

STATE OF CONNECTICUT

SITING COUNCIL

Re: The Connecticut Light and Power Company and) Docket 272
The United Illuminating Company Application for a)
Certificate of Environmental Compatibility and)
Public Need for the Construction of a New 345-kV)
Electric Transmission Line and Associated Facilities)
Between Scovill Rock Switching Station in)
Middletown and Norwalk Substation in Norwalk,)
Connecticut Including the Reconstruction of)
Portions of Existing 115-kV and 345-kV Electric)
Transmission Lines, the Construction of the Beseck)
Switching Station in Wallingford, East Devon)
Substation in Milford, and Singer Substation in)
Bridgeport, Modifications at Scovill Rock)
Switching Station and Norwalk Substation and the)
Reconfiguration of Certain Interconnections) May 3, 2004

SUPPLEMENTAL TESTIMONY OF DR. WILLIAM H. BAILEY
CONCERNING PASSIVE REGULATORY RESPONSES
WITH RESPECT TO 60 HZ ELECTRIC AND MAGNETIC FIELDS

Q. Dr. Bailey, in the March 25th hearing Councilman Tait asked about the difference between passive and aggressive regulatory action. Please elaborate on the information you provided at that time.

A. As was discussed at the hearing, the distinction between passive and active regulatory action has been made by the Director of the National Institute of Environmental Science (NIEHS) in the report of his agency to Congress (NIEHS, 1999). (Tr. 3/25/04, at 62, 63). The Director indicated that there is only marginal, scientific support that exposure to extremely low frequency electric and

magnetic fields (“ELF-EMF”), which include the 60-Hz fields associated with electric power transmission, are a health hazard and that it is unclear what aspect of the exposure, if any, may be the active component of the field statistically associated with cancer risk. In this context, NIEHS provided suggestions to agencies for the scope of regulatory actions. Specifically,

The NIEHS suggests that the level and strength of evidence supporting ELF-EMF exposure as a human health hazard are insufficient to warrant aggressive regulatory actions; thus, we do not recommend actions such as stringent standards on electric appliances and a national program to bury all transmission and distribution lines. Instead, the evidence suggests passive measures such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. NIEHS suggests that the power industry continue its current practice of siting power lines to reduce exposures and continue to explore ways to reduce the creation of magnetic fields around transmission and distribution lines without creating new hazards. We also encourage technologies that lower exposures from neighborhood distribution lines provided that they do not increase other risks, such as those from accidental electrocution or fire. [emphasis added] (NIEHS, 1999, pp. 37-38).

Here, NIEHS identifies aggressive regulatory actions and passive [non-regulatory] actions by example, not by definition. The examples of aggressive regulatory actions include stringent standards and costly, universal mitigation. Clearly, such actions would need to be mandated by regulatory agencies. Instead of such actions, NIEHS recommended “passive measures” including education of public and the regulated community, the design and siting of transmission lines, and technologies for distribution lines, as voluntary activities to reduce exposures of the public to EMF. Further down in this section of the report NIEHS also identifies the mitigation of improper grounding and improper wiring in residences and alternative designs to appliances as methods to reduce magnetic fields “at

minimal cost”. These recommendations are consistent with their concluding opinion that “inexpensive and safe reductions to exposure should be encouraged.” (p. 38).

Q. Did the NIEHS describe any other passive measures?

A. No, but I believe that other measures that could be shown to reduce exposures at low or no cost without increasing environmental impacts or safety risks would be consistent with the NIEHS recommendations.

Q. Are there related discussions of passive measures that might be of interest to the Council?

A. Yes, Dr. M. Granger Morgan of Carnegie Mellon University has published extensively on appropriate public policies to consider in the face of questions as to whether human exposure to EMF involves risks to health or the environment. He is best known as the originator of the concept of “prudent avoidance” (Morgan, 1988) that was mentioned at the hearing, and popularized in a widely circulated informational brochure (Morgan, 1989). Even though NIEHS did not credit Dr. Morgan as the inspiration for its policy recommendations, they are clearly informed by his work.

Q. What did Dr. Morgan mean by prudent avoidance in relation to EMF?

A. By prudent avoidance, Morgan meant “limiting exposures which can be avoided with small investments of money and effort.” He believed that:

...because our understanding of the science of the problem is still very incomplete, there is a real chance that some or all of the expense and associated trouble that would result from “aggressive action” taken now, would ultimately turn out to have been ineffective. There are two ways this could happen. First, it could turn out that there are no health risks from fields or that there are risks but they are very small. Second, it could turn out that while there are risks, we’ve done the wrong things to control them and gotten little or no improvement for our money....

In our discussion of the strategy of “prudent avoidance” we argued that today it is hard to justify spending more than a few thousand dollars per person exposed in order to reduce exposures. We said this because we believe that if fields pose health risks, only a very small fraction of all the people exposed can be expected to develop adverse health consequences (probably not more than one in many thousands). That means that spending a few thousand dollars per exposure avoided amounts to spending millions of dollars *or more* per possible health effect avoided (Morgan, 1989, pp. 28-29).

- Q. What are some of Dr. Morgan’s examples of exercising prudent avoidance?
- A. He describes how individuals could respond to concerns about unverified potential risks of EMF in fiscally prudent ways by using regular instead of electric blankets, moving small electric motors, such as are found in electric clocks, further away, and including the location of transmission and distribution lines as one of many things considered in making a decision for purchasing a residence. Such decisions are easy because we are making the decision for ourselves, the costs for the above decisions are negligible, and we can make tradeoffs against alternative choices for expenditures. See **Attachment 1** to this testimony for another excerpt of Morgan’s discussion of his prudent avoidance approach (OTA, 1989).

Q. Can Dr. Morgan's concept of prudent avoidance be easily applied to the making of public policy?

A. No. As Morgan points out, "In our private lives we exercise prudence all the time when we face an uncertain risk. In public decision making we have more trouble being 'prudent' about uncertainty"(Morgan, 1989, p. 26). Some of the difficulties in applying this concept are that: the actions of public agencies affect groups of persons with very different attitudes toward, and judgments about, potential risk; actions by public bodies may mistakenly be interpreted as proof that a risk exists, even if not demonstrated; the costs and benefits often accrue to different groups within the population; and the costs for avoiding exposures to power line fields are much greater than costs for controlling an individual's exposures.

Q. According to Dr. Morgan, what expenditures to limit exposure would not be fiscally prudent?

A. Dr. Morgan argues the upper bound for spending to reduce exposure to an unknown risk should be less than that for known risks. He states, "Clearly it makes no sense to invest more per person-exposure avoided than we invest per **death** avoided for various **known** risks in our society....We conclude that it might be possible to justify investment rates of up to some thousands of dollars of person-exposure avoided, but not possible to justify rates of investment in field avoidance activities that are significantly higher than this" [Emphasis in original text] (OTA, 1989, p. 79).

Q. Did Dr. Morgan believe that the setting of limits on field strengths from transmission or distribution lines, the undergrounding of transmission lines, or doing nothing were compatible with a prudent avoidance approach given the current state of the science?

A. No, he believed that setting field limits could not be justified upon scientific grounds, widespread undergrounding was too costly, and doing nothing was not an appropriate response to public concern (OTA, 1989).

Q. Have public agencies tried to apply this concept without incurring the drawbacks mentioned above?

A. There are several examples. Consider the approach of the World Health Organization (WHO). WHO has recommended that concern about EMF be addressed by separating strategies for private persons from public strategies. The WHO public strategies further distinguish between the actions that are necessary to address *health issues* and those that necessary to address *public concerns* (Repacholi, 2001). Addressing public health issues involves the vigorous unbiased evaluation of EMF research as has been carried out by various scientific, national, and international health organizations and this tradition is continuing under sponsorship of WHO.

Activities that the WHO has recommended to address public concern about EMF include:

- Research programs to address data gaps and narrow uncertainties to better health risk assessments;
- Encourage manufacturers to keep exposures to the minimum needed for the technology
- Improve risk communication
- Encourage public involvement in decision making
- Siting facilities to minimize public exposure and concerns

Q. Are there examples in the United States?

A. Yes. The recommendations of NIEHS discussed above and the Connecticut EMF Best Management Practices both embrace the strategy of encouraging responses and expenditures that are proportionate to the degree of scientific evidence that there might be a risk, and responsive to public concern.

It is important here to point out here that the approach taken by the state of Connecticut in 1993 to request that utilities follow best management practices, as described in the “Supplemental Testimony of Robert E. Carberry. Concerning State Policies With Respect To 60-Hz Electric And Magnetic Fields,” predated the recommendations of NIEHS by six years.

Q. Is the ‘Precautionary Principle’ also an example of a passive non-regulatory response?

- A. Only in a non-technical sense. The precautionary principle is embedded in both European and U.S. regulatory considerations and actions as a legal principle and therefore when applied by government agencies would seem to go beyond a “passive response.”

The European Commission has identified the precautionary principle as a key tenet of environmental policy. The Rio Declaration on the Environment at The United Nations Conference on Environment and Development, the precautionary principle is defined:

Principle 15

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation (UNEP, 1992)

The European Commission (EC, 2000) has provided guidance to decision makers on the application of the precautionary principle. The Commission recommends:

- *Proportionality*. “Measures . . . must not be disproportionate to the desired level of protection and must not aim at zero risk.”
- *Nondiscrimination*. “[C]omparable situations should not be treated differently and. . . different situations should not be treated in the same way, unless there are objective grounds for doing so.”
- *Consistency*. “[M]easures . . . should be comparable in nature and scope with measures already taken in equivalent areas in which all the scientific data are available.”
- *Examination of the benefits and costs of action or lack of action*. “This examination should include an economic cost/benefit analysis when this is appropriate and feasible. However, other analysis methods . . . may also be relevant.”
- *Examination of scientific developments*. “The measures must be of a provisional nature pending the availability of more reliable scientific

data”. . . “scientific research shall be continued with a view to obtaining more complete data.”

The European Commission’s recommendations make very clear that “The precautionary principle should be considered within a structured approach to the analysis of risk which comprises three elements: risk assessment, risk management, risk communication.”

With regard to EMF, the European Commission has summarized the scientific evidence as:

Regarding the long term effects there is much more debate. Possible effects that are considered include carcinogenic effects (e.g. leukemia and other cancers) and biological effects. The results of the research in this field have been contradictory, and the balance of scientific evidence did not demonstrate at the time any risk associated with EMF exposure at the low levels to which the public is confronted in its everyday life. Before implementation of the 1999 Recommendation, all the available evidence [from] the world’s largest health authorities have concluded that the weight of the scientific evidence indicated that electromagnetic fields did not cause cancer [Emphasis added] (EC, 2002, p. 5).

The Commission therefore concluded that the precautionary principle should not be invoked because:

...there are no clear scientific indications that the possible effects on human health may be potentially dangerous.

Therefore the Commission decided to base its proposal on established health effects only, for which there are thresholds of exposure before the effects occur. However, since there are safety factors of about 50 between the threshold values for acute effects and the basic restrictions this recommendation would cover implicitly possible long-term effects in the whole frequency range. As a result, ICNIRP guidelines provide safe protection thresholds with respect to adverse health effects which may be caused by EMF exposure (EC, 2002, p. 10).

- Q. At the March 25th hearing, Mr. Tait expressed an interest in what state health departments outside Connecticut had listed on their websites concerning EMF. (Tr. 3/25/04 at 310). Have you done anything to provide that information?
- A. Yes. We searched for websites maintained by Departments of Health in all the 50 states and determined if they posted information about EMF. We found seven such websites (including that of the Connecticut Department of Health). In addition, we found that the health department websites of four states contained no such information, but EMF information was posted at a website of another state agency. We printed out all of this material, and I understand that the Companies have filed a request that the Council take administrative notice of it. **Attachment 2** to my testimony lists the health department websites that we visited, and indicates whether or not there was EMF information posted on it. **Attachment 2** also identifies the materials from all eleven states that were included in the Companies Request to Take Administrative Notice.
- Q. Do any of these state agency websites suggest need to update Connecticut's EMF Best Management Practices?
- A. No. No state has recommended a more aggressive approach than Connecticut's EMF Best Management Practices. Moreover, the information posted by the Connecticut Department of Health appears to have been updated more recently than most of these other states.

