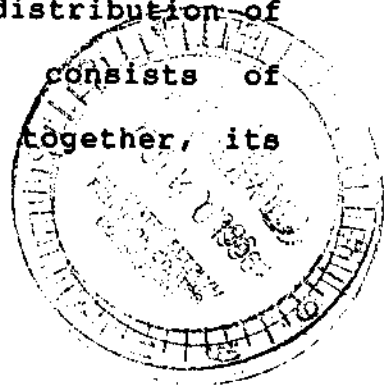


FINDINGS OF THE BULK POWER FACILITY  
SITE EVALUATION COMMITTEE IN DSF-85-155

I. BACKGROUND AND PROCEDURAL HISTORY

New England Hydro-Transmission Electric Company, Inc. (New England Hydro), the Applicant in these proceedings, had its application for a certificate of site and facility for the New Hampshire portion of the Phase II dc transmission line approved for filing with the New Hampshire Public Utilities Commission (Commission) and the New Hampshire Bulk Power Supply Facility Site Evaluation Committee (SEC and Committee) on August 8, 1985.

New England Hydro is a New Hampshire Corporation formed on December 27, 1984. It is part of the New England Electric System and was organized for the purpose of owning, constructing, operating, maintaining, and leasing electric transmission facilities associated with Phase II of the New England/Hydro-Quebec project. The subject of these proceedings was the New Hampshire portion of the project, which was designed to import Canadian hydro-electric energy into New England. Under Phase I and Phase II of the project, hydro-electric energy produced by Hydro-Quebec, the provincial electric utility of the Province of Quebec in Canada, will be purchased by participating member companies of the New England Power Pool (NEPOOL) for distribution of customers in New England. The Pool consists of participating utilities in New England and together, its



members own of 98% of the generating capacity in New England and most all of the transmission network. Exhibit 118 (Testimony of Robert O. Bigelow) pp. 12-13.

The New Hampshire portion of Phase I of the project was certified by the Committee and the Commission in DSF 81-349, by the Commission's Fourth Supplemental Order No. 16,060, issued December 18, 1982. The Findings of the Committee in Phase I were made on December 10, 1982 and incorporated into the Commission's Order. Exhibit 118, p. 22.

Phase I of the project consists of approximately 107 miles of I 450 kilovolt (kv) direct current transmission line, of which about 49 miles are in Quebec, about 52 miles are in Vermont, and 6.1 miles are in New Hampshire.

The direct current (dc) power transmitted by the line is changed to alternating current (ac) power and vice versa by converter terminals located at the northern end of the line in DesCantons, Quebec, and at the southern end of the line at the Comerford terminal in Monroe, New Hampshire.

Under New England Hydro's proposal, the Phase II facilities would consist of an extension of the Phase I dc transmission line from Monroe, New Hampshire, to Groton, Massachusetts. In addition they would include:

- 1) An 1800 MW converter terminal at the southern end of the line at a site adjacent to the existing Sandy Pond 345 kv dc substation between Groton and Ayer, Massachusetts;

2) A 345 kv ac transmission line from the Sandy Pond substation to the existing Millbury 345 kv ac substation in Millbury, Massachusetts; and

3) A 345 kv ac transmission line from the Millbury substation to the existing 345 kv ac substation in Meadway, Massachusetts. Exhibit 35 (Testimony of Robert H. Snow) pp. 7-8.

The energy contract in Phase I calls for Hydro-Quebec to offer 3 terawatthours (twh) to NEPOOL participants. One terawatthour equals one million megawatthours of electricity. Although the Phase I converter terminals have a nominal design capacity of 690 megawatts (mw), the transmission line in that phase was designed to be able to transmit 2000 mw economically, in anticipation of possible additional purchases of energy from Hydro-Quebec. Exhibit 35, pp. 5-6.

Under a Firm Energy Contract entered into between Hydro-Quebec and the participating members of NEPOOL, on October 14, 1985 7 terawatthours of energy per year will be made available by Hydro-Quebec to the NEPOOL participants in addition to the energy purchased under the Phase I contract.

Exhibit 120, ROB-13, 2.1. This contract also provides for the construction of the Phase II facilities in order to allow the transmission of the additional amount of energy.

The entire length of the transmission line proposed in Phase II in New Hampshire will be along existing utility

rights-of-way or on utility-owned property. It will begin near the Comerford terminal in Monroe, New Hampshire and will first extend from the terminal about 0.8 mile on utility-owned property to an existing right-of-way already occupied by two 230 kv ac lines and then, will continue about 111.7 miles along this right-of-way to a point on the right-of-way in the Town of Hudson, New Hampshire known as Sandy Pond Junction.

South of Sandy Pond Junction, the dc line will depart the 230 kv right-of-way, along with the existing 345 kv ac line, and continue on another right-of-way for about 8.5 miles to the New Hampshire/Massachusetts state line in Hudson, New Hampshire. From there, the dc transmission line will continue in Massachusetts as previously described, to Millbury and Medway, Massachusetts. Exhibit 120, p. 24.

In its Application, New England Hydro filed the following petitions with the Commission seeking a ruling on them at the same time it rules on the application for a certificate of site and facility:

- 1) A Petition for a License to Construct and Maintain a Transmission Line Crossing Public Waters of the State and Land Owned by the State;
- 2) A Petition for Permission to Construct a Transmission Line Traversing or Paralleling the Tracks and Property of Railroads; and
- 3) A Petition to Engage in the Business of a Public

Utility and to Begin Construction of Transmission and Related Facilities in Certain Towns.

