gas, again to ensure proper chemical reactions.

497

498 **Q. Was PSNH able to get a performance guarantee regarding the amount of**  
499 **mercury removal?**

500 A. Yes, PSNH selected the only vendor who was willing to provide a performance  
501 guarantee. The guarantee was that a minimum of 85 percent of mercury would be  
502 removed.

503

## 504 **5. Project Estimates**

505

506 **Q. How are major utility projects, like the Clean Air Project, estimated?**

507 A. Typically, utilities go through a series of project estimate stages that depend on  
508 the level of information accessible and cost estimate parameters available. As  
509 projects move from conceptual design through detailed engineering design and

510 pre-construction design to construction, estimates become better defined and  
511 refined. Cost estimates will change in response to design concept modifications,  
512 variations in scope, more detailed material cost estimates, and as build sequence  
513 modifications. Any of these changes can affect the total cost; and in some cases  
514 appreciably.

515

516 **Q. Did PSNH have project estimates developed for the Clean Air Project?**

517 A. Yes, in total there were three project estimates. In 2005, Sargent & Lundy  
518 prepared an initial conceptual project estimate of \$250M for the installation of a  
519 flue gas desulfurization scrubber.<sup>16</sup> In 2006, Sargent & Lundy issued additional  
520 information associated with the conceptual cost estimate of \$250M; and in 2008,  
521 after awarding the program management services to URS, URS developed a  
522 detailed project estimate of \$457M.<sup>17</sup>

523

524 **Q. Is it unusual that a program manager would develop the detailed estimate for**  
525 **a project that it would manage, especially since there were project bonuses**  
526 **applied to budget and schedule goals?**

527 A. This is not unusual, but is rather the norm for this type of project. Before an  
528 accurate, detailed estimate can be prepared, there are significant amounts of  
529 preliminary engineering and equipment selection required to accurately define the  
530 project. The program manager is the one best capable to perform these functions.

531 However, to ensure there are no questions of impropriety or conflicts of interest,

---

<sup>16</sup> Flue-Gas Desulphurization refers to the technology used to remove sulfur dioxide (SO<sub>2</sub>) from the exhaust flue gases of fossil fuel power plants.

<sup>17</sup> DR JCI-025 Janus Report.

532 there must be a close oversight of the project. If the Owner has adequate,  
533 experienced staff, they can do it themselves. If, as was the case in this project, the  
534 Owner does not have the staff, an outside and competent firm must be engaged to  
535 provide this function. For the Clean Air Project at the Merrimack Station, PSNH  
536 hired R.W. Beck, an experienced and competent firm, to provide this service.

537

538 **Q. Describe the conceptual project estimate developed by Sargent & Lundy.**

539 A. The cost estimates provided by Sargent & Lundy relied on past installations of  
540 flue gas desulphurization and certain specific Merrimack Station conditions.  
541 During the conceptual pricing of a scrubber system, Sargent & Lundy and PSNH  
542 found flue gas desulfurization suppliers were open to discussions, but unwilling to  
543 provide mercury reduction guarantees and equipment pricing with associated  
544 guarantees. Based on limited available information, Sargent & Lundy issued an  
545 initial conceptual estimate of \$250M for the installation of a flue gas  
546 desulphurization system at Merrimack Station.

547

548 **Q. Was the original cost estimate by Sargent & Lundy a firm estimate?**

549 A. No, Sargent & Lundy was contracted to develop an early conceptual estimate to  
550 satisfy legislative and stakeholders' discussions. Since the estimate relied on past  
551 scrubber installations for flue gas desulphurization, limited Merrimack Station  
552 conditions and no mercury reduction guarantees, it only could serve as an early  
553 conceptual estimate.