Q. Have any states concluded that an even less aggressive strategy is appropriate based upon multidisciplinary reviews of the literature?

A. Yes. After considering the review of the literature in 1997 performed by a multidisciplinary panel of scientists for the National Academy of Sciences, the Public Service Commission of Wisconsin, formerly at the forefront of addressing EMF issues, *rescinded* its 1992 mandates to utilities at the conclusions of Advance Plan Proceedings to:

- Use low-EMF design structures where practicable when proposing to construct new electric transmission lines or rebuild old ones;
- Investigate and report on methods of reducing EMF on their distribution systems; and
- Incorporate the possibility of adverse health effects from EMF into the integrated resource planning process.

A copy of the ruling in which the Wisconsin PSC announced this position is submitted as **Attachment 3** to this testimony. The Wisconsin example highlights the fact that most public policies regarding EMF (including those based on prudent avoidance) were developed in the late 1980s and early 1990s when the uncertainty about EMF was much greater than it is today. At that time epidemiology research had just begun gaining momentum, the U.S. national EMF research program (RAPID) had not started, no long-term chronic exposure studies in animals had been initiated, and there were hints of potential mechanisms to

explain the contribution of EMF to carcinogenic processes, which subsequent research failed to confirm.

Q. Why did the Wisconsin Public Service Commission rescind these mandates?

A. After hearing expert testimony, the Commission concluded that the evidence did not invalidate a previous conclusion of “no evidence that electric fields pose a significant health risk to the general public.”

Regarding magnetic fields, the Commission stated:

A scientific consensus is growing that, despite many years of focused research, exposure to power frequency EMF has not been shown to adversely affect human health. This consensus is supported by an extensive review of EMF research published by the National Academy of Sciences in 1997. In light of this consensus, it is reasonable to eliminate a number of EMF regulatory requirements established in previous Advance Plans. However, because some concern remains, especially in the mind of the public, and because research on this subject is continuing, it would be unreasonable to ignore EMF altogether. (Attachment 3, at. 6-7, Emphasis added)

Q. At the March 25th hearing, Mr. Tait asked whether any EMF exposure standards or guidelines have been set by any state or by any regulatory agency in the world. (Tr. 3/25/04, at 282). Have you prepared any information in response to that request?

A. Yes. **Attachment 4** is a list of the standards and guidelines for electric and magnetic fields associated with electric power transmission lines that have been adopted in other states. There are seven of them. **Attachment 5** is a list of exposure guidelines and recommendations adopted by other countries and international agencies.

Q. What are the bases for the standards and guidelines adopted by these states regarding transmission lines?

A. For electric fields the goal of these guidelines and standards is to prevent contact shocks, particularly from large ungrounded vehicles parked under the conductors and to minimize field perception. The two states that enacted standards for magnetic fields thoroughly examined health and safety issues regarding fields from transmission lines but did not that the pose a public health risk. The basis for limiting magnetic fields from transmission lines was to maintain the 'status quo' so that fields from new transmission lines would be no higher those produced by existing transmission lines.

Q. Have state health or transmission siting agencies recommended limits on electric or magnetic fields based upon new scientific information that has become available since the completion of the RAPID program and evaluation of the research by NIEHS?

A. No. As shown in **Attachment 4**, the most recent standards that we could for magnetic fields were published in 1990; and for electric fields it was 1996.

Q. Would populations near the existing or proposed transmission lines on the proposed or alternative routes be identified as subject to adverse health effects as

implied by exposures exceeding health-based limits on electric or magnetic fields recommended by national or international organizations?

A. No. **Attachment 5** summarizes the most frequently cited limits for fields at 60 Hz. For instance, a magnetic field exposure limit for the general public of 830 mG has been recommended by the International Committee on Nonionizing Radiation Protection (ICNIRP) and has been adopted by the National Radiological Protection Board in the United Kingdom and other countries. The projected EMF levels even underneath/above the overhead/underground conductors are below these exposure limits. And each of these standards incorporates large safety factors.

Q. You recently submitted supplemental testimony describing site-specific EMF reduction measures that Exponent and the Companies have designed for potential use at the Jewish Community Center and the B'nai Jacob/Ezra Academy complex in Woodbridge. In your opinion, would the adoption of these measures be consistent with the concept of prudent avoidance and the Siting Council's Best Management Practices?

A. It is a borderline case. The estimated the cost of designing and implementing these alternate designs could be expected to exceed a no-cost or low cost criterion. However, in comparison to the overall project cost and the cost per mile of undergrounding, it could be considered modest. Given the expressed public concern about the use of these sites by large numbers of young children, the

Council could consider these measures to be consistent with Best Management Practices.

However, the Council also is faced with equity issues.

- The cost of splitting the phases of the new line for its entire length would not be a modest one, even if there were enough room on the right of way to do that without expanding the right of way or making room by moving an existing line off the right of way. Moreover, for much of the length of the proposed line, there is not enough room on the existing right of way, so the total cost of split phasing would be prohibitively high.
- Is it equitable to provide for the reduction of EMF at two specific locations, where children might be at school or voluntary activities part of the day, while denying reductions in involuntary EMF exposure at perhaps hundreds of residences along a much longer portion of the overhead route, where it could be argued that children spend even more time?
- Does taking what may appear to many to be ‘drastic’ action to reduce EMF at a specific site imply that a risk exists, and thereby attach a stigma to properties along the route, where similar EMF reductions are not proposed or where the opportunity to take similar action does not even exist because of right-of-way limitations.

Q. Do you have any further discussion of regulatory responses at this time?

A. No. This concludes my testimony.

Attachment 1

Attachment 1

Dr. Morgan's Prudent Avoidance Policy

Our fifth and final option is a strategy of “prudent avoidance” of field exposures. By avoidance we mean taking steps to keep people out of fields, both by re-routing facilities and by redesigning electrical systems and appliances. By prudence we mean undertaking only those avoidance activities which carry modest costs. When, as individuals, we think a risk may exist but we are not sure, we exercise prudence. For example, broccoli and cauliflower may contain anti-carcinogens. Dietary fiber may help to reduce the risk of certain cancers. Conversely char-grilled meats may carry increased risks of cancer. The evidence on these things is suggestive but inconclusive. As a matter of prudence many people have tried to increase the frequency with which they eat cauliform vegetables, increase their fiber intake, and reduce the amount of char-grilled meat they eat. But reasonable people do not rent a helicopter to fly high fiber bread in to them when they spend a week at a mountain ski resort which serves only regular bread. Families who eat meat, would not buy lobster for their kids every night for a week at that same ski resort if it is the only meat on the menu that is not charbroiled. Nor do reasonable people rent their own refrigerated truck to supply them with broccoli and cauliflower when they travel in places where these foods are not available. Such steps go beyond prudence. At the least they would be foolishly expensive, at the worst, signs of serious paranoia.

What would constitute prudence in the context of keeping people out of 60 Hz fields? Here are a few possibilities:

- Attempt to route new transmission lines so that they avoid people;
- Widen transmission line rights-of-way;
- Develop designs for distribution systems, including new grounding procedures, which minimize the associated fields;
- Develop new approaches to house wiring that minimize associated fields;
- Redesign appliances to minimize or eliminate fields.

If we decide to do these things we have to ask how do we avoid going overboard...how do we avoid the equivalent of renting the helicopter? The answer lies in asking how much we should be prepared to invest in avoiding exposing people to fields. It is fairly easy to set an upper bound on the amount we should be willing to spend. Clearly it makes no sense to invest more per person-exposure avoided than we invest per *death* avoided for various *known* risks in our society. In other writings we have used the rates at which our society invests in avoiding *known* risks of death and injury to develop an upper bound on the rates at which it would be prudent to invest in field avoidance (Morgan 87b, Morgan 87c). We conclude that it might be possible to justify investment rates of up to thousands of dollars of person-exposure avoided, but not possible to justify rates of investment in field avoidance activities that are significantly higher than this. Thus, for example, while it might make sense to work to avoid exposing people in siting new lines, in most cases, with our current knowledge, it would not make sense to tear out and rebuild old lines. Similarly it might make sense to redesign new appliances to reduce fields exposure if this can be done for small increments in their cost. It might even make sense to selectively replace a few old appliances, such as electric blankets, with “field-free” versions. But it probably would not make sense to throw out all old appliances before they wear out and replace them all immediately with new “field-free” ones (OTA, 1989, pg 78-79).

Attachment 2

Attachment 2.

Department of Health Web Sites

State	Department of Health Web Site Address	EMF information/policy listed on web site? (Yes/No)
Alabama	http://www.adph.org/Default.asp?bhcp=1	No
Alaska	http://health.hss.state.ak.us/	No
Arizona	http://www.hs.state.az.us/	No
Arkansas	http://www.healthyarkansas.com/	No
California	http://www.dhs.ca.gov/	Yes
Colorado	http://www.cdphe.state.co.us/cdphehom.asp	No
Connecticut	http://www.dph.state.ct.us/	Yes
Delaware	http://www.state.de.us/dhss/	No
District of Columbia	http://dchealth.dc.gov/index.asp	No
Florida	http://www.doh.state.fl.us/	No
Georgia	http://www.ph.dhr.state.ga.us/	No
Hawaii	http://www.hawaii.gov/doh/	No
Idaho	http://www.idahohealth.org/	No
	http://www2.state.id.us/dhw/health/index.htm	
Illinois	http://www.idph.state.il.us/home.htm	No
Indiana	http://www.in.gov/isdh/	No
Iowa	http://www.idph.state.ia.us/	No
Kansas	http://www.kdhe.state.ks.us/	No
Kentucky	http://chs.ky.gov/publichealth/	No
Louisiana	http://www.dhh.state.la.us/	No
Maine	http://www.state.me.us/dhs/boh/	No
Maryland	http://www.dhmr.state.md.us/	No
Massachusetts	http://www.state.ma.us/dph/dphhome.htm	No
Michigan	http://www.michigan.gov/mdch	No
Minnesota	http://www.health.state.mn.us/	Yes
Mississippi	http://www.msds.state.ms.us/	No
Missouri	http://www.dhss.state.mo.us/	No
Montana	http://www.dphhs.state.mt.us/	No
Nebraska	http://www.hhs.state.ne.us/	No
Nevada	http://health2k.state.nv.us/	No
New Hampshire	http://www.dhhs.state.nh.us/DHHS/DHHS_SITE/default.htm	No
New Jersey	http://www.state.nj.us/health/	No
New Mexico	http://www.health.state.nm.us/website.nsf/frames?ReadForm	No
New York	http://www.health.state.ny.us/	Yes
North Carolina	http://www.dhhs.state.nc.us/	No
North Dakota	http://www.health.state.nd.us/	No
Ohio	http://www.odh.state.oh.us/	No
Oklahoma	http://www.health.state.ok.us/	No
Oregon	http://www.dhs.state.or.us/publichealth/	No
Pennsylvania	http://www.dsf.health.state.pa.us/health/site/default.asp	No
Rhode Island	http://www.health.state.ri.us/	No
South Carolina	http://www.scdhec.net/	No
South Dakota	http://www.state.sd.us/doh/	No
Tennessee	http://www.state.tn.us/health/	No
Texas	http://www.tdh.state.tx.us/	No ¹
Utah	http://health.utah.gov/	Yes
Vermont	http://www.healthyvermonters.info/	No ²
Virginia	http://www.vdh.state.va.us/	Yes
Washington	http://www.doh.wa.gov/	No ³
West Virginia	http://www.wvdhhr.org/	No
Wisconsin	http://www.dhfs.state.wi.us/	Yes
Wyoming	http://wdh.state.wy.us/main/index.asp	No