In addition, New England Hydro in accordance with the provisions of RSA 162-F:7, IV, included in its Application information to meet the requirements of other individual state agencies and departments having jurisdiction over the proposed construction of the Phase II dc line in New Hampshire. These included:

- 1) A Petition to the Commissioner of Public Works and Highways to Cross State-Maintained Highways with Overhead Electric Conductors;
- 2) An Application to the Wetlands Board and/or the Governor and Council and the Water Supply and Pollution Control Commission for Permission under RSA Chapters 483-A, 482:41-e to-i, 488-A and 149:8-a Relating to Filling, Dredging or Construction of Structures in State Waters and Wetlands.

Subsequent to filing the Application, New England Hydro filed three amendments to it. They were as follows:

- 1) On January 6, 1986, it filed a Partial Withdrawal of and Amendment to Application. The purpose of this amendment was to withdraw its application only to the extent that the Application requested certification of an 8.1 mile long Alternate Network to be located in the Towns of Hudson, Windham, and Pelham.

2) On February 21, 1986, it filed a Motion to Amend Application. The purpose of this Motion was to conform appendicies E and F of the Application, which identify the wetlands and waters to be crossed by the Phase II dc line to the evidence presented in the proceedings. The Committee accepted this amendment on May 22, 1986.

3) On August 12, 1986, it filed another Motion to Amend Application. The purpose of this Motion was to conform Appendicies H and I of the Application to the evidence presented in the proceedings. The amendment of Appendix H was submitted to cover the possibility that New England Hydro might not expand the Phase I ground electrode as originally proposed in Appendix H, but might instead extend the dedicated metallic neutral return conductor from Littleton, New Hampshire to Norton, Vermont, along the Phase I transmission structures. The Amendment of Appendix I reflected updated cost estimates for the Phase I project. The Committee accepted this amendment on August 14, 1986.

As required by the provisions of RSA 162-F:7, I (Supp. 1985), the Committee held public informational hearings in Merrimack County on October 3, 1985; in Hillsborough County on October 10, 1985; in Rockingham County on October 17, 1985; and in Grafton County on October 24, 1985.

Other participants in the proceeding were an assistant attorney general as counsel for the public, representing the public and its interests throughout the proceeding as provided for the RSA 162-F:9, and one intervenor, the Powerline Awareness Campaign (PAC), which was granted permission to intervene on January 21, 1986 in accordance with the provisions of N.H. Admin. Reg. Bul 202.01. There was no other intervenors.

Seventeen days of public adversarial hearings were conducted jointly by the Committee and the Commission between February 5, 1986 and August 14, 1986. Fourteen witnesses testified on behalf of New England Hydro regarding various aspects of the Phase II project during the hearings. Counsel for the public and counsel for the intervenor, PAC, cross-examined these witnesses.

The Committee called as a witness, Dr. Michael G. Bissell, who testified about potential health effects of the project, and the Commission called as a witness, Roy G. Barbour, a vice president of Public Service Company of New Hampshire, who testified about the need for electricity and the benefits of the project to its customers. No witnesses were called by the intervenor or by counsel for the public.

On October 2, 1986, the Committee met in a public meeting in Concord, New Hampshire, and eight members of the Committee who were present unanimously voted to make the findings required by RSA 162-F:8, and to incorporate into

and make a part of these findings, the seven conditions set forth in Stipulation dated September 16, 1986 filed by New England Hydro, PAC and the Attorney General, with certain modifications which are hereinafter set forth, and to transmit these findings to the Commission as provided for in RSA 162-F.

## II. FINDINGS

One preliminary matter on which a finding must be made, before taking up the two main findings which the SEC must make under the statute, is whether the proposed 121 mile +450 kv dc facility should require a certificate of site and facility because of a substantial environmental impact. RSA 162-F:2(c) defines a Bulk Power Supply Facility, among other definitions, as a line in excess of 100 kilovolts (kv) which the Site Evaluation Committee or Commission determines should require a certificate because of a substantial environmental impact. The proposed facility is more than 100 kv in design and goes for its entire length over existing transmission rights-of-way.

This matter was not referred to in New England Hydro's Application and was not brought up during the proceedings. However, the SEC discussed this same matter in DSF 81-349, and consistent with our findings in that docket with reference to Phase I of this project, for the purposes of these findings, the SEC finds that the proposed facility is



one which should require a certificate.

There are two main findings which are the responsibility of the SEC under RSA 162-F:8. The SEC must find that the proposed facility:

- 1) Will not interfere with orderly development of the region with consideration having been given to the views of municipal and regional planning commissions and municipal legislative bodies and
- 2) Will not have an unreasonable adverse effect on esthetics, historic sites, air and water quality, and natural environment and the public health and safety.

The SEC hereby finds that the proposed facility will not unduly interfere with the orderly development of the region and will not have an unreasonable adverse effect on esthetics, historic sites, air and water quality, and natural environment and the public health and safety.

The SEC makes these findings after having considered the available alternatives and the environmental impact of the site and facility presented by the Applicant, New England Hydro, and after due consideration having been given to the views of municipal and regional planning commissions and municipal legislative bodies.

Several possible alternatives to both the project location and the specific use of the existing right-of-way for the project, the so-called Preferred Route, were

discussed and studied by the Applicant and by NEPOOL. The primary elements with respect to general project location are the 1800 new converter terminal and the transmission facilities required to deliver the Phase II energy to New England Load centers. These apply regardless of which alternative is used. The Phase II converter terminal could theoretically be at some location other than Sandy Pond. Several options were considered for the placement of the converter terminal and the required transmission facilities.

NEPOOL originally studied six potential sites, and from these locations defined nine different transmission line plans for study. The Preferred Route as presented in these proceedings came out of these studies. It was selected for reasons of economy, reliability and environmental suitability. Among other alternatives considered was a converter terminal at Comerford, with a single ac transmission line. The study of this alternative was requested by counsel for the public during the hearings. Although the study revealed the plan to be technically feasible, it was considerably more costly than the Preferred route dc plan which was preferable both in terms of economy and reliability.