554

555 **Q. Why were the costs associated with mercury reduction guarantees excluded**  
556 **from the Sargent & Lundy conceptual estimate?**

557 A. At the time of the estimate, the state-of-the-art regarding mercury removal was  
558 evolving. Consequently, the estimate contained one very significant caveat, “No  
559 specific mercury guarantee was included in Sargent & Lundy’s pricing since it  
560 was not available at this time from suppliers.”<sup>18</sup>

561

562 **Q. Was the estimate by URS a firm estimate?**

563 A. Yes, this estimate was based on a detailed study, which incorporated site-specific  
564 needs, included mercury reduction and equipment guarantees, and contained  
565 project specific AFUDC.<sup>19</sup> It also built upon Sargent & Lundy’s conceptual  
566 project cost estimate assumptions and determined that a number of enhancements  
567 were needed.

568

569 **Q. Did Jacobs request, from PSNH, a detailed reconciliation between the**  
570 **Sargent & Lundy conceptual and URS firm estimates?**

571 A. Yes, Jacobs requested and did receive a detailed draft reconciliation table from  
572 PSNH. A condensed version of PSNH’s table was reproduced and is identified as  
573 EXHIBIT JCI 04 – Comparison of Cost Estimates for Clean Air Project, URS  
574 versus Sargent & Lundy.<sup>20</sup>

---

<sup>18</sup> DR JCI-037 Mercury Reduction.

<sup>19</sup> AFUDC stands for Allowance for Funds Used During Construction. AFDUC is an accounting mechanism that accounts for the net cost of construction of borrowed funds used for construction purposes and a reasonable rate on funds when so used.

<sup>20</sup> DR JCI-026 Comparison of Cost Estimates.

575

576 **Q. Was Jacobs' review able to reconcile the difference between the Sargent &**  
577 **Lundy conceptual and URS firm estimates?**

578 A. EXHIBIT JCI 04 – Comparison of Cost Estimates for Clean Air Project, URS  
579 versus Sargent & Lundy attempts to compare line item by line item the various  
580 major item descriptions. However, the comparison is complicated by the fact that  
581 a number of Sargent & Lundy line items are not broken down similar to the URS  
582 cost estimate, inhibiting a direct comparison. For example, items 1 through 7, in  
583 the URS estimate, are displayed as item 1 in the 2005 Sargent Lundy estimate.  
584 Despite our inability to make this direct comparison, we were able to reconcile the  
585 various estimates after reviewing the Item Description, the side-by-side  
586 comparison, and assessing the Discussion of the Differences.

587

588 **Q. What major factors account for the difference between the 2005 and 2006**  
589 **Sargent & Lundy<sup>21</sup> cost estimates and the 2008 URS cost estimate?**

590 A. The major factors that account for the difference between the Sargent & Lundy  
591 cost estimate and the URS cost estimate can be grouped into three categories: 1.)  
592 progression from the initial conceptual estimate to detailed design estimate, 2.)  
593 site-specific factors, and 3.) economic and commodity volatility.

594

595 **Q. Please elaborate for each category why there is a difference between the cost**  
596 **estimates.**

---

<sup>21</sup> DR JCI-009 Sargent & Lundy Wet FGD Retrofit Conceptual Cost Estimate\_

597 A. 1.) Progression from the initial conceptual estimate to detailed design estimate – as  
598 previously explained, project estimates go through stages that depend on the level  
599 of information accessible and cost estimate parameters available. In this instance,  
600 firm price contracts with vendor guarantees replaced initial estimated pricing and  
601 with the majority of project design completed, preliminary engineering estimates  
602 were replaced. Detailed design necessitated certain enhancements including:

603 • Separate ducts for MK-1 and MK-2 generating units involved almost  
604 2,000 tons of steel, as compared to a single duct requiring 365 tons of  
605 steel. This enhancement provided for increased operating flexibility by  
606 allowing either generating unit to safely operate independent of each of  
607 the other.

608 • Nearly doubled the size of the gypsum storage building to 26,600 square  
609 feet from 14,000 square feet; conforming to the Town of Bow  
610 requirement that all handling of the gypsum had to be indoors.

611 • A larger absorber tank was needed in order to assure sufficient mercury  
612 removal, adding a substantial amount of exotic metal to the tank's  
613 construction.