ELF- EMF = Extremely Low Frequency Electric and Magnetic Fields

¹ EMF web page under construction

2 Vermont Department of Health's ("VDH") Position Paper ("VDH Position Paper") on Electric and Magnetic Fields ("EMF") was found on Vermont's State web site.
 3 Provided link to NIEHS, 2002

State Agency EMF Postings

Ex.	State	Last Updated	EMF Web Site Posting
1.	CA		California EMF Program homepage: http://www.dhs.ca.gov/ps/deodc/ehib/emf/about.html
		Published 6/02	Executive Summary from: An Evaluation of the Possible Risks From Electric and Magnetic Fields (EMFs) From Power Lines, Internal Wiring, Electrical Occupations and Appliances http://www.dhs.ca.gov/ps/deodc/ehib/emf/RiskEvaluation/riskeval.html
		Published 4/01	Policy Options: http://www.dhs.ca.gov/ps/deodc/ehib/emf/RiskEvaluation/Old%20Draft%203%20Docs/policy.pdf
			California Public Utilities Commission: http://www.cpuc.ca.gov/static/industry/environment/electromagnetic+fields/
2.	CT	Posted 01/04	Department of Health Fact Sheet: http://www.dph.state.ct.us/Publications/BCH/EEOH/emf_2004.pdf
3.	FL	Published 12/11/03	Florida Department of Environmental Protection, 2003 Annual Report on EMF Research http://www.dep.state.fl.us/siting/Programs/electric_magnetic_rpt_2003.pdf
4.	MD		Power Plant Research Program, Reports printed by Maryland Department of Natural Resources:
		Published in 2001 ¹	Status report on investigations of potential human health effects associated with power frequency electric and magnetic fields (EMF): reporting period, September 1998-June 2001. Hill, Doreen, Maryland Power Plant Research Program, Maryland Dept of Natural Resources, Patty, Sandra S., Public Service Commission of Maryland. Maryland Power Plant Research Program, Dept. of Natural Resources.
		Published in 1998	Status report on investigations of potential human health effects associated with power frequency electric and magnetic fields. Patty, Sandra S. Maryland Department of Natural Resources, Power Plant Research Program Found at: http://www.vims.edu/GreyLit/MDNR/ppse-t-42
		Published in 1995	Status report on investigations of potential human health effects associated with power frequency electric and magnetic fields. Reporting period: June 1994 - October 1995. Patty, Sandra S. Maryland Department of Natural Resources, Power Plant Research Program. Found at: http://www.vims.edu/GreyLit/MDNR/ppse-t-40
5.	MN	In the process of updating the site at this time ²	Page dedicated to EMF http://www.health.state.mn.us/divs/eh/radiation/emf/index.html
		Published 9/02	Minnesota White Paper on EMF, Found at: http://www.health.state.mn.us/divs/eh/radiation/emf/emfrept.pdf
6.	NY	Created in early 1990s ³	Powerlines Project Q&A http://www.health.state.ny.us/nysdoh/consumer/environ/power.htm

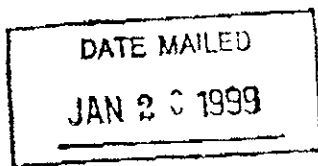
¹ This report was not available on line; obtained directly from MDNR.

² Email correspondence with George Johns of the MN DOH 4/7/04.

Ex.	State	Last Updated	EMF Web Site Posting
7.	NJ	Created in 1996 updated 3/1/04	New Jersey Department of Environmental Protection, 60 Hz Electrical Power http://www.nj.gov/dep/rpp/nrs/powlines.htm
8.	UT	Published 12/10/93	Utah Radiation Control Board Position Statement - Found at: http://radiationcontrol.utah.gov/BOARD/emf_pos.htm
9.	VT	Published 12/15/03	Vermont Department of Health's ("VDH") Position Paper ("VDH Position Paper") on Electric and Magnetic Fields ("EMF"), Found at: http://www.state.vt.us/psd/Menu/Dockets/6860_files/6860-VDH-Exhibit3.pdf
10.	VA	Last updated 6/21/03 Published 10/31/00	Non-Ionizing Radiation Web page http://www.vdh.state.va.us/rad/RHP-Spec-topics.asp (provides link to NIEH) Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Final Report), 2000. Found at: http://www.vdh.state.va.us/hhcontrol/highfinal.PDF
11.	WI	Revised 11/00 No Date	EMF Fact Sheet, Found at: http://dhfs.wisconsin.gov/eh/Air/fs/EMF.htm Wisconsin Public Service Commission: http://psc.wi.gov/consumer/brochure/ind_broch.htm EMF: Electric and Magnetic Fields: http://psc.wi.gov/consumer/brochure/document/electric/6002b.pdf

³ Information about NYSDOH web site was obtained through telephone conversation with Mark Virgil, Associate Radiological Health Specialist, Bureau of Environmental Radiation Protection, on 3/25/04 and written correspondence between Attorney General Richard Blumenthal and Mr. Virgil on 4/16/04 previously distributed to the service list.

ATTACHMENT 3



JAN 21 1999

BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Advance Plans for Construction of Facilities as Filed With the
Commission for Review and Approval Pursuant to Sec. 196.491, Stats.

05-EP-8

**FINDINGS OF FACT, CONCLUSIONS OF LAW,
AND PHASE II ORDER**

This is the eighth and final Advance Plan order of the Public Service Commission of Wisconsin (Commission). The first Advance Plan was signed on August 7, 1978; twenty years later, Advance Plan 8 will mark the conclusion of this process. Under 1997 Wisconsin Act 204, Strategic Energy Assessments will replace Advance Plans. The basic function of these Assessments is to evaluate the adequacy and reliability of Wisconsin's energy supply.

Advance Plan 8 will serve as a benchmark for the Strategic Energy Assessments that follow. Advance Plan 8 is also integral to the transmission planning process, which will continue in Wisconsin.

The Commission segregated this Advance Plan into two phases. Phase I, which was completed in 1997, concerned the development of the information needed to prepare generation and transmission plans. Hearings were held on Phase I in September 1997, and the Phase I order of Advance Plan 8 was mailed on November 20, 1997.

The Commission identified 15 issues to be considered in Phase II, all associated with its review and approval of utility generation and transmission plans, at a pre-hearing conference on April 17, 1998. The Commission conducted technical hearings on these issues from July 20 to July 22, 1998, and held public hearings in Green Bay, Stevens Point, and Madison on July 27, 28, and 30, 1998. With its initial brief Commission staff filed a synopsis of the case, as provided in Wis. Stat. § 196.24(3). At its open meeting on October 6, 1998, the Commission made oral decisions on these 15 issues, which are each discussed below.

A complete list of parties is attached as Appendix A.

FINDINGS OF FACT

THE COMMISSION FINDS:

1. **Will the Northern States Power Company-Wisconsin and NSP System filed forecasts provide adequate supply for Wisconsin customers?**

Northern States Power (NSP), whose service territory extends well beyond Wisconsin's borders, plans on a multi-state level. Although Northern States Power Company-Wisconsin (NSPW) creates its own forecast of system demand and energy growth, the company prefers to use the NSP forecast for its entire system. In its Phase I order, the Commission authorized NSPW to use the system forecast, whose growth rate differs from the Wisconsin statewide growth rates approved in Phase I. The Commission required, however, that NSPW must demonstrate that this system forecast would meet the needs of NSPW's customers.

Commission staff reviewed NSPW's filing and considered it reasonable. Although the NSP system forecast is less than the approved Wisconsin statewide growth rates, these higher projections primarily reflect reliability concerns in eastern Wisconsin. The Commission finds that the NSP system forecast and resulting supply plan will reasonably provide for the needs of NSPW's customers and is suitable for use by NSPW.

2. **Are Northern States Power Company's supply parameters (those that differ from those ordered in Phase I) acceptable to the Wisconsin Commission for use in the System plan?**

In Phase I, NSPW requested that it be allowed to adjust the supply parameters it had submitted for use in the Electric Generation Expansion Analysis System (EGEAS) computer model. NSPW indicated that any changes would reflect the generation resource plan that NSP needed to file with the Minnesota Public Utilities Commission. The Commission authorized such modifications, but required the company to justify any changes in Phase II. NSPW adequately explained the reasonableness of the supply parameters it ultimately used in the EGEAS data set, and these changes to the supply parameters approved in Phase I are acceptable.

3. **Who is responsible for Incumbent Network Load?**

In Phase I, the utilities created a new category of statewide demand known as "incumbent network load" (INL). This category includes the wholesale load of municipal utilities that are being supplied by Wisconsin investor-owned utilities, but have given termination notice or are expected to give such notice to their suppliers. INL could eventually be lost from the host utility system and be served by some other utility, or by the expanding wholesale market. In their Phase II filings, Alliant-Wisconsin Power and Light (Alliant) forecast 32 MW of INL, while Wisconsin Electric Power Company (WEPCO) estimated 171 MW of INL and Wisconsin Public Service Corporation (WPS) projected 56 MW of INL. The total INL from these three utilities is 259 MW, which represents 2 percent of the joint utilities' forecasted total statewide electric

demand for the year 2007 (12,375 MW). Commission staff estimated that the ultimate amount of INL could be slightly more, from 300 to 350 MW. Since the state's investor-owned utilities could recapture some of the INL and continue to serve municipal utilities, a reasonable approximation of INL by the year 2007 is between 250 and 350 MW.

1997 Wisconsin Act 204 has legalized merchant power plants in Wisconsin, so a competitive wholesale marketplace could provide the appropriate generation resources to meet INL, instead of the investor-owned utilities. Since municipal utilities that do not have a contract with an investor-owned utility are responsible for their own generation supply planning, an investor-owned utility that formerly provided electric service to such a municipal utility would no longer be obliged to plan for its wholesale customer. The Commission finds that investor-owned utilities must continue to plan for all the load that they have contracted to provide, however, and that transmission owners must continue to plan for all the transmission needs of Wisconsin's transmission-dependent utilities.

Because the issues surrounding INL could affect the state's electric system reliability, the amount of INL should be updated in the next Strategic Energy Assessment.

4. **What is the best way to create a voluntary inventory of end-user generation and determine how much of that inventory is currently committed to firm customer use?**

The record in this docket does not demonstrate that a reliable inventory of end-user generation could be created, given the information available to utilities. Wisconsin utilities have only a partial list of generation owned by their customers; since customer-specific information is treated confidentially by the utilities, it has limited usefulness. In addition, it is impossible to determine whether private generation plants, owned by utility customers, are currently committed to use by the customers or have extra capacity available.

5. **What kind of research is needed (beyond current EPA efforts) to establish the effects, costs, and mitigation strategies for electric generation mercury emissions?**

and

6. **What are the effects on the filed plans of the new NO_x regulations proposed by the EPA?**

The Wisconsin Department of Natural Resources (DNR) is in the process of preparing a white paper on mercury emissions in the state. Because DNR's work is not complete, it is premature to order the utilities to fund additional specific scientific research on mercury. Future regulation of this pollutant, and of nitrogen oxides (NO_x), could also have a substantial effect on the reliability of generating plants in Wisconsin because numerous plants may need to be taken out of service (in order to be retrofitted with emissions reduction equipment) or may need to be retired from service. As a result, it may be reasonable to open a separate docket early next year on the environmental effects of utility emissions and on the related impacts to reliability of environmental regulations.

7. **What are the effects on the filed plans of the Department of Energy's failure to honor the Standard Contract for Disposal of Spent Fuel on the due date of January 31, 1998?**

WEPCO is now able to use dry cask storage at its nuclear plant at Point Beach, in lieu of transferring possession of its spent nuclear fuel to the Department of Energy for storage off-site. When the U.S. Department of Energy lifted its Confirmatory Action Letter, which had previously prevented the use of dry cask storage at the Point Beach plant, it rendered this issue moot for WEPCO.