Another alternative considered was that part or all of the dc transmission line be placed underground. The resulting studies indicated that not only would costs be much higher, but the environmental impacts would be greater

and system reliability would be lower for an underground system than for the proposed overhead system. Exhibit 143 (Draft DOE Environmental Impact Statement), sections 2.2.8.5, 4.2.1.4. Two other alternatives routes, the so-called Eastern and Western Alternatives were studied by the Applicant. These would also use existing rights-of-way located generally east and west of the Preferred Route. Both of these routes were not wide enough to accommodate the new dc transmission line, and would require significant right-of-way acquisition and clearing including relocation of homes and business. Exhibit 23 (Environmental Report, Vol I) pp. 188-189.

The evidence indicates that the dc overhead plan on the Preferred Route proposed by New England Hydro is preferable to each of the alternatives that have been examined, based on consideration of economics, environmental concerns, and power planning, and the SEC so finds.

The following is a discussion of the basis for these findings.

**A. The Proposed Facility Will Not Unduly Interfere with the Orderly Development of the Region.**

As was the case in docket DSF 81-349, Phase I of the proceedings, the single most important fact bearing on this finding is that the proposed transmission line occupies or follows existing utility transmission rights-of-way or utility-owned property for its entire length of 121 miles.

The width of the right-of-way along most of the line will be 350 feet.

The Phase II facilities would consist of an extension of the Phase I dc transmission line from Monroe, New Hampshire to Groton, Massachusetts. An 1800 MW converter terminal would be built at the southern end of the line adjacent to an existing 345 kv ac substation and then, 345 kv transmission lines constructed into and extended to two substations in Massachusetts.

Two kinds of support structures will be used for the dc transmission line. A lattice steel H-frame structure will be used for the first 112.5 miles of the line, from the Comerford converter terminal in Monroe to Sandy Pond Junction. A narrower single-shaft steel-pole structure will be used on the remaining 8.5 miles of the route, where there is insufficient room on the right-of-way for H-frame structures. Other structure types will be used on a limited basis.

On the issue of the orderly development of the region, New England Hydro presented an Environmental Report prepared by Chas T. Main, Inc. (Main) of Boston, Massachusetts, supported by the testimony of two of its employees, David F. Jenkins and James K. Nickerson, Jr., and the testimony of Stewart Lamprey, a New Hampshire real estate broker and appraiser, who testified on the issue of land use. Main was retained by the Applicant to gather data on environmental

resources and to evaluate potential environmental impacts associated with the Phase II transmission facilities.

One of the issues covered by witnesses Jenkins and Nickerson was that of orderly development. Their Environmental Report, Exhibit 23, addresses several aspects of development, with the first one being land use. Their report notes that 99 percent of the length of the project would be constructed on rights-of-way that have been used by transmission lines for many years. It further notes that industrial, commercial, and residential development has taken place adjacent to the existing rights-of-way with no apparent adverse effect, and there is no reason to expect the Phase II transmission line to interfere with additional development. Exhibit 23, p. 9. Their report concludes that any direct impact on land use would be limited to effects on land use within the existing rights-of-way and would be confined to minor secondary uses such as sand and gravel excavation. It further concludes that potential impacts on adjacent land uses would be minimal and would be related primarily to incremental visual impacts. Exhibit 23, P. 112.

Mr. Stewart Lamprey, a real estate broker and appraiser, gave further testimony on the issue of land use. He performed a study of land uses and property values along the corridor proposed for construction of the Phase II transmission line, in order to determine what effect the

project would have on the values of existing properties. Mr. Lamprey prepared three reports totalling about 600 pages in length. Exhibits 12-17.

Mr. Lamprey examined and evaluated land uses along the existing right-of-way to determine whether the presence of the existing high-voltage transmission lines appeared to have altered land uses. Exhibit 12 (Testimony of Stewart Lamprey) pp. 7-13; Exhibit 13 (Land Utilization Study). Then he selected 46 properties in close proximity to the right-of-way that had been sold in recent arms-length transactions and compared their sales prices to the sale prices of comparable, recently sold properties away from the right-of-way in the same communities. Finally, he also looked for properties that had been sold within a reasonable time before and after the addition of high-voltage transmission line on a right-of-way with two or more existing high-voltage transmission lines. The purpose of these studies was to determine the effect on property values under the circumstances of each study. Exhibit 12, pp. 14-23; Exhibit 14 (Economic Impact of Transmission Lines on Property Values in the State of New Hampshire); Exhibit 15 (Exhibits SL-3 & SL-4 to Testimony of Stewart Lamprey)

Mr. Lamprey's conclusions were:

- 1) That land uses along the existing right-of-way are similar to those in surrounding areas and do not appear to have been adversely affected by the

right-of-way. Exhibit 12, pp. 6, 13.

2) The presence of high-voltage transmission lines does not affect sale price or marketability of nearby properties, although it may have some effect on depth of the market. Exhibit 12, pp. 6, 17-19; Exhibit 14, pp. 20-21.

3) Although, the data on Sales of the same properties before and after the addition of a high-voltage transmission line to a right-of-way with existing high-voltage transmission lines are insufficient to allow the formulation of any definite conclusions, there is no evidence to suggest any negative effect on market values. Exhibit 12, p. 6, 23; Exhibit 15.

Mr. Lamprey concluded that the addition of the dc line along the existing right-of-way would not have a detrimental effect on market value of nearby properties. Exhibit 12, p. 7; Tr. Vol. II, pp. 58-59; Exhibit 20 (Kinnard, Tower Line and Residential Property Values 35 the Appraisal Journal 269 (1967)). No contradictory evidence was introduced to rebut Mr. Lamprey's Testimony.