614 • Additional scrubber spray level was added to the scrubber in order to  
615 help assure sufficient mercury removal.

616 2.) Site-specific factors – Sargent & Lundy completed their analysis based on like-  
617 project experience, consequently their conceptual cost estimates needed to be  
618 reassessed by URS to embody site-specific factors. Site-specific factors include:

- 619                   • Scrubber must guarantee approximately 84 percent mercury reduction as  
620                   primary design criteria.
- 621                   • Two power generation units with pressurized cyclone design furnaces of  
622                   differing sizes must be connected to the one scrubber system.
- 623                   • The Merrimack Station site is congested, requiring relocation of various  
624                   equipment, and created a more difficult and expensive work  
625                   environment.
- 626                   • Harsh and moist winters common in the Northeast needed to be factored  
627                   in. Examples of site-specific, weather-related enhancements include:
- 628                   ○ Railroad car unloader became a rotary dump as compared to a  
629                   bottom dump to ensure unloading capabilities during moisture-  
630                   related freeze ups.
- 631                   ○ Basis for silo discharge was rotary plow dischargers as compared  
632                   to a basic hopper arrangement due to winter conditions.
- 633                   ○ Totally enclosed conveyor galleries as compared to a hooded  
634                   conveyor system for proper moisture management.
- 635                   ○ Included a limestone emergency silo fill-bucket elevator and  
636                   receiving hopper to ensure unloading capabilities during moisture-  
637                   related freeze ups.
- 638                   3.) Economic and commodity volatility – in the time period between the Sargent &  
639                   Lundy cost estimate and the URS cost estimate, significant commodity price  
640                   escalation was being experienced both nationally and in the world economy.



641 Jacobs Engineering Estimating Group estimated that during this time period,  
642 prices for certain materials and commodities escalated between 45 and 60  
643 percent<sup>22</sup>.

644

645 **Q. Was Jacobs able to justify the cost differences between the various project**  
646 **estimates?**

647 A. Looking at the major cost categories and the reason for their change, including  
648 items such as Owners' cost, contingency, AFUDC, cost escalation, and items<sup>23</sup>  
649 that were excluded from the original preliminary estimates, we conclude that the  
650 differences between the various estimates are justifiable.

651

652 **6. Project Cost Controls**

653

654 **Q. Please describe PSNH's cost control process.**

655 A. Project costs are reported and controlled at various levels against the project  
656 Code of Accounts.<sup>24</sup> A Clean Air Project resource analyst maintained the Project  
657 Cost Summary and the project manager reviewed the actual costs, comparing  
658 them to the projected costs and revised future cost projections as necessary.

---

<sup>22</sup> Based on various alloy commodity price indices fluctuations, which occurred between 2005 and 2008.

<sup>23</sup> DR JCI-010 NU Scrubber Cost

<sup>24</sup> A code of accounts is an essential tool in the management of any project as it allows the ability to easily distinguish multiple components of a project without need to remember lengthy names or terminologies.

659 Contract management was accomplished using change notices and change orders,  
660 and processed, as outlined in Section 10.6 of the URS Project Execution Plan and  
661 Attachment K of the PXP, PEP-314 Change Control.<sup>25</sup>

662 Change Orders must be approved by PSNH and URS management and were  
663 processed in accordance with Article 6 of the Contract.

664

665 **Q. What was the dollar amount of change orders and was this unusual for a**  
666 **project of this size?**

667 A. There were 777 change orders totaling \$27.6M, which is 6 percent of the original  
668 budget. The change order amount is within the acceptable industry range of 5 to 7  
669 percent<sup>26</sup>.