WPS provided information showing that it could operate the Kewaunee Nuclear Power Plant until 2001 without further facilities for storing spent nuclear fuel at the site. The company also declared that it could expand on-site storage in its existing pool, allowing the plant to continue operating until 2013. As a result, the U.S. Department of Energy's failure to honor its contractual obligations to take spent nuclear fuel does not require that the Commission alter the filed supply plans at this time.

8. **What are the effects on the filed plans of the decision to shut down the Zion nuclear plant in Illinois?**

and

9. **What are the effects on the filed generation and transmission plans if other Midwest nuclear plants are shut down?**

The record demonstrates that loss of generating capacity at the Zion Nuclear Power Plant has increased purchased power costs for all the utilities, and thus increased all the costs of generation plans. This increase, however, has not substantively affected the type of generating resource that would be selected or the projected date when new capacity would be on line. No record was developed regarding the effect on plans of shutting down other Midwest nuclear plants, so no answer can be provided for this issue.

10. **Are the renewable resource "action plans" of the joint or individual utilities adequate?**

In Advance Plan 6, the Commission was dissatisfied with the superficial nature of utility reports on renewable resources and required utilities to submit subsequent reports on renewable resource potential "in the character of implementation plans." The Commission directed the utilities to "include actual plans expanding the use of renewable resources" when appropriate. (Advance Plan 6, Order Point 4.6)

1997 Wisconsin Act 204 has advanced the schedule for adding renewable resources to the mix of generation in Wisconsin. Under Wis. Stat. § 196.377(2)(b), eastern Wisconsin

utilities must construct or procure 50 MW of new renewable electric capacity by December 31, 2000. As a result, it is now appropriate for the utilities to prepare and submit "actual plans" describing how they will comply with this law. The Commission may extend the deadline for constructing or procuring these renewable resources beyond the year 2000, if a later date is needed due to circumstances beyond a utility's control. See Wis. Stat. § 196.377(2)(d). An eastern Wisconsin utility that has not made timely preparations for complying with this statute will not receive such an extension. WEPCO and Alliant have issued Requests For Proposals (RFPs) to procure their portion of new renewable electric capacity, while Madison Gas and Electric Company (MGE) and WPS have already commenced the process of securing local permission to construct new facilities. In order to demonstrate that the RFP process will be completed in a timely manner, WEPCO and Alliant must receive proposals by December 31, 1998, and notify the Commission of the selected contractor by March 31, 1999. All four utilities must begin construction by June 1, 1999, so that the projects will be on-line and producing power by December 31, 2000.

11. How should Targeted Area Planning analyses be incorporated into the regulatory process?

Targeted Area Planning (TAP) is a process of analyzing alternatives to meeting local energy needs, considering both environmental impact and cost. In some situations, a new transmission or distribution line is not the most cost-effective solution to growth in local energy demand. A voluntary committee that includes representatives of Dairyland Power Cooperative (DPC); Wisconsin Public Power, Inc. (WPPI); the investor-owned utilities; some public interest groups; and Commission staff first commenced work on TAP alternatives before Advance Plan 7. The Commission endorsed the consensus proposals of this TAP Collaborative Group in Advance Plan 7 and approved further expenditures of resources by the utilities on this process, through Advance Plan 8.

The TAP Collaborative Group has again proposed several consensus proposals for this Advance Plan. The Collaborative Group recommended specific criteria and methods of analysis to screen TAP project proposals and recommended that the Commission continue the current, accepted process for transmission analysis being performed by the utilities' joint transmission planning task force. The Collaborative Group requested that the Commission direct the utilities to complete agreed-upon TAP screening for transmission projects filed in Advance Plan 8 and, for each project that passes the screens, direct the utility to complete and file a TAP analysis of the project no later than when it would file an application for a Certificate of Public Convenience and Necessity (CPCN). The Collaborative Group also reached agreement on two other subjects, but both depend upon the continued existence of Advance Plans and have therefore been rendered moot by the recent statutory changes.

The Commission finds the areas of agreement to be reasonable and endorses their implementation. TAP continues to be an important element in analyzing the need for a new transmission line in Wisconsin and the Commission finds it prudent for Wisconsin utilities to continue expending resources on this process.

In certain other areas, the members of the Collaborative Group failed to reach an agreement. In this docket, public members of the Collaborative Group advocated screening not just CPCN projects, but also projects involving lower-voltage transmission or distribution lines that would require a Certificate of Authority (CA) from the Commission under Wis. Stat. § 196.49. The entire process of transmission planning, however, is now in flux. It is therefore reasonable to defer decisions about whether to expand TAP until the Commission establishes a new framework for transmission planning in Wisconsin.

12. **Has a scientific consensus formed regarding the possible health effects of exposure to power frequency electromagnetic field (EMF) that would justify a change in the present Commission EMF policy?**

The Commission has reviewed national and international electromagnetic field (EMF) health research and policy development for years. This review is ongoing. The Commission has previously considered EMF exposure and health effects, as they relate to power lines, in Advance Plans 5, 6, and 7. In these dockets, the Commission found that concern about the potential health effects of exposure to EMF was justified, even though a causal relationship between exposure to EMF and harmful human health effects was not established. The Commission also determined, in part, that it is reasonable for utilities to reduce exposure to power line EMF where practicable, contribute to research, provide information to the public about EMF, and report annually to the Commission on utility EMF programs and compliance with previous orders.

In Advance Plan 8, the Commission has focused on scientific studies and reviews published since the Advance Plan 7 order to determine whether its earlier EMF orders remain valid. The record includes expert testimony on scientific research into the potential health effects resulting from exposure to EMF.

Electric Fields

In Advance Plans 5 and 6, the Commission found no evidence that electric fields from transmission lines pose a significant health risk to the general public. The testimony in this proceeding does not add any evidence to indicate that the Commission's former determination about electric fields is invalid.

Magnetic Fields

A scientific consensus is growing that, despite many years of focused research, exposure to power frequency EMF has not been shown to adversely affect human health. This consensus is supported by an extensive review of EMF research published by the National Academy of Science in 1997. In light of this consensus, it is reasonable to eliminate a number of EMF regulatory requirements established in previous Advance Plans. However, because some

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concern remains, especially in the mind of the public, and because research on this subject is continuing, it would be unreasonable to ignore EMF altogether.

The Commission reaffirms all previous Advance Plan EMF order points with the exception of:

- A. Use low-EMF design structures where practicable when proposing to construct new electric transmission lines or rebuild old ones (docket 05-EP-6, Order, May 8, 1992, pages 9 and 10).
- B. Investigate and report on methods of reducing EMF on their distribution systems (docket 05-EP-6, Order, May 8, 1992, pages 10 and 11).
- C. Incorporate the possibility of adverse health effects from EMF into the integrated resource planning process (docket 05-EP-6, Order, May 8, 1992, page 12).

13. Should future transmission planning studies explicitly consider the impact of multiple contingencies?

Currently, the regional reliability councils whose territory encompasses Wisconsin (the Mid-Continent Area Power Pool and the Mid-America Interconnected Network) use a "single contingency" criterion when examining the reliability of the transmission system. This criterion requires that the electric system be able to withstand the outage of any one transmission facility (line or transformer) without causing service interruptions. Multiple contingencies do occasionally occur, however. The reasonableness of expanding transmission planning to consider the impact of multiple contingencies is, like questions about enlarging the scope of TAP, more appropriately considered when the Commission engages in a wholesale reevaluation of transmission planning. The record in this docket is not sufficient to analyze whether multiple contingencies ought to be considered in transmission planning; in subsequent Strategic Energy Assessments or in other transmission planning forums, this matter can be addressed more completely.

14. Have the utilities' plans been developed in compliance with outstanding Commission order points?

Commission staff challenged the utilities' compliance with four provisions from Advance Plan 6 and Advance Plan 7, which are discussed below.

Advance Plan 6, Order Point 15.3: The utilities shall continue to consider externalities other than those quantified by the Commission. Consideration of these other externalities may be either qualitative or quantitative, but shall be factored into each utility's planning and decision making.

This order point concerns the Commission's requirement that each utility make clear how it factors environmental impacts into its planning and decision-making process. Some environmental impacts, such as greenhouse gases and sulfur dioxide, have been assigned monetary costs for each ton emitted by a generating plant. As a result, they are internalized in economic analyses of a new generating plant or transmission line. Other environmental impacts, such as the damage associated with mercury contamination, remain excluded from such economic analyses and are therefore known as "externalities."

Commission staff argued that, except for NSPW, the utilities failed to explain how (or if) they had factored externalities into their processes. Externalities are principally associated with electricity generation and are therefore most significant when planning new sources of generation. The recent changes in state law that allow independent power producers to build merchant plants on speculation, without proving that such plants are needed, have considerably loosened state regulation regarding generation planning. Thus, compliance with this order point from Advance Plan 6 has become largely a moot issue.

The consideration of externalities remains significant when a utility files a CPCN application and will continue to be considered during CPCN review.

Advance Plan 7, Order Point 2.6: The utilities shall fully participate in the process by which DILHR revises the residential conservation codes.

This order point required utility participation in revisions of the Uniform Dwelling Code. The utilities admit that, with the exception of MGE, they failed to keep track of meetings organized by the Wisconsin Department of Commerce¹ for the purpose of revising this Code. The utilities asserted that this error was unintentional and expressed their willingness to participate in future revisions. Direct communications between the Department of Commerce and the utilities could facilitate future engagements.

Advance Plan 6 Order Point 11.1: An inter-utility group, including staff of the Commission, DNR and other interested agencies, shall be constituted to further the inclusion of environmental information in all stages of the transmission planning process. . . .

The need for improving the environmental analysis and review of transmission line plans was established in Advance Plan 6, where the Commission ordered that environmental aspects of transmission planning be developed to the same level of competence and sophistication as engineering aspects. The criteria for achieving this level of competence were further developed in Advance Plan 7.

¹ When the Wisconsin Department of Industry, Labor and Human Relations (DILHR) became the Wisconsin Department of Workforce Development, enforcement of this Code was transferred to the Wisconsin Department of Commerce.

While the sophistication of environmental analysis and review of transmission plans has advanced, it still lags behind engineering efforts. Using Geographic Information Systems (GIS) technology is the most effective way of improving environmental analysis for transmission line planning. GIS requires the creation and maintenance of high quality digital data. The existing digital transmission line data is out of date and has a number of significant errors that need correction. Continued progress toward improving the environmental analysis of transmission plans requires that the existing digital transmission line data be updated and corrected. The total cost of these updates and corrections is estimated to be no more than \$10,000. It is reasonable to allocate this cost among the transmission-owning utilities, according to each utility's proportionate share of transmission plant in Wisconsin. It is also reasonable to require that each utility pay its share of this cost to DNR Geographic Information Services, which is performing the work involved.

Advance Plan 7 Order Point 5.4: Utilities shall contribute to the cost of developing a statewide GIS data base to be used for the purpose of siting wind energy facilities in the state.

In Advance Plan 7, the Commission ordered the utilities to participate in a cooperative effort of stakeholders for the purpose of developing statewide wind energy siting guidelines. Advance Plan 7, Order Point 5.4 required investor-owned utilities (including NSPW) to contribute to the cost of developing a statewide GIS data base to be used for the purpose of siting wind energy facilities in the state.

The utilities have participated in a cooperative process for developing siting guidelines, but this work is not finished and the GIS data base ordered in Advance Plan 7, Order Point 5.4 awaits development. Commission staff has undertaken the development of a five-county prototype GIS wind energy siting project. This project is nearly complete. Upon completion, the five-county GIS project can be used as the basis for developing statewide GIS coverage. The utilities have not yet contributed to the cost of developing the statewide GIS database. Commission staff is in the process of developing a budget for a statewide GIS project, based on costs incurred for the development of the prototype, which the Commission will use to assess costs to the utilities. It is reasonable to allocate this cost among WEPCO, Alliant, MGE, WPS, and NSPW, based on each utility's proportionate share of the five utilities' total annual 1996 peak demand. It is also reasonable to require that each utility pay its share of this cost to the contractors the Commission selects to perform the work.