The Environmental Report of witnesses Jenkins and Nickerson also considered the likely effects of the Phase II facilities on transportation and utilities, on agricultural areas, socioeconomic impacts, and on the recreational resources of the region, and concluded that the incremental

impacts attributable to those factors would be minimal. Exhibit 23, pp. 121, 123, 126-127, 128, 135-137, and 143-144. Overall, they concluded that the Phase II project would not cause any undue interference with the orderly development of the region. Exhibit 23, p. 9.

On the issue of orderly development, the Committee is required to give "due consideration" to the views of municipal and regional planning commissions and municipal legislative bodies. Although these proceedings were widely noticed and publicized in the counties through which the proposed transmission line is to be routed, only two such bodies presented their views. These were the Bedford Board of Selectmen and the Bedford Planning Board. Both expressed concerns about the project, but did not state that the project should not be approved, and they did not present any facts to indicate that the project would interfere with the orderly development of the region.

On this issue, several commercial and industrial organizations made limited appearances during the proceedings to express strong support for the Phase II project. These were the New Hampshire Association of Commerce and Industry, which represents six hundred New Hampshire businesses, Tr. Vol. II, pp. 12-14; the Business and Industry Association of New Hampshire, which represents businesses employing more than 70,000 people in New Hampshire, Tr. Vol, XV, pp. 4-6; and the New Hampshire Farm



Bureau Federation, which is a federation of ten county farm bureaus consisting of over 3,000 farm and rural member families engaged in various agricultural enterprises, Tr. Vol. VII, pp. 21-23.

New England Hydro's position on this issue, in summary, is that the proposed facilities would not interfere unduly with the orderly development of the region. We agree. No contradictory evidence was introduced to rebut this position. Under these circumstances, we conclude that the proposed Phase II facility is compatible with land use patterns in the area and will not interrupt or conflict with existing commerce.

We conclude, on the basis of the above findings, that the proposed facility will not unduly interfere with the orderly development of the region.

**B. The Proposed Facility Will Not Have an Unreasonable Adverse Environmental Impact.**

The SEC must address five specific categories of environmental impacts in this proceeding. These are 1) impacts on esthetics, 2) impacts on historic sites, 3) impacts on air and water quality, 4) impacts on the natural environment, and 5) impacts on public health and safety. RSA 162-F:8. We will treat each impact separately below.

As stated in our findings in the Phase I proceeding, docket DSF 81-349, and as we have already noted, the proposed facilities will be located on existing utility

transmission rights-of-way or on utility-owned property for its entire length of 121 miles. Also, as previously stated, every human activity has some effect on the environment and, as with the Phase I facilities, construction and operation of the Phase II Facilities is no exception to the rule. However, we again note, that the relevant inquiry under the statute is whether the proposed facility will have an "unreasonable" environmental impact. We also again note that whether the impacts are "unreasonable" depends on the assessment of the environment in which the facility will be located, an assessment of statutory or regulatory constraints or prohibitions against certain impacts on the environment, and a determination as to whether the proposed facility exceeds those constraints or violates those prohibitions.

New England Hydro had an environmental assessment performed for it by Main and offered the testimony of witnesses Jenkins and Nickerson on this overall assessment. Further, on the issue of public health and safety, New England Hydro offered the testimony of witnesses Johnson, Charry, Justesen and Banks as well as the exhibits they introduced. The Committee offered the testimony of Dr. Michael G. Bissell on this issue. Finally, the Draft Environmental Impact Statement dated August, 1986, prepared by the U.S. Department of Energy, was offered in evidence. It concluded that the environmental impacts of this project

would be minor and incremental in nature, and the operation of the proposed line and associated facilities would not pose any significant hazards associated with electric fields or related effects, or seriously affect other components of human health and welfare in the project region.

The testimony and the exhibits show no violation of existing regulatory or statutory constraints by construction, operation and maintenance of the proposed Phase II facilities. On the evidence adduced and on the record before us, we find that there will be no unreasonable, adverse environmental effects.

#### 1) Esthetic Impacts

The proposed Phase II transmission line will be located entirely on existing right-of-way and utility property. The proposed towers will be from 75 to 115 feet tall, with a typical height of 90 feet, some 25 to 40 feet taller than the existing towers. The structures for the dc line will be located in line with the structures of the existing 230 kv ac lines, thereby maintaining symmetry with the existing facilities. The average span between structures will be about 600 feet, but could be increased to about 1200 feet to accommodate special conditions. Exhibit 37 (Testimony of Frank S. Smith) pp. 6-7; Tr. Vol. V, pp. 102-103 (Testimony of Mr. Nickerson) Tr. Vol. VI, pp. 27-30.

Very little additional clearing would be required for

construction of the facilities. The proposed facilities would have only an incremental visual impact. The Main study concluded that the overall visual impact of the line would be low to moderate, Exhibit 23, pp. 152, 159, and that the visual impact at most points along the line would be minimal or none. Exhibit 23, pp. 159-160; Tr. Vol. II, pp. 177-198.

We find that the esthetic impacts of the proposed Phase II facility will be minimal and would not have an unreasonable adverse effect.

## 2) Impacts on Historic Sites.

The undisputed evidence produced by New England Hydro is that the Phase II project would not have an unreasonable adverse effect on historic sites. The Applicant has developed a Cultural Resources Plan in consultation with the New Hampshire State Historic Preservation Officer and this plan provides for a thorough evaluation of sites listed in or potentially eligible for listing the National Register of Historic Places and development of mitigative measures at such sites, if necessary. Exhibit 23, pp. 10, 114-146. The Main study indicated that the project would not have a physical impact or an unreasonable incremental or new visual impact on any known historic sites and that the project is not expected to have an adverse effect on the eligibility of any known sites for inclusion in the National Register of Historic Places. Exhibit 23, p. 10. The United States

Department of Energy has tentatively concluded that the project will have no adverse effect on significant archeological sites and that effects on historic structures are not likely to exceed those already created by the existing rights-of-way. Exhibit 143, (DOE Draft Environmental Impact Statement) These studies indicate that there will not be an unreasonable adverse impact on historic sites.