670

671 **Q. Please describe any project scope changes.**

672 A. During the course of the Clean Air Project, nine project scope changes were  
673 added resulting in a net increase of \$42.7M to the cost of the project<sup>27</sup>. Referring  
674 to EXHIBIT JCI 05 - Clean Air Project Scope Changes, eight of the project scope  
675 changes were increased while one was a decreased. Scope change increases  
676 included a limestone truck unloader and scales, corrosion protection of the flue  
677 gas desulphurization vessel, acoustic study changes, enhanced mercury and  
678 arsenic system, an enhanced wastewater treatment system, a soda ash  
679 softening process and the relocation of the service water pump house. The  
680 majority of the scope changes, both in number and cost, for the Clean Air Project

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<sup>25</sup> DR JCI-001 Project Execution Plan Part II.

<sup>26</sup> Benchmark is based on industry experience.

<sup>27</sup> DR JCI-046 Scope changes to final budget plan 06/18/08

681 were a result of either, permitting, cost saving or technical issues found after the  
682 initial engineering was completed.

683

684 **Q. Can you describe each of these project scope increases in greater detail?**

685 **A. Items 1 and 2 Limestone Truck Unloading and Scales** - PSNH determined that,  
686 due to physical site limitations, it was more effective to retrofit the existing  
687 unloading system than to build a new one for limestone unloading. To ensure it  
688 would have flexibility in the delivery of limestone and obtain cost competitiveness,  
689 PSNH decided to build a limestone truck unloading system. Truck scales were  
690 installed at the same time to reduce third-party charges for weighing trucks.

691 **Item 3 Corrosion Protection of the Flue Gas Desulphurization Vessel** - At the  
692 time of the scrubber design, the industry accepted type 2205 Stainless Steel as a  
693 suitable and cost effective material to use on the absorber vessel. Near the end of  
694 construction, PSNH learned from the power industries experience that type 2205  
695 Stainless Steel was experiencing unexpected corrosion in similar installations and  
696 contracted with Sargent & Lundy to evaluate and recommend actions to minimize  
697 corrosion in the absorber vessel. Sargent & Lundy<sup>28</sup> recommended installation of  
698 a Potential Adjustment Protection System<sup>29</sup> to protect against corrosion of  
699 degraded weld heat affected zones and design inherent crevices. The Sargent &  
700 Lundy study also identified other construction deficiencies and recommended  
701 correcting them to the extent achievable to minimize the corrosion possibilities.

702 PSNH did not perform studies to predict lifespan with the corrosion, but was able

---

<sup>28</sup> DR JCI-039 WFGD Reaction Tank Evaluation

<sup>29</sup> Potential Adjustment Protection systems upgrade the corrosion resistance of passive metals making their corrosion resistance comparable to higher-grade alloys.

703 to learn from the experience of others. Similar installations were experiencing  
704 significant corrosion in less than one year. Therefore, such predictive studies  
705 would have been of minimal value. The more telling aspect was the rapid  
706 deterioration observed in some very similar absorber vessel units with the same  
707 metallurgy as the Merrimack Station unit. In addition, the project was the stage  
708 where action had to be taken as soon as possible to prevent the corrosion observed  
709 at similar installations from manifesting itself at Merrimack Station.  
710 Consequently, PSNH heeded the advice of the Sargent & Lundy Study.

711 The cost of the actions taken to minimize the potential corrosion was relatively  
712 small for the assurance that the installation would be reliable and able to operate  
713 well into the future. The New Hampshire Clean Air Project, when conceived,  
714 contracted, and constructed, was envisioned to operate for many decades into the  
715 future, so in Jacobs' opinion, the decision to install the Corrosion Protection  
716 System was a prudent one.

717 **Item 4 Acoustic Changes** - Throughout the Clean Air Project, PSNH worked  
718 with the Town of Bow to obtain the necessary permits and waivers needed for  
719 construction activities. Acoustic changes were made to accommodate activities  
720 during the construction and as a result from testing of equipment. In addition,  
721 several scope changes were made to accommodate changes required by the Town  
722 of Bow. These changes included the Gypsum Building Expansion, Booster Fan  
723 Enclosure, and Service Water Pump House Relocation.