15. Should the utilities' joint plan and each utility's plan be approved, disapproved, or modified by the Commission?

Generation Plans

In Phase II, four utilities filed joint electric generation expansion plans covering the ten-year period 1998 to 2007, for the Commission's approval. WEPCO, Alliant, MGE, and WPS jointly filed five different generation plans. Their first plan was based on the set of

conditions specified by prior Advance Plans (known as the "required plan"). The remainder were based on four additional scenarios, covering the following situations: the required plan without the monetization of greenhouse gases; the required plan with the Kewaunee Nuclear Power Plant retired in December 2002; the required plan less an amount of INL; and the required plan using the load forecast that the joint utilities had originally forecast in Phase I. The joint utilities requested that the Commission approve all five of their filed plans in order to maximize flexibility, given the unsettled state of electric industry restructuring in Wisconsin.

Commission staff reviewed the joint utilities' required plan and corrected errors in it. Commission staff also included monetized greenhouse gases, removed constraints that limited the EGEAS computer model's choices in developing plans, and modified the required plan to account for the 50 MW of renewable resources that are required under 1997 Wisconsin Act 204. With these adjustments, the joint utilities' required plan reasonably meets projected energy needs and is approved. Given the findings above regarding the potential loss of INL it is also reasonable to approve one of the joint utilities' scenarios: the adjusted, joint required plan less 250 to 350 MW of INL. Diagrams of these plans are shown in Appendix B. The adjusted, joint required plan less INL recognizes the developing competitive market in wholesale electric generation, and its potential to reduce the amount of load that investor-owned utilities must serve. By law, however, the Commission must account for the energy needs of all electric customers in Wisconsin, not just the customers of investor-owned utilities. For this reason, the Commission also approves the adjusted, joint required plan that includes INL.

These two adjusted, joint required plans apply to WEPCO, Alliant, MGE, and WPS. The joint utility plans offered for the other three scenarios do not include the greenhouse gas monetization costs that were required by Advance Plan 6, and therefore are not approved.

Current state law sets forth a schedule for WEPCO, Alliant, and MGE to procure new capacity by contracting with independent power producers. (1997 Wisconsin Act 204, Section 96.) The Commission required these utilities to obtain this additional capacity as a condition of approving updated supply plans earlier this year. Since then, the Commission has received CPCN applications from the three successful bidders, seeking approval to construct generating plants in Wisconsin. If these projects are approved and constructed, the three host utilities can offset capacity needs shown on their approved, joint required plans with the megawatts from these new plants that they reserve by contract.

It is also reasonable to approve the individual generation plans submitted by NSP, DPC, WPPI, Manitowoc Public Utilities (MPU), and Superior Water, Light, and Power Company (SWLP). NSP's plan used reasonable system-wide cost parameters in its EGEAS data set. The other four utilities were not required to use the EGEAS computer model, but the plans they produce reasonably meet their customers' energy needs.

Transmission Plans

The Commission must also approve a transmission expansion plan for the ten-year period 1998 to 2007. In this docket, the issue was uncontested. The utilities' transmission plan, as modified at hearing and shown in Appendix C, is reasonable and is approved. CPCN applications may be filed for the high-voltage transmission line projects listed in Appendix C.

Statutory Conditions

These approved plans comply with the state energy policy established by law. Under Wis. Stat. §§ 1.12(4) and 196.025, the state has established energy conservation and renewable resources as its highest energy priorities in meeting demand. The Commission must, to the extent cost-effective and technically feasible, implement these priorities in its Advance Plans. The Commission has done so by its determination of available demand-side management in Phase I, and by its selection of reasonable cost parameters for renewable resources and other supply options in Phase I. The approved generation plans are based on the level of demand-side management and the costs established in Phase I.

These approved plans also comply with the necessary conditions expressed in Wis. Stat. § 196.491(2)(i). The utilities' use of the growth forecasts specified in Phase I, and NSP's use of its own Commission-approved forecast, means that the plans include a reasonably adequate supply of electrical energy to meet the needs of the public during the planning period as required by Wis. Stat. § 196.491(2)(i)1. The use of the EGEAS computer model to create plans, and the methods used by other utilities that were not required to use EGEAS, means the plans comply with the provisions of Wis. Stat. § 196.491(2)(i)2. These plans are reasonably coordinated with long-range plans and policies of other state agencies and other federal agencies that regulate utilities, as required by Wis. Stat. § 196.491(2)(i)3. The incorporation of demand-side management projections into the approved growth forecasts discourages inefficient and excessive power use, as required by Wis. Stat. § 196.491(2)(i)4.

1999 Reliability Report

At hearing, Commission staff recommended that utilities submit an electric system reliability report in 1999. Such a report could help the Commission monitor the evolving generation market in Wisconsin and apprise the Commission of generation construction needs in the state, given the Commission's concern about the lack of new generation resources to meet demand. The report could also be a valuable precursor to the first Strategic Energy Assessment. It is reasonable to require such a report in 1999. At the Commission's direction, Commission staff can inform the utilities of the appropriate process for creating this report. Depending on the filing schedule that is established for the Strategic Energy Assessment, the Commission may direct that this report be combined with the utilities' Strategic Energy Assessment data filings in order to reduce the burden of compliance.

direct that this report be combined with the utilities' Strategic Energy Assessment data filings in order to reduce the burden of compliance.

FINDINGS OF ULTIMATE FACT

THE COMMISSION FINDS:

1. The NSP system forecast is also a reasonable forecast for NSPW to use.
2. The supply parameters that NSPW used in its EGEAS data set are reasonable.
3. A reasonable approximation of INL by the year 2007 is between 250 and 350 MW.
4. It is reasonable to require investor-owned utilities to continue planning for all the load that they have contracted to provide, and to require transmission owners to continue planning for the transmission needs of Wisconsin's transmission-dependent utilities.
5. The record does not demonstrate that a reliable inventory of end-user generation can be created by utilities.
6. Pending further work on mercury emissions by DNR, it is premature to require that utilities fund additional specific scientific research on mercury.
7. The U.S. Department of Energy's failure to honor its contractual obligations to take spent nuclear fuel does not require a change in the generation plans of Wisconsin utilities at this time.
8. The loss of generating capacity at the Zion Nuclear Power Plant does not substantially affect the generation plans of Wisconsin utilities. The record does not demonstrate whether shutting down other Midwest nuclear plants would substantially affect these plans.
9. It is reasonable to require that the eastern Wisconsin utilities meet the timetable prescribed in the Findings of Fact, in order to construct or procure its required portion of new renewable electric capacity by December 31, 2000.
10. It is reasonable for the utilities to continue expending resources on and provide staff to support the TAP Collaborative Group. It is also reasonable for the utilities to use the specific screening criteria and methods of analysis that the TAP Collaborative Group developed by consensus. It is reasonable to require that the utilities perform this screening for transmission projects listed in Appendix C and, for each project that passes the screens, complete and file a TAP analysis with the Commission on or before the date when a CPCN application is filed.

11. Electric fields from transmission lines do not pose a demonstrated health risk to the general public. A scientific consensus is developing that exposure to power frequency EMF has not been shown to adversely affect human health. Some health concerns remain, however, and nationally funded research on EMF is continuing. It is therefore reasonable to rescind some, but not all, of the Commission's previous orders concerning EMF.

12. The reasonableness of considering multiple contingencies as part of transmission plans can be deferred until the Commission has created a new forum for transmission planning.

13. It is reasonable to allocate the cost (estimated to be up to \$10,000) for the correction and updating of GIS digital transmission line data among the transmission-owning utilities, and require these utilities to pay their share of the cost to DNR, as specified in the Findings of Fact.

14. It is reasonable to allocate the cost of a statewide GIS wind energy siting project, when these costs are budgeted by the Commission staff, among WEPCO, Alliant, MGE, WPS, and NSPW, as specified in the Findings of Fact. It is also reasonable to require that these utilities pay their share of the cost to the contractors the Commission selects to perform the work.

15. It is reasonable to approve the adjusted, joint utilities' required generation plan, and the adjusted, joint utilities' required generation plan less 250 to 350 MW of INL (as shown in Appendix B). It is also reasonable to approve the individual generation plans of NSP, DPC, WPPI, MPU, and SWLP.

16. It is reasonable to approve the utilities' transmission plan, as modified at hearing and shown in Appendix C.

17. These approved plans will provide a reasonably adequate supply of electrical energy to meet the needs of the public during the planning period. These plans are in the public interest when considering engineering, economic, health, safety, reliability, efficiency and environmental factors and alternate methods of generation or sources of supply. These plans are reasonably coordinated with long-range plans and policies of other agencies, and include programs that discourage inefficient and excessive power use.

18. It is reasonable to require an electric system reliability report from the utilities in 1999.

CONCLUSION OF LAW

THE COMMISSION CONCLUDES:

The Commission has authority to issue this order under §111 of the federal Energy Policy Act of 1992, and under Wis. Stat. §§ 1.12, 196.02, 196.025, and 196.491.

ORDER

THE COMMISSION ORDERS:

1. Investor-owned utilities shall continue to plan for all the generation needs of Wisconsin load that they have contracted to serve. Municipal utilities are responsible for their own generation planning, to the extent they lack sufficient contracts with the investor-owned utilities to meet the needs of their customers.

2. Transmission-owning utilities shall continue to plan for the transmission needs of Wisconsin's transmission-dependent utilities.

3. As part of their data filing for the first Strategic Energy Assessment, the utilities shall update the Commission regarding current and projected amounts of INL.

4. Each eastern Wisconsin utility that is required, under Wis. Stat. § 196.377(2), to construct or procure a portion of 50 MW of new electric capacity from renewable resources by December 31, 2000, shall adhere to the schedule established in the Findings of Fact for developing these resources. Failure to do so will jeopardize the utility's ability to secure an extension of the deadline under Wis. Stat. § 197.377(2)(d) for bringing these resources on line.

5. The utilities shall continue to expend resources on and provide staff to support the TAP Collaborative Group. The utilities shall use the specific criteria and methods of analysis to screen TAP proposals that the TAP Collaborative Group developed by consensus, as part of their analysis of transmission projects. The utilities shall complete this screening for transmission projects listed in Appendix C; for each project that passes the screens, a TAP analysis shall be completed and filed with the Commission on or before the date when a CPCN application is filed.

6. The utilities shall continue to comply with the requirements concerning EMF that were established in Advance Plans 5 and 6, except the utilities are no longer required to:

A. Use low-EMF design structures where practicable when proposing to construct new electric transmission lines or rebuild old ones (docket 05-EP-6, Order, May 8, 1992, pages 9 and 10).

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B. Investigate and report on methods of reducing EMF on their distribution systems (docket 05-EP-6, Order, May 8, 1992, pages 10 and 11).

C. Incorporate the possibility of adverse health effects from EMF into the integrated resource planning process (docket 05-EP-6, Order, May 8, 1992, page 12).

7. Each transmission-owning utility shall pay its allocated share of the estimated cost for the correction and updating of GIS digital transmission line data, as specified in the Findings of Fact.

8. WEPCO, Alliant, MGE, WPS, and NSPW shall each pay its allocated share of the cost of a statewide GIS wind energy siting project, as specified in the Findings of Fact.

9. The adjusted, joint required plan and the adjusted, joint required plan less 250 to 350 MW of INL are approved for WEPCO, Alliant, MGE, and WPS. The individual generation plans of NSP, DPC, WPPI, MPU, and SWLP are also approved.

10. The utilities shall submit an electric system reliability report in 1999, as provided in the Findings of Fact.

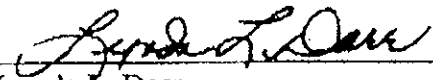
11. The utilities' transmission plan, as shown in Appendix C, is approved.

12. The utilities are directed to comply with the outstanding order points of prior Advance Plans that remain in effect, as listed in Appendix D.