We find there will be no unreasonable adverse impact on historic sites by the proposed Phase II facility.

### 3) Impacts on Air and Water Quality

The construction of the Phase II facilities will require some excavation and filling of wetlands and surface waters of the State. Of 206 surface waters on the existing rights-of-way, 197 will be crossed by the Phase II facilities. Of these, only a few may require some excavation and filling activities within their limits. A minimal number of stream crossings could require clearing of some vegetation adjacent to an existing cleared right-of-way. These clearing would have minimal impacts. Exhibit 23, p. 68.

Mr. Frank S. Smith, one of Applicant's engineers, described how streams would be crossed and access gained to wet areas. Small streams would be forded where possible. Otherwise a culvert or bridge would be installed that would allow free passage of water and fish. Existing access roads

and stream crossings would be used where practicable and access roads would be built only as necessary to cross streams and wetlands. Exhibit 23, p. 49; Exhibit 25 (Environmental Report Correction) p. 1.

Overall impacts on wetlands would be low, and there would be no long-term impact on water quality in wetlands. Exhibit 23, pp. 54-56; Tr. Vol. IV, p. 131; Exhibit 143, B-3 to B-5. Effects on ground water and surface water would primarily be construction-related and short-term. Impacts from erosion and sedimentation would be minimized by construction and soil stabilization procedures. Exhibit 23, p. 11.

Only a very small percentage of the surface waters traversed by the Phase II Transmission line would be on rights-of-way where any additional clearing of tall-growing vegetation or additional right-of-way maintenance would be required. Temporary increases in sedimentation and turbidity might result in a few cases. Mitigative measures, including soil erosion and sedimentation controls, would minimize these effects. Water quality would not be adversely affected in the long run. Exhibit 23, p. 12. The project is not expected to have any effect on rivers that are inventoried under the Federal Wild and Scenic Rivers Act. Tr. Vol. V, p. 140.

With respect to air quality, impacts of construction-related dust and vehicle emissions would occur

occur only intermittently on the rights-of-way and would be confined to their vicinity. Exhibit 23, p. 46, the situations involving air ions and herbicide applications are discussed under "5) Impacts on Public Health and Safety."

Long-Term air quality in New England would benefit because the Phase II imports of electricity would displace fossil-fuel generation, thereby reducing air emissions. Exhibit 23, p. 11.

On the basis of this evidence we find that there would be no substantial impacts on air and water quality of the construction and operation of the proposed Phase II facilities, and no unreasonable adverse effect on air and water quality.

#### 4) Impacts on the Natural Environment.

A review of all the testimony and exhibits indicates that there would be no continuing, significant overall impacts on the natural environment by the construction and operation of the proposed Phase II facilities. About 25 acres of forest out of a total of 5,000 acres of rights-of-way would have to be cleared for construction. The impact on local forest resource would be minimal. There would be no negative impact on species of rare plants on or in the vicinity of the right-of-way. Long-term changes to micro-climate conditions of the cleared area would be minimal. Exhibit 23, pp. 85-86.

As noted above, overall impacts on wetlands would be

low and there would be no long-term impact on water quality in wetlands. Effects on fish and wildlife would be minimal. Potential effects on fish would be associated with habitat alteration and short-term changes in turbidity, sedimentation and temperature. These effects would be minor and there would be no long-term adverse effects. The only impacts on wildlife that use the shrub/herbaceous habitat on the existing right-of-way would be short-term impacts associated with construction. There would be no significant risk of harm to endangered species. Exhibit 23, pp. 98-101, 103-105.

Dr. Gary Johnson, in his testimony, stated that the construction of the Phase II dc line in existing rights-of-way, will either have no effect on the audible noise levels at the edge of the existing rights-of-way or else have only a small effect by increasing the audible noise levels by 3dB(A) or less.

For the case of the dc line alone, the audible noise levels, that will be found at the edge of the right-of-way, due to the dc line, will be quite low and will likely be less than the ambient noise levels. Except in extremely quiet areas, it is unlikely that the audible noise levels from the dc line would be detectable above ambient background noises.

Dr. Johnson explained the significance of the calculated levels of audible noises.

These audible noise levels in all cases would be below



the guideline value of audible noise established by the Environmental Protection Agency to protect public health and welfare.

The construction of the dc line causes only a small increase, or in many cases no increase, in the audible noise levels at the edge of the right-of-way. Exhibit 57, pp. 10-12.

Dr. Johnson also described the expected effects of radio interference.

He stated that the construction of the Phase II dc line in existing ac rights-of-way causes only a small increase, generally 3dB or less, in the radio interference levels that existed at the edges of the right-of-way prior to construction, and in some cases actually causes a decrease in the radio interference levels.

Dr. Johnson then described how a dc conductor can cause television interference when it is in corona and then concluded that the proposed line should not create a problem with regard to television interference. Exhibit 57, pp. 12-16.

We find that, on the basis of this evidence, the Phase II project will not have an unreasonable adverse effect on the natural environment.

#### 5) Impacts on Public Health and Safety.

The issue of public health and safety received a substantial amount of attention during these proceedings,

both by the Applicant and by various individual members of the public who made limited appearances and expressed their views on this issue.

Dr. Gary B. Johnson, a witness for the Applicant and an expert in the field of electrical phenomena associated with high-voltage transmission lines, testified about phenomena associated with operation of the dc line. Among these phenomena are electric and magnetic fields caused, respectively, by voltage on the conductors and current in the conductors. Another phenomenon is ion production caused by corona on the surface of the conductors. Exhibit 57 (Testimony of Gary B. Johnson) p. 4.

Three other expert witnesses, Dr. Jonathan M. Charry, Dr. Don Robert Justesen, and Robert S. Banks testified for the Applicant on the potential health effects of electrical phenomena associated with hv dc transmission systems. The Committee also called its own independent expert witness, Dr. Michael G. Bissell to testify regarding the potential for health effects.