724 **Item 5 Enhanced Wastewater Treatment System** - In order to meet the  
725 New Hampshire Department of Environmental Services imposed emission

726 limits on water discharge, PSNH installed an enhanced wastewater treatment  
727 system for \$3.5M. This system provides for polishing treatment of mercury  
728 and arsenic downstream of the primary wastewater treatment system.

729 **Item 6 Secondary Wastewater Treatment System** - This system is designed  
730 to receive the effluent from the enhanced wastewater treatment system and to  
731 reduce it further. Phase 1 of the secondary wastewater treatment system reduces  
732 the volume of water to 0-5 gpm through concentration and crystallization and the  
733 effluent can be recycled into the process. In Phase 2, which involves an  
734 additional crystallizer step and dewatering, the liquid effluent is reduced to zero,  
735 resulting in no liquids being discharged into the river. The output of the  
736 secondary wastewater system also reduces the solid effluent to an amount that can  
737 be disposed of in a licensed landfill.

738 **Item 7 Soda Ash Softening Process** - Due to the hardness of the water, the  
739 Soda Softening Process was required to minimize metal plating during the  
740 evaporation process, enabling a proper functioning secondary wastewater  
741 treatment system.

742 **Item 8 Service Water Pump House Relocation** - Relocation to the north  
743 bank of the station's treatment pond allowed for the use of recycled water in  
744 the scrubber, avoided potential permitting delays, minimized impact on the  
745 project's electrical substation construction and improved operational access.

746

747 **Q. Can you describe the project scope decrease in greater detail?**

748 A. **Item 1 New Rail Unloading Facility for Limestone** - The New Rail Unloading  
749 Facility for Limestone was included in the URS estimate, but eventually it was  
750 recognized that it would be more efficient and just as effective to modify the  
751 existing Railcar Unloading System.

752

753 **Q. Were there any overall project cost reductions to offset the costs associated**  
754 **with the project scope changes?**

755 A. Although the \$47.2M in net scope change additions increased the total project  
756 cost, the project was able to remain within budget due to savings in other areas  
757 achieved during the course of the project. Savings resulted from lower than  
758 anticipated subcontractor bids, lower commodity costs due to the changing  
759 economic cycle, and higher productivity.

760

761 **Q. Why did PSNH feel that the single largest change in scope item, the**  
762 **secondary wastewater treatment system, was needed?**

763 A. Based on the Environmental Protection Agency's position, that discharge from  
764 the secondary wastewater treatment system could only be accommodated by  
765 adding it to the plant's National Pollutant Discharge Elimination System (aka  
766 NPDES) permit, and the NPDES Permit Process has been in revision for 14 years,  
767 PSNH felt that approval<sup>30</sup> would be an extremely long process, possibly taking  
768 many years. A delay of this magnitude could also delay the start-up of the  
769 scrubber and keep the Merrimack Station from operating.

---

<sup>30</sup> DR JCI-042 Risks in Obtaining the Remaining Operation Permit – Wet Flue Gas Desulfurization (WFGD) Discharge.

770           Consequently, to avoid further potential litigation and possibly years of delay in  
771           placing the unit into operation, PSNH elected to install the secondary wastewater  
772           treatment system. As previously mentioned, the output of this secondary system  
773           reduces the liquids effluent to zero, resulting in nothing being discharged into the  
774           river and reduces the solid effluent to a minimum that can be disposed of in  
775           existing licensed landfills.

776           The original construction plans had the treated water from the wastewater  
777           treatment system discharging into the river. PSNH had to reconfigure the system  
778           due to permit and litigation issues during the early part of the system construction.  
779           This redesign eliminated the need for the discharge portion to the river. All  
780           discharge from the original engineering designs now enters the secondary system.  
781           The wastewater treatment system, that now includes the primary and secondary  
782           wastewater treatment, works together to have true zero liquid discharge in  
783           conjunction with the wet scrubber.<sup>31</sup>

784

785   **Q.    What are the benefits associated with the installed wastewater system?**

786   A.    While the installation of the secondary wastewater system represents a significant  
787           cost of \$36.4M<sup>32</sup>, it is in line with costs for similar installations that have been  
788           and are being installed on other power plant flue gas desulphurization systems.  
789           By choosing to add the secondary treatment system, PSNH sought to avoid  
790           potential litigation delays that probably would have accompanied a public  
791           involvement in the revision of the plant NPDES permit, potentially rendering the

---

<sup>31</sup> Jacobs WWT Inquiry 821.