13. Jurisdiction is retained.

Dated at Madison, Wisconsin, January 19, 1999

By the Commission:


Lynda L. Dorr
Secretary to the Commission

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See attached Notice of Appeal Rights

Notice of Appeal Rights

Notice is hereby given that a person aggrieved by the foregoing decision has the right to file a petition for judicial review as provided in Wis. Stat. § 227.53. The petition must be filed within 30 days after the date of mailing of this decision. That date is shown on the first page. If there is no date on the first page, the date of mailing is shown immediately above the signature line. The Public Service Commission of Wisconsin must be named as respondent in the petition for judicial review.

Notice is further given that, if the foregoing decision is an order following a proceeding which is a contested case as defined in Wis. Stat. § 227.01(3), a person aggrieved by the order has the further right to file one petition for rehearing as provided in Wis. Stat. § 227.49. The petition must be filed within 20 days of the date of mailing of this decision.

If this decision is an order after rehearing, a person aggrieved who wishes to appeal must seek judicial review rather than rehearing. A second petition for rehearing is not an option.

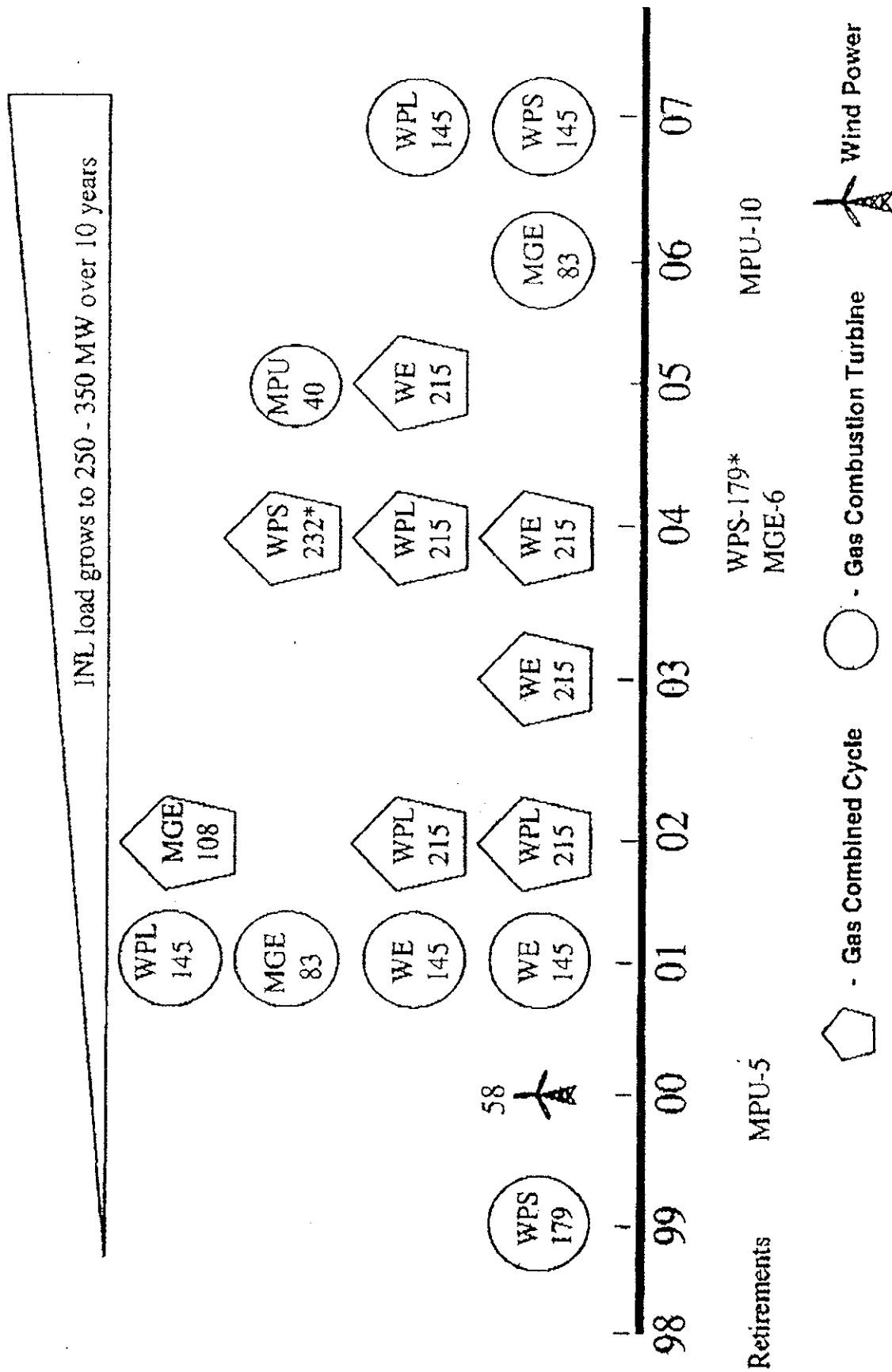
This general notice is for the purpose of ensuring compliance with Wis. Stat. § 227.48(2), and does not constitute a conclusion or admission that any particular party or person is necessarily aggrieved or that any particular decision or order is final or judicially reviewable.

Revised 9/28/98

Advance Plan 8

Statewide Plan w/o INL

Rated capacity Excluding NSP

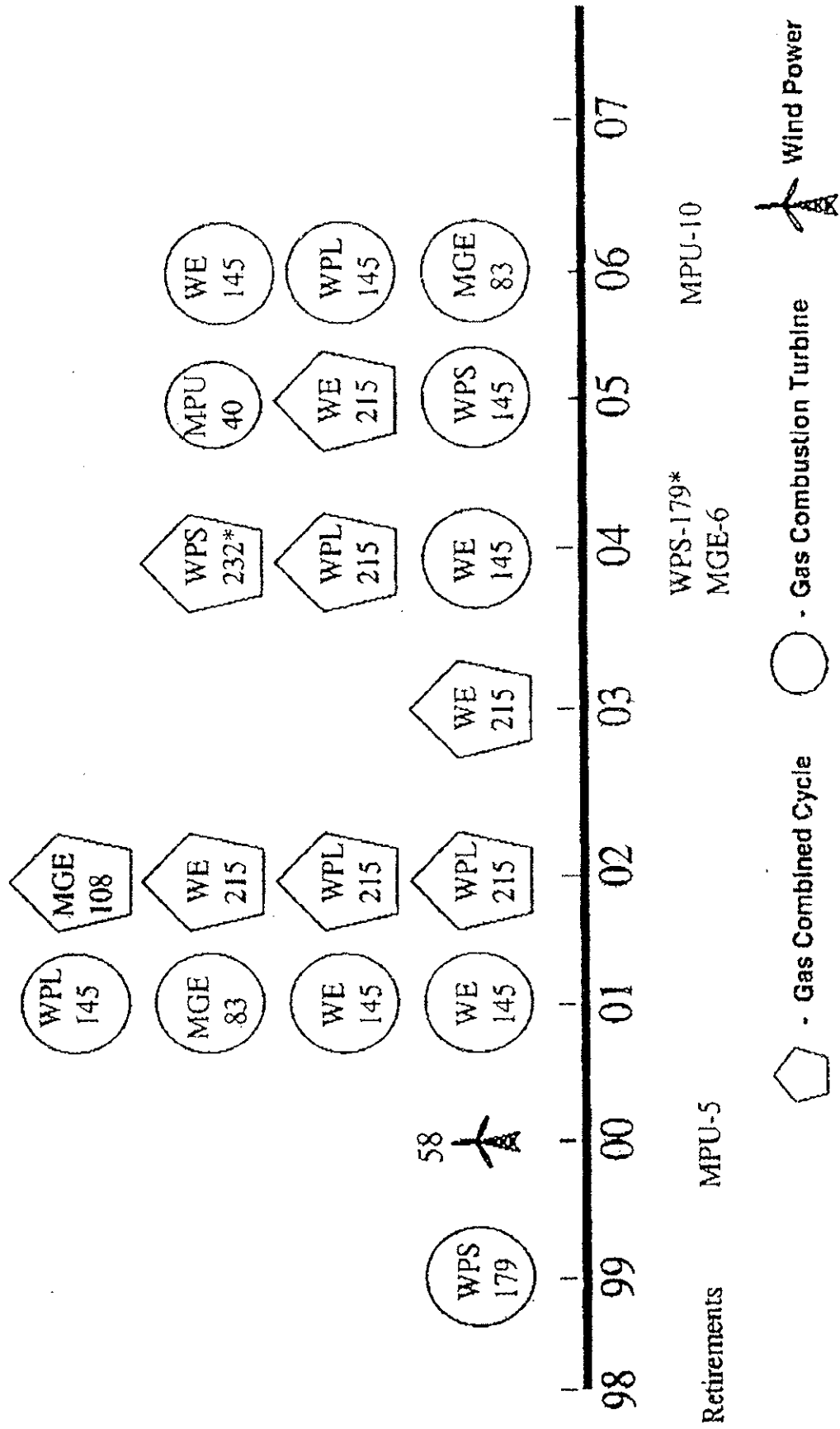


* The Combustion turbine built in 1999 is converted to 232 MW of combined cycle

Advance Plan 8

Statewide Required Plan with INL

Rated capacity Excluding NSP



* The Combustion turbine built in 1999 is converted to 232 MW of combined cycle

TRANSMISSION LINES APPROVED FOR PLANNING PURPOSES							
County	ID No.	Line Description (substation terminals)	Design Voltage (kV)	Length (miles)	Cost (K\$)	In-Service Date (year)	Study Area
Sheboygan	101	Erdman-Howard's Grove	138	5	700	2001	WP&L North
Sheboygan	102	Howard's Grove-Meeme	138	7	750	2007	WP&L North
Sheboygan	103	Nicolet-Huebner	138	1	400	2005	WP&L North
Dodge	104	Springbrook-Butternut	138	12	4,400	2007	WP&L North
Dodge	106	Rubicon-Hustisford	138	6	1,500	2007	WP&L North
Fond du Lac	109	N Fond du Lac-Hickory Street	138	2	300	2007	WP&L North
Fond du Lac	110	S Fond du Lac-Willow Lawn-Mercury Marine-Morris St-Rienzi Rd-Ohmstead	138	7	1,100	2007	WP&L North
Wood	112	Sigel-Vesper-Pittsville	138	7	950	2005	Arpin
Marathon	113	Arpin-Auburndale-Rosclerville	115	20	3,800	2005	Arpin
Wood	114	Rubicon-Springbrook	138	16	4,100	2007	WP&L North
Dodge	115	Arpin-Rudolph-W Wis Rapids-Port Edwards	138	29	4,600	2007	Arpin
Wood	116	Port Edwards-Coyne	115	8	4,000	2007	Arpin
Sheboygan	117	Edgewater-Riverside-Erdman	138	8	1,400	2005	WP&L North
Wood	118	Port Edwards-Baker	115	10	10,300	1998	Arpin
Dane	119	Box Elder-Simon-Reiner	138	16	2,900	2003	Madison
Dane	120	Windsor-Windsor Tap	138	1	400	2003	Madison
Dane	123	Verona-Belleville-New Glarus-Monitello-N Monroe	138	26	2,200	2001	Madison
Dane	124	Spring Green-Arcua-Mazomanie-Black Earth-Stagecoach-W Middleton	138	28	3,500	2001	Madison
Iowa	125	Newark-Paddock	138	6	1,550	2003	WP&L South
Rock	126	Russell-Sheepskin	138	9	1,000	2003	WP&L South
Walworth	127	Elkhor-Bristol-West Dancin-Rock River	138	32	7,000	2007	WP&L South
Rock	128	Paddock-Shirland-Shaw-E Rockton-Park St-Colley Rd	138	16	1,500	2007	WP&L South
Winnebago (IL)	129	NW Beloit Tap-NW Beloit	138	1	600	2003	WP&L South
Rock	130	Blackhawk-Shaw	138	5	1,500	2003	WP&L South
Columbia	132	Portage-Portage Industrial Park	138	2	800	1998	WP&L North
Juneau	133	Council Creek-Hilltop-Kilbourn	138	50	13,000	2000	Southwest Wis
Monroe	134	Hillsboro-Reedsburg-Kilbourn	161	28	7,000	2000	Southwest Wis
Juneau	135	Kilbourn-McKenna-Peterwell	138	44	7,000	2005	WP&L North
Adams	136	Kirkwood-Reedsburg-Kilbourn	138	34	6,000	2005	WP&L North
Juneau	138	X52-X19 tie and new Maass Rd Substation	138	2	1,000	2005	WP&L North
Columbia	139	Lancaster-Monroe	138	30	7,600	2003	WP&L South
Green	140	Port Edwards-GP Port Edwards and Nekoosa	138	4	2,200	2005	Arpin
Stephenson (IL)	142	Badger Substation-Belle Plaine	115	3	700	2007	WP&L North
Wood	143	Traxler Tap-Traxler-McCue	138	4	750	2003	WP&L South
Shawano	144	Janesville-Parkview-Milton Lawns-McCue	138	8	1,400	2003	WP&L South
Rock	145	Jackson County-Port Edwards	161	50	17,800	2007	Arpin
Jackson	147	Nelson Dewey-Lore	161	20	2,150	2005	Southwest Wis
Wood	148	Fitchburg-Verona	138	6	1,250	2001	Madison
Grant	151	Cross Country-Verona	138	4	3,000	2001	Madison
Dubuque (IA)	152	Hillsboro-Reedsburg-Kirkwood	161	43	8,600	2000	Southwest Wis
Dane	153	Sank County-N Madison	138	26	4,000	2005	Southwest Wis
Juneau	154	Bell Center-Spring Green	161	53	10,000	2005	Southwest Wis
Sauk	157	Spring Green-Darlington	138	42	5,300	2005	Southwest Wis
Vernon	160	Blackhawk-Rock River	138	6	300	2007	WP&L South
Sauk	162	Spring Valley-N Lake Geneva	138	17	4,300	2007	WP&L South
Walworth	164	Brick Church-Zenda-Katzenburg-Twin Lakes-S Lake Geneva-Lake Geneva-N Lake Geneva	138	34	6,800	2007	WP&L South