All of these witnesses were subjected to extensive cross-examination. The opinion expressed by all of these witnesses was that based on available evidence, the proposed dc transmission line is unlikely to cause adverse health effects and that concern for public health should not prevent or delay the construction of the facilities proposed. The DOE Draft Environmental Impact Statement

reached a similar conclusion. It stated that "the operation of the proposed line and associated facilities would not pose any significant hazards associated with electric fields or related effects, or seriously affect other components of human health and welfare in the project."

These witnesses discussed electric and magnetic fields, corona and air ions associated with the proposed Phase II dc line, the behavioral and biological effects of air ions and public health studies related to these phenomena.

The proposed dc line would produce electric fields from two sources, one caused by voltage on the line, and the other produced by the charge carried by the ions from corona. These two electric-field components combine to produce an electric fields that can be measured at ground level. Dr. Johnson, in his research and studies, measured these fields. He stated that the electric fields at the edge of the right-of-way along most of the length of the line during summer fair weather conditions would be within the range of the earth's natural electric fields, that is, the electric fields to which people are constantly exposed under normal conditions. He testified that a person located at the edge of the right-of-way would not perceive any effects from the electric field and that a person within the right-of-way might perceive a very mild sensation, similar to that from exposure to a light wind, during periods of high corona activity. Exhibit 57, pp. 20, 23, 24.

Dr. Jonathan M. Charry testified about the potential health effects of the dc electric fields. He had performed an exhaustive review and evaluation of the literature on dc field effects. Data from the studies on the effects of dc electric fields on human beings indicate mixed results. None of the studies on human responses to dc electric fields meet the criteria for minimally acceptable scientific studies. Only a few of the studies on dc electric field effects in animals meet the criteria for minimally acceptable scientific quality. Based on his review of the literature on dc electric field effects, Dr. Charry concluded that, while there is a possibility that dc electric field exposure could produce biological effects, these effects cannot be considered harmful. There is no scientifically credible evidence to indicate adverse health effects at the electric field strengths characteristic of the proposed dc line. Exhibit 61 (Testimony of Jonathan M. Charry) pp. 23, 9, 26-28.

Dr. Michael G. Bissell, the Committee's witness, an expert in the field of behavioral and biological effects of air ions and electric fields agreed with Dr. Charry's conclusions. He indicated that there is no scientific basis for believing that the electric fields or magnetic fields produced by the powerline would cause adverse health effects. Exhibit 110 (Testimony of Michael G. Bissell) pp. 4-5.

No testimony was presented to contradict the opinions of Dr. Charry and Dr. Bissell, and the Committee finds that electric fields produced by the Phase II project will not cause unreasonable adverse health effects.

Current flowing through dc conductors will produce a static magnetic field whose strength can be measured in gauss. Dr. Johnson measured the magnetic fields of the proposed line and concluded that the values he measured are all close to or less than the earth's natural field and thus should present no problems, not already present in the natural environment. Another witness, Dr. Don Robert Justesen, elaborated on the possible effects of the dc magnetic field. He explained that the magnetic field created by the dc line would not have harmful effects on human beings or other mammals, because of the weakness of the field. Exhibit 72 (Testimony of Don Robert Justesen) pp. 9-11, 19. Tr. Vol. VII, pp. 175-181.

Again, no contrary evidence was presented to rebut the testimony of Dr. Johnson and Dr. Justesen.

The public health issue which received the most attention in these proceedings was the potential effects of air ions produced by corona and the dc transmission line's conductors. Corona is a partial electrical breakdown of the air surrounding the conductors. It occurs when local electrical stress on the surface of the conductor (the "surface voltage gradient") becomes large enough to dislodge

one or more electrons from the molecules of air surrounding the conductors. When this happens, the air molecules are broken down into two components (ions) one having a positive electric charge and the other having a negative electric charge. Ions produced by corona will drift, under the influence of the electric field, from conductors of one polarity to conductors of the other polarity and also toward the ground. Exhibit 57, pp. 6-8.

The Phase II transmission line is designed so that the conductors will normally be operating below the corona inception gradient, which is a level of electrical stress, at which corona occurs, 30 kv/cm. However, nicks in the conductor, small airborne particles of vegetation, pollen, insects, raindrops, or snowflakes on the conductors will create points where the electrical stress is intensified sufficiently to produce corona. Among the potential effects of corona are audible noise, radio interference, ozone and air ions. Dr. Johnson discussed these effects and testified that noise, radio interference, and ozone are not serious concerns. Exhibit 57, pp. 7-16.

One major concern regarding corona has been the production of air ions. Dr. Johnson testified at length regarding the level of air ions that can be expected to exist on the transmission right-of-way, at the edges of the right-of-way, and beyond the right-of-way under various weather conditions. Exhibit 57, p. 17; Tr. Vol. VIII, pp.

28-30 (Testimony of Dr. Johnson.)

Ions are a common phenomenon and are not unique to dc transmission lines. They are produced by many natural and man-made causes, including sunlight, waterfalls, precipitation, and combustion processes. The ion levels expected at the edges of the right-of-way will in many cases be within the range of ambient background levels and will generally be less than ion levels commonly encountered during daily activities. Exhibit 57, p. 18. The ion levels expected to exist under the dc transmission line are substantially less than those found in many common situations.

A substantial amount of laboratory investigation has been done on the effect of air ions on human beings and animals. The many studies of air ion effects were evaluated by Dr. Charry and Dr. Bissell. After evaluating these studies, Dr. Charry concluded that while there is a possibility that ion and/or dc field exposure could produce biological and behavioral effects under certain conditions in the laboratory, these effects do not extrapolate to harm. He noted that the kinds of effects observed in the studies are similar to those caused by every-day stimuli and are likely to disappear when the stimulus is removed. Exhibit 61, pp. 27-28.