<sup>32</sup> Includes the secondary waste water treatment \$32.6M plus the soda ash softening process \$3.8M.

792 Merrimack Station output unusable. The new enhanced wastewater treatment  
793 system and secondary wastewater systems are providing immediate benefits of  
794 eliminating the discharge of metals, especially mercury and arsenic, into the  
795 Merrimack river.

796 This is a path being taken by a number of utilities in the U.S. to avoid potentially  
797 costly delays. These systems provide the ultimate cleanup of the scrubber  
798 effluent and in zero heavy metals being discharged into the country's waterways.  
799 Based on PSNH's corporate environmental and legal opinions, and faced with the  
800 real possibility of not being able to place the Scrubber Project into service at  
801 completion, PSNH chose to add the secondary treatment system. Based on the  
802 operational intentions for the Merrimack Station that existed when the decision  
803 was made to add this last system to ensure on-time start-up, PSNH felt that is was  
804 a prudent decision. The secondary wastewater system was the only method  
805 available to avoid an effluent discharge and therefore, without it, likely to further  
806 delay the long sought after NPDES permit. Consequently, PSHN decided to  
807 proceed with the installation of this system. Considering the cost of the secondary  
808 wastewater system, which is in line with similar installations, and the fact that this  
809 system would allow the Merrimack Station to meet the Legislative mandate for  
810 mercury removal, it is Jacobs' opinion that the decision to install the secondary  
811 wastewater system was a prudent one.

812

## 813 **7. Performance**

814



815 **Q. In your opinion, how well did PSNH Clean Air Project teams perform?**

816 A. Given the size and complexity of the New Hampshire Clean Air Project at the  
817 Merrimack Station, the construction approach functioned as planned. The various  
818 contractors worked well together and produced a project that was on schedule and  
819 within budget. The project safety performance initially was above (worse than)  
820 the national average and, after the development of a Safety Recovery Plan, the  
821 project experienced a reduction in its recordable incident rate. URS performed the  
822 project management role adequately developing a Commissioning Plan that led to  
823 unit tie-in with minimal problems.

824

825 **Q. Is the system performing as guaranteed and within compliance?**

826 A. The system, based on early testing in 2012, indicates that the Wet Flue Gas  
827 Desulphurization System could perform at or above the guaranteed mercury  
828 removal performance levels and exceed the State mandated requirements. The  
829 preliminary test results from an independent lab indicated a 96-98 percent removal  
830 of both sulfur and mercury. However, it will only be after more thorough testing,  
831 evaluation, and plant operations that the technology will be proven consistently  
832 effective.

833

834 **Q. Was the system installed economically?**

835 A. During our October 2010 Due Diligence Review, it was stated that the project  
836 estimate was revised from \$457M to \$430M. The reduction was due to higher  
837 productivity than estimated in subcontractor bids, lower than anticipated  
838 commodity costs, and favorable weather conditions during the major construction

839 period in 2008 through 2010. Several contract additions were made to cover  
840 secondary water treatment, cathodic protection, and enhanced treatment for the  
841 primary water treatment without changing the final estimate of \$430M.<sup>33</sup> In  
842 October 2011, PSNH further reduced reserves by \$8M and revised the project  
843 estimate to \$422M. As of January 31, 2013, the final estimate for the project was  
844 \$421M. This final estimate included all additional systems, work, and studies  
845 identified after the project started.

846

847 **Q. Does this conclude your testimony?**

848 A. Yes.

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<sup>33</sup> DR 040 CAP Cost Summary January-April 2011.