TRANSMISSION LINES APPROVED FOR PLANNING PURPOSES							
County	ID No.	Line Description (substation terminals)	Design Voltage (kV)	Length (miles)	Cost (K\$)	In-Service Date (year)	Study Area
Rock	165	Rock River-Liberty-Janesville	138	7	2,000	2002	WP&L South
Rock	166	Rock River-Janesville	138	10	3,000	2002	WP&L South
Rock	167	Janesville-Russell	138	6	2,000	2002	WP&L South
Walworth	172	Walworth-Tap of Brick Church-Elkhorn	138	2	300	1999	WP&L South
Fond du Lac	174	N Fond du Lac-Sadoff-Macy St-Mercury	138	5	1,040	2007	WP&L North
Sauk	175	Kirkwood-Island Moore-Kirkwood	138	5	750	2002	WP&L North
Columbia	179	Cambria-Tap of Hamilton-N Randolph	138	1	200	2003	WP&L North
Walworth	180	Elkhorn-Sugar Creek	138	5	1,500	2007	WP&L South
Grant Dubuque (IA)	181	Nelson Dewey-Liberty	161	15	4,000	2005	Southwest Wis
Columbia	182	N Randolph-Tap of Columbia-S Fond du Lac	345	1	1,000	2000	WP&L North
Fond du Lac	183	Ledgeview-Tap of Ohmstead-Kettle Moraine	138	3	825	2000	WP&L North
Fond du Lac	184	Ledgeview-Tap of Ohmstead-E Scott St Tap	138	2	550	2000	WP&L North
Rock	204	Whitewater-Sunrise Tap (rebuild)	138	8	2,216	2000	Milwaukee
Walworth							
Ozaukee	205	St Lawrence-Pleasant Valley-Saukville (rebuild)	138	19	5,260	2000	Milwaukee
Washington							
Milwaukee	210	Bluemound-Tosa	138	4	700	2000	Milwaukee
Milwaukee	211	Granville-Tosa	138	6	820	2000	Milwaukee
Milwaukee	212	Granville-Butler	138	4	570	2000	Milwaukee
Milwaukee	213	Oak Creek-Arcadian (convert K-884 to 345 kV)	345	35	7,400	2000	Milwaukee
Racine							
Waukesha							
Milwaukee	214	Oak Creek-Pennsylvania	345	6	9,576	2004	Milwaukee
Racine							
Milwaukee	215	Pennsylvania-Thompson (double circuit)	345/138	8	13,804	2004	Milwaukee
Milwaukee	216	Resting Oak Creek (KK-824, KK-848) to structure 8640 (double circuit)	138	5	3,600	2004	Milwaukee
Milwaukee	218	28th St-Center (underground)	138	2	2,575	2001	Milwaukee
Milwaukee	219	Fiebrantz-Center (underground)	138	2	1,765	2001	Milwaukee
Kenosha	222	Bain-Racine	138	13	2,737	2004	Milwaukee
Racine							
Kenosha	227	Kenosha-Waukegan	138	18	7,130	2007	Milwaukee
Lake (IL)							
Walworth	228	Whitewater-Mukwonago	138	22	2,800	2005	Milwaukee
Waukesha							
Waukesha	229	Sussex-Duplainville	138	5	1,760	2010	Milwaukee
Waukesha	230	Waukesha-Duplainville	138	4	1,290	2010	Milwaukee
Waukesha	231	Arcadian-Chinook (double circuit)	138	5	6,214	2005	Milwaukee
Waukesha	232	Mukwonago-Merrill Hills (KK-77354) to Chinook (double circuit)	138	6	6,960	2005	Milwaukee
Waukesha	233	Merrill Hills-Chinook	138	8	6,390	2005	Milwaukee
Waukesha	234	Chinook-Big Bend	138	3	2,851	2005	Milwaukee
Waukesha	235	Loop Mukwonago-St. Martins (KK-77353) into Big Bend	138	3	3,664	2005	Milwaukee
Walworth	236	Mukwonago-St Martins	138	14	4,682	2005	Milwaukee
Waukesha							
Milwaukee	238	Cornell-Shorewood (overhead/underground)	138	3	4,627	2006	Milwaukee
Milwaukee	242	Shorewood-Haymarket (underground)	138	4	9,400	2006	Milwaukee
Milwaukee	243	Everett-Haymarket (underground)	138	1	2,100	2006	Milwaukee
Milwaukee	244	Harbor-Everett (underground)	138	1	4,900	2006	Milwaukee
Calumet Winnebago	245	Butte des Morts-City Limits	138	4	527	2002	Northeast
Milwaukee	246	Harbor-Haymarket (underground)	138	2	6,262	2006	Milwaukee
Ozaukee	247	Saukville-68th St	138	13	1,925	2001	Milwaukee
Dickinson (MI)	248	Plains-Spalding	345	22	7,490	Unknown	Northeast
Menominee (MI)							
Marquette Menominee (MI)	249	Spalding-W Marinette	345	45	27,289	Unknown	Northeast
Marquette Menominee (MI)	250	Presque Isle-Spalding	345	58	32,920	Unknown	Northeast

TRANSMISSION LINES APPROVED FOR PLANNING PURPOSES							
County	ID No.	Line Description (substation terminals)	Design Voltage (kV)	Length (miles)	Cost (K\$)	In-Service Date (year)	Study Area
Oconto Outagamie Shawano	253	Falls Tap-N Appleton	345	42	18,120	2002	Northeast
Marquette Dickinson (MI)	254	Presque Isle-Plains	345	83	46,500	Unknown	Northeast
Marquette Oconto Dickinson (MI)	255	Plains-Stiles (double circuit)	345/138	66	54,920	Unknown	Northeast
Florence Forest Oneida Dickinson (MI)	256	Plains-Venus	345	72	40,730	2002	Northeast
Ozaukee	257	Saukville-Mequon	138	9	1,000	2001	Milwaukee
Milwaukee Ozaukee	258	Granville-Mequon	138	9	1,100	2001	Milwaukee
Milwaukee Ozaukee	259	Granville-68th St	138	5	725	2001	Milwaukee
Delta (MI) Menominee (MI)	263	Escanaba-Spalding (double circuit)	345	24	20,536	Unknown	Northeast
Marquette Delta (MI) Menominee (MI)	272	Escanaba-W Marquette	345	73	41,406	Unknown	Northeast
Delta (MI) Dickinson (MI) Menominee (MI)	273	Escanaba-Plains	345	53	22,952	Unknown	Northeast
Delta (MI)	275	Chandler-Escanaba (double circuit)	138	9	4,271	Unknown	Northeast
Oconto	276	Falls-Falls Tap	138	5	1,300	2002	Northeast
Oconto Shawano	277	White Clay-Falls Tap	138	12	3,300	2002	Northeast
Oconto Falls	278	Falls-Pioneer	138	4	1,100	2002	Northeast
Oconto	279	Pioneer-Stiles	138	2	850	2002	Northeast
Calumet	280	Loop Pt Beach-Arcadian (L-121) into Forest Junction	345	1	976	2002	Northeast
Forest Oneida	302	Venus-Sand Lake Mine	115	18	3,890	2000	Wis River
Marathon	303	Maine-Brokaw	115	2	690	2001	Wis River
Marathon	305	Kelly-Town Line	115	2	445	2002	Wis River
Marathon	306	Sherman St-Wausau Hvdro	115	1	290	2003	Wis River
Marathon	307	Wausau Hvdro-Town Line	115	2	430	2004	Wis River
Marathon	308	Wausau Hvdro-Stowbridge	115	2	595	2005	Wis River
Marathon	309	Stowbridge-Brokaw	115	5	930	2005	Wis River
Oneida	311	Skarawan-Highway 8	115	16	5,600	2002	Wis River
Marathon Lincoln Marathon Wood	312	Arpin-Highway 8	345	110	49,290	2002	Wis River
Oneida Price Rusk	313	Osprey-Highway 8	345	80	35,840	2002	Wis River
Langlade	315	Blackbrook-Aurora St	345	8	2,800	2002	Wis River
Marathon	319	Bunker Hill-Black Brook	115	8	1,700	2002	Wis River
Marathon	320	Wien-Stratford	115	9	800	2005	Arpin
Marathon	321	Stratford-McMillan	115	11	960	2005	Arpin
Wood	322	Rozellville Tap-McMillan	115	9	2,480	2005	Arpin
Wood	323	Arpin-McMillan	115	20	5,050	2005	Arpin
Langlade Oneida	330	Black Brook-Venus	345	34	19,586	2002	Northeast
Winnebago	331	Ellinwood-Sunset Pt	138	4	350	2007	Northeast
Winnebago	332	Ellinwood-12th-Pearl-Sunset Pt	138	5	1,113	2007	Northeast
Portage	334	W Side-Coyne	115	13	680	2001	Arpin
Portage	345	Rocky Run-W Side	115	2	375	2001	Arpin
Brown	351	De Pere Energy-Glory Rd-Ashland	138	3	1,800	2001	Northeast
Brown	352	Liberty-Ashland	138	3	900	2001	Northeast