Dr. Bissell agreed with Dr. Charry's views. Dr. Bissell was asked by the Committee to represent the

Minnesota Environmental Quality Board Science Advisors. In his direct testimony, Dr. Bissell quoted at length from two documents published by the Science Advisors, the first published in December 1982, and the second in April 1986.

The Science Advisors concluded in 1982 that "there is now no scientific basis to believe that the electric and magnetic fields and air ions produced by the powerline pose a hazard to human or animal health." In the same study they stated that "there is insufficient reason to believe that acute exposure to air ions are harmful or injurious. As far as is known, all effects that have been described in animals and humans are quite mild and fully reversible, usually within a few hours" In 1986, "the six Advisors unanimously agreed that their December 1982 conclusion [quoted above] is still valid." Exhibit 110, (Testimony of Michael G. Bissell) pp. 406.

When asked on direct examination whether any of his laboratory work in this area could be "construed as suggesting that negative air ions might be biologically harmful," Dr. Bissell answered that it could not. Exhibit 110, p. 11. On cross-examination, Dr. Bissell stated that he agreed with Dr. Charry's conclusions that effects of air ions are fully reversible, are small in magnitude, and are within normal biological variability. Tr. Vol. XIII, pp. 116, 172. Dr. Bissell's opinion was that there is no reason to believe that the proposed Phase II transmission line



would cause adverse health effects.

Dr. Bissell stated that, having at one time lived and slept with a negative air ion generator for a year or two, he would be quite comfortable living and raising a family as an abutter to the right-of-way if the Phase II line should be constructed. Tr. Vol. XIV, pp. 152-153, 187.

Dr. Charry and Dr. Bissell were the only expert witnesses to testify regarding laboratory studies of the biological effects of air ions, and both of them agreed that there is no scientific basis for believing that the proposed transmission line will have any adverse health effects. Although some studies reporting the certain effects were referred to during the hearings and were submitted as exhibits, both of the witnesses evaluated these studies and agreed that they do not indicate a likelihood of adverse effects from the transmission line.

There are currently four hv dc transmission systems in operation in North America. To date, six studies have been undertaken to examine the human and veterinary public health implications of the hv dc electrical environment, based on the operating experience of one or more of these systems. Robert S. Banks, an expert in the field of public health implications of energy facilities, testified for the applicant about the results of the studies. Dr. Bissell also testified on this subject.

Mr. Banks' conclusion regarding the results of the six

human and veterinary health studies was that, taken as a whole, they indicate that there is no evident pattern of adverse health effects in proximity to the four North American HVDC transmission systems suggesting a general absence of perceivable health effects from exposure to the HVDC electrical environment. In addition, he stated, "While of themselves of limited public health significance, these conclusions are consistent with the available laboratory and clinical research findings which, as discussed by Dr. Charry, indicate that acute adverse health effects are not likely to result." Exhibit 65, pp. 46-47.

Dr. Bissell agreed with Mr. Banks' assessment of various public health studies. Although he acknowledged that each of the studies had some limitations, he still attributed a substantial amount of value to them. He explained that it probably would be impossible for any epidemiological study to show affirmatively that no health effects will result. He stated, however, that "each study that is successfully completed is a piece of evidence one way or the other." Dr. Bissell expressly agreed with Mr. Banks' statements that there is no evident pattern of health effects in proximity to any of the existing hv dc systems and that the studies indicate a general absence of perceivable health effects from such systems. Tr. Vol. XII, pp. 156-164.

On the basis of these public health studies, considered in the light of the laboratory studies discussed previously, both Mr. Banks and Dr. Bissell concluded that hv dc power systems do not have an adverse impact on human or animal health. On this basis, Dr. Bissell's opinion was that there is no public health reason to delay the construction of the Phase II system in New Hampshire.

Rufin VanBossuyt, Jr., system arborist for New England Power Service Company, testified about the vegetation management practices that will be used on rights-of-way to be occupied by the Phase II facilities. The Phase II facilities would be located almost entirely on established rights-of-way that are already being managed in the manner described by Mr. VanBossuyt. The vegetation management program that is currently being used successfully on these rights-of-way would be continued with the addition of the Phase II facilities. Exh. 5 (Testimony of Rufin VanBossuyt), pp. 10-11.

Mr. VanBossuyt testified that the primary vegetation management technique will be the selective use of herbicides, which will be applied in accordance with New England Electric System policies and procedures and all applicable federal and state laws and regulations. The New Hampshire Division of Pesticide Control or its designated agent must approve any vegetation treatment on the rights-of-way. Exhibit 5, pp. 5-6.

In certain sensitive areas, such as near public water supply reservoirs, public and private wells, wetlands containing standing water, and gardens, special management techniques such as hand-cutting, mowing, use of only certain herbicides, and use of only certain herbicide application methods will be employed. Herbicides will be applied only by professional herbicide application companies that are licensed by the New Hampshire Division of Pesticide Control. Exhibit 5, pp. 6-7.

System contractors are instructed to use only certain herbicides, all of which are registered by both the Environmental Protection Agency and the New Hampshire Department of Agriculture for use of rights-of-way. The contractors are also instructed to take special steps to minimize the chance that herbicides will drift off the right-of-way. If wind speed reaches a point at which herbicides might drift, the vegetation treatment is discontinued. Exhibit 5, pp. 9-10.

Mr. VanBossuyt concluded that maintenance of the phase II rights-of-way will not have an unreasonable adverse effect on public health and safety, air and water quality, or the natural environment. Exhibit 5, p. 12.

The Statute requires that the Committee to make a finding on the reasonableness or unreasonableness of the impacts on public health and safety of the electrical effects of the proposed line. Although the witnesses on

this issue testified that the available scientific data and information was uneven and often unsatisfactory, they agreed that there is no basis for concluding that the proposed Phase II facilities will have an unreasonable adverse effect on the public health and safety.

From the evidence, it is evident that the proposed dc transmission line is designed so as to produce as low a level of air ion emissions as possible. It will emit air ions only when it is corona and the concentrations of air ions emitted from the line will be substantially less, in most instances, than those encountered by human beings under many ordinary circumstances.

With this state of the testimony and evidence, we find that the risks of adverse effects on the public health and safety are minimal and fall within an acceptable range. Accordingly, we find that the electrical effects of the facility will not have an unreasonable adverse effect on the public health and safety.

### III. OTHER PETITIONS OF THE APPLICANT

In its Application, New England Hydro included several petitions to the Commission for licenses and permits within its jurisdiction, and to the other state agencies which have jurisdiction to issue licenses and permits needed by the Applicant for this project. These petitions will be referred to state agencies involved for their appropriate

action in accordance with the provisions of RSA 162-F, and consistent with the findings of the Committee herein, to be included in any certificate of site and facility issued by the Public Utilities Commission in this proceeding.

#### IV STIPULATIONS OF THE PARTIES

At the conclusion of the proceedings, the Applicant and the two other parties, PAC, and the Attorney General's office filed two stipulations. The first stipulation provided that the designation "for identification" may be stricken from all exhibits and they may be accepted as full exhibits. The Committee accepts and approves this stipulation, and all exhibits are considered full exhibits.

The second stipulation was submitted by the parties in full and complete settlement between them of all issues that have been or could have been raised in this proceeding. After entering into the stipulation, the Powerline Awareness Campaign withdrew its appearance and removed itself from further participation in this proceeding.

At its October 2, 1986 meeting, the Committee voted unanimously to include the seven conditions of the stipulation as a part of its findings after first amending Exhibit B to the stipulation. On page 3 of Exhibit B, the Committee amended the first paragraph to read as follows:

This Exhibit shall be construed so as to obligate the Company to conduct the human epidemiological

study should it be deemed feasible by the Site Evaluation Committee and the Public Utilities Commission upon such terms and conditions as they deem advisable.

The Committee further amended the third paragraph on page 3 of Exhibit B to read as follows:

All costs associated with compliance with this Exhibit B shall be borne by the Company.

The seven conditions set forth in the stipulation are otherwise accepted by the SEC as set forth in its conclusions below.

#### V. CONCLUSION

The SEC hereby finds and determines that:

1. The proposed facility, in the light of all the circumstances, is a facility which has a sufficiently significant environmental impact, to require a certificate of site and facility.

2. The proposed facility consisting of 121 miles of a 450 kv dc transmission line from Monroe, New Hampshire to the Massachusetts border and a 1800 mw converter terminal at the southern end of the line at a site adjacent to the existing Sandy Pond 345kv ac substation, and its associated transmission lines:

a) Will not unduly interfere with the orderly development of the region.

b) Will not have an unreasonable adverse effect on esthetics, historic sites, air and water quality, the natural environment and the public health and safety.

3. The petitions and applications in New England Hydro's Application are referred to the Wetlands Board and Water Supply and Pollution Control Commission, to the Commissioner of Public Works and Highways and to the Public Utilities Commission for the findings required by them and for their issuance of such permits and licenses as required by law and pursuant to standard and normal conditions for such permits, to be included in any certificate of site and facility issued by the Public Utilities Commission in this proceeding.

4. The seven conditions in the stipulation of the parties are acceptable as part of the SEC's findings herein as follows:

A. The stipulation is accepted as a full and complete settlement between them of all issues that have been or could have been raised in these proceedings upon the terms expressed therein.

B. New England Hydro shall conduct a monitoring study concerning static electric and magnetic fields and ion levels as set forth in Exhibit A to the stipulation.

C. New England Hydro shall undertake an investigation of the feasibility of a long-term epidemiological study as



set forth in Exhibit B to the stipulation as amended by the SEC herein.

D. New England Hydro shall fulfill the mitigation requirements of Exhibit C of the stipulation during the final design of the Project.

E. New England Hydro shall report, on a calendar-year basis by May 21 of the following year, to the Public Utilities Commission the nature and resolution of all visual, noise and health-related complaints made to it in any way related to the direct current transmission line for the period before and five (5) years after the proposed transmission line is first energized. Such reports of such complaints, their nature and manner of resolution shall be available for public inspection.

F. New England Hydro agrees that commencement of construction (as defined in RSA 162-F:2 (VI)) of the Project shall not take place until the required United States and New Hampshire government permits and approvals necessary for such commencement of construction are obtained.

G. New England Hydro agrees to adopt the mitigation measures set forth in Exhibit D to the stipulation.

5. The stipulation is hereby incorporated by reference as a part of the SEC's findings.

The undersigned members of the Bulk Power Supply Facility Site Evaluation Committee, hereby adopt these findings and transmit them to the New Hampshire Public

Utilities Commission under RSA 162-F:8,I:

William A. Healy, Chairman  
Executive Director, Water Supply  
and Pollution Control Commission

Robert Estabrook, Chief  
Aquatic Biologist, Water Supply  
and Pollution Control Commission

John T. Flanders, Commissioner  
Department of Resources and  
Economic Development

Allen F. Crabtree III, Director  
Fish and Game Department

Davis G. Scott, Director  
Office of State Planning

Wilbur LaPage, Director  
Division of Parks and Recreation  
Department of Resources and  
Economic Development

John E. Sargent, Director  
Division of Forests  
Department of Resources and  
Economic Development

Wallace E. Stickney, Commissioner  
Public Works and Highways

Vincent J. Iacopino, Chairman  
Public Utilities Commission

Delbert F. Downing, Chairman  
Water Resources Board

Dennis R. Lunderville, Director  
Air Resources Agency

DATE: October 8, 1986