TRANSMISSION LINES APPROVED FOR PLANNING PURPOSES							
County	ID No.	Line Description (substation terminals)	Design Voltage (kV)	Length (miles)	Cost (K\$)	In-Service Date (year)	Study Area
Marquette	353	Ogden-Fiber	138	0.5	700	2002	Northeast
Brown	354	Pulliam-Tower/Eastman (double circuit)	138	2	1,400	2007	Northeast
Brown	355	Tower-Freble (rebuild double circuit)	138	3	1,200	2007	Northeast
Brown	356	Freble-Highway V (rebuild double circuit)	138	2	800	2007	Northeast
Brown	357	Pulliam-Highway V	138	5	2,000	2007	Northeast
Brown	358	Highway V-Liberty	138	3	1,400	2007	Northeast
Brown	362	Howard-Bayport	138	2	450	2005	Northeast
Brown Oconto	363	Bayport-Pioneer	138	21	7,500	2005	Northeast
Brown	364	Pulliam-Bayport	138	2	700	2005	Northeast
Brown	365	Pulliam-Howard (reconductor/rebuild)	138	3	700	2005	Northeast
Brown	366	Forest Junction-Lost Dauphin	138	14	1,000	2002	Northeast
Calumet Brown Kewaunee	367	Kewaunee-E Krok-Highway V	138	29	3,900	2002	Northeast
Marquette Oconto	368	W Marquette-Stiles	345	24	10,667	Unknown	Northeast
Brown Oconto	369	Stiles-Wesbay	345	24	16,196	Unknown	Northeast
Brown	370	Wesbay-R304	345	7	6,231	Unknown	Northeast
Langlade Marathon	371	Weston-Black Brook	345	6	3,683	Unknown	Northeast
Marquette	372	Loop Sherwood-W Marquette (M-17) into Roosevelt	138	2.5	950	2002	Northeast
Marquette	373	Roosevelt-Wells (double circuit)	138	2	700	2002	Northeast
Marquette	374	Goodman-Caldron Falls-High Falls	138	28	9,800	2005	Northeast
Marquette Menominee (MI)	375	Crivitz-Menominee	138	18	4,000	2002	Northeast
Marquette	376	Wells-Ogden	138	1	400	2002	Northeast
Menominee (MI)	377	Wells-Menominee	138	6	1,600	2002	Northeast
Marquette Menominee (MI)	378	W Marquette-Menominee	138	7	1,700	2002	Northeast
Marquette Menominee (MI)	379	Menominee-Grand Rapids-Amberg	138	41	3,100	2002	Northeast
Marquette Oconto	380	Pioneer-Crivitz (double circuit)	138	22	6,600	2005	Northeast
Marquette Delta (MI)	381	Menominee-Chandler	138	65	16,500	2002	Northeast
Marquette Oconto	382	Pioneer-W Marquette (rebuild/reconductor)	138	25	8,800	2002	Northeast
Oconto	383	Stiles-Oconto (reconductor)	138	2	250	2002	Northeast
Manitowoc	384	Valders-Custer	138	10	3,500	2002	Northeast
Manitowoc	385	Reifs Mills-Custer	138	10	3,500	2002	Northeast
Manitowoc	386	Shoto-Custer	138	10	3,500	2002	Northeast
Brown Calumet	387	Highway V-Forest Junction (reconductor)	138	20	1,700	2002	Northeast
Brown Outagamie	388	Loop Lost Dauphin-N Appleton into Wrightstown	138	4	1,000	Unknown	Northeast
Manitowoc Sheboygan	389	Erdman-Custer	138	22	4,900	2002	Northeast
Brown	390	Lost Dauphin-Mystery Hills-Highway V (reconductor)	138	11	2,400	2002	Northeast
Calumet Manitowoc	391	Gravesville-Custer (loop 138 kV line KK-4035 into Gravesville)	138	21	4,600	2002	Northeast
Calumet	392	Gravesville-Glenview	138	13	2,900	2007	Northeast
Calumet	393	Forest Junction-Glenview (reconductor)	138	5	1,300	2007	Northeast
Door Kewaunee	394	Dyckesville-Brusbay-Sawyer (rebuild O-15 line)	138	25	5,500	2007	Northeast
Door Kewaunee	395	Rosiere-Brusbay-Sawyer	138	17	3,700	2007	Northeast
Brown Manitowoc	396	Wesmark-Kellnersville-Manrap (rebuild to 138 kV)	138	20	4,400	Unknown	Northeast

TRANSMISSION LINES APPROVED FOR PLANNING PURPOSES							
County	ID No.	Line Description (substation terminals)	Design Voltage (kV)	Length (miles)	Cost (K\$)	In-Service Date (year)	Study Area
Brown Outagamie	397	Howard-Mason-N Appleton (reconductor/rebuild)	138	22	1,900	2007	Northeast
Brown Outagamie	398	Lost Dauphin-N Appleton (reconductor)	138	12	1,000	2007	Northeast
Marmette	399	Crivitz-High Falls (rebuild double circuit)	138	13	4,600	2005	Northeast
Dane	401	Sprecher-Ferrite	138	4	7,000	2004	Madison
Dane	402	Sprecher-Kegonsa	138	8	7,600	2004	Madison
Dane	403	W Middleton-Tokay	138	8	6,000	2003	Madison
Dane	404	Tokay-W Towne	138	2	1,000	2003	Madison
Dane	405	W Towne-Fitchburg	138	7	8,000	2003	Madison
Dane	406	Blount-Sycamore	138	4	6,500	2005	Madison
Dane	407	Blount-E Campus	138	2	3,000	2007	Madison
Dane	408	E Campus-Walnut	138	1	3,000	2007	Madison
Dane	409	Walnut-Blackhawk	138	3	4,000	2007	Madison
Dane	410	Blackhawk-W Middleton	138	4	8,000	2007	Madison
Dane	411	N Madison-Huiskamp	138	9	6,800	2006	Madison
Dane	412	Pleasant View-W Towne	138	2		2007	Madison
Dane	413	Columbia-N Madison	345	17	4,500	2003	Madison
Dane	414	Rockdale-Fitchburg	345	24	20,100	2003	Madison
Dane	415	N Madison-W Middleton	345	21	14,400	2003	Madison
Dane	416	W Middleton-Fitchburg/Belleville	345	17	8,400	2003	Madison
Dane	417	Rockdale-Fitchburg	230	24	14,000	2003	Madison
Dane	418	Rockdale-Belleville	345	23	21,000	2003	Madison
Dane	419	Belleville-Verona/Fitchburg	138	15	6,050	2003	Madison
Polk Chisago (MN)	502	Chisago County-Apple River	230	38	11,800	2003	AP7 WWU Bulk
Chippewa Dunn St. Croix	504	King-Hydro Lane	161	77	4,300	2010	AP7 WWU Bulk
Burnett Polk Pine (MN)	506	Rock Creek-Washco	161	57	17,350	2003	AP7 WWU Bulk
Burnett Polk Pine (MN)	507	Rock Creek-Apple River	161	52	15,400	2003	AP7 WWU Bulk
Buffalo Goodhue (MN)	509	Spring Creek-Alma	161	52	13,300	2004	AP7 WWU Bulk
Burnett Polk Washburn	520	Apple River-Washco	161	37	10,800	2005	Northwestern Wis Electric
Ashland Gogebic (MI)	568	Ironwood-Gogebic	161	39	9,500	2000	Northern
La Crosse Vernon	600	Genoa-Coulee (reconductor)	161	17	1,872	2000	La Crosse
La Crosse Vernon	601	Genoa-Coulee (second circuit)	161	17	5,157	2000	La Crosse
Monroe Vernon	602	Monroe County-Council Creek-Hillsboro	161	43	14,600	2002	Southwest Wis
La Crosse Houston (MN)	603	Genoa-French Island	161	21	8,510	2000	La Crosse
Monroe	605	Monroe County-Council Creek	161	16	6,500	2002	Southwest Wis
Monroe Vernon	606	Council Creek-Hillsboro	161	27	9,200	2002	Southwest Wis
Vernon	607	Genoa-Hillsboro	161	48	12,200	2002	Southwest Wis
Bayfield	608	Tap-TransCanada	115	2	550	2000	Northern
Barron Polk	610	Apple River-Barron	230	24	500	2004	AP7 WWU Bulk
Eau Claire	540a	Seven Mile-Eau Claire	161	20	6,000	2010	Eau Claire
Eau Claire	540b	Seven Mile-Elk Mound	161	24	7,300	2010	Eau Claire
Barron Rusk	611a	Barron-Osprey	161	50	8,250	2004	AP7 WWU Bulk
Barron Rusk	611b	Barron-Osprey	230	50	15,400	2004	AP7 WWU Bulk

Proposed CONTINUED ORDER POINTS

Advance Plan 1 - August 17, 1978

ORDER POINTS: 9

Advance Plan 2 - December 4, 1980

ORDER POINTS: 15, 21

Advance Plan 3 - May 23, 1983

ORDER POINTS: 20, 21, 23, 32, 33,

Advance Plan 4 - August 8, 1986

ORDER POINTS: 9, 14, 20, 33, 34, 50

Advance Plan 5 - April 7, 1989

ORDER POINTS: 33, 38

SOAP - November 5, 1990

ORDER POINTS: 1, 20

Advance Plan 6 - September 18 1992

ORDER POINTS: 3.1, 3.3-3.5, 3.7, 3.8, 3.10, 3.12, 3.14, 3.15, 4.3-4.5, 4.9, 4.11, 4.14,
6.2, 6.5, 7.2, 10.2, 11.1, 15.3, 18.4, 18.9, 20.1

Advance Plan 7 - December 22, 1995

ORDER POINTS: 2.1-2.3, 2.6, 2.7, 4.1-4.3, 5.2-5.5, 8.1, 9.1-9.4

Attachment 4

Attachment 4. State Transmission Line Standards and Guidelines

State	Year Published	Electric Field		Magnetic Field	
		On R.O.W.*	Edge R.O.W.	On R.O.W.	Edge R.O.W.
California	1992	-	1.6 kV/m	-	-
Florida	1989; 1996	8 kV/m ^a 10 kV/m ^b	2 kV/m	-	150 mG ^a (max. load) 200 mG ^b (max. load) 250 mG ^c (max. load)
Minnesota	-**	8 kV/m	-	-	-
Montana	1996	7 kV/m	1 kV/m ^e	-	-
New Jersey	1981	-	3 kV/m	-	-
New York	1978; 1990	11.8 kV/m 11.0 kV/m ^f 7.0 kV/m ^d	1.6 kV/m	-	200 mG (max. load)
North Dakota	-**	9 kV/m	-	-	-
Oregon	198	9 kV/m	-	-	-

*R.O.W. = right-of-way (or in the Florida standard, certain additional areas adjoining the right-of-way).

**Original citation not found

kV/m = kilovolt per meter. One kilovolt = 1,000 volts.

^a For lines of 69-230 kV.

^b For 500 kV lines.

^c For 500 kV lines on certain existing R.O.W.

^d Maximum for highway crossings.

^e May be waived by the landowner.

^f Maximum for private road crossings.

Attachment 5

Attachment 5. 60 Hz EMF Exposure Guidelines and Recommendations of Selected Organizations

	ICNIRP ¹ (1998)	EC ² (1999)	SSK ³ (2001)	ICES ⁴ (2002)	ACGIH ⁵ (2003)	NRPB ³ (2004)
Controlled Environment						
Magnetic Field	0.42 mT (4,200 mG)	-	-	2.71 mT (27,100 mG)	1 mT (10,000 mG)	0.42 mT (4,200 mG)
Electric Field	8.3 kV/m	-	-	20 kV/m	25 kV/m	8.3 kV/m
Contact Current	1.0 mA	-	-	1.5 mA	1.0 mA	1.0 mA
General Public						
Magnetic Field	0.083 mT (830 mG)	83.3 µT (833 mG)	0.083 mT (830 mG)	0.904 mT (9,040 mG)	-	0.083 mT (830 mG)
Electric Field	4.2 kV/m	4.2 kV/m	4.2 kV/m	5 kV/m ⁴	-	4.2 kV/m
Contact Current	0.5 mA	-	-	0.5 mA	0.5 mA	0.5 mA

0.1 mT = 1G or 1,000 mG

1 microTesla (µT) = 10 milliGauss (mG)

¹ ICNIRP = International Commission on Nonionizing Radiation Protection. Countries that have adopted the ICNIRP standards include Belgium, The Netherlands, Germany, Sweden, France, Spain, Switzerland, Czech Republic, South Africa, Japan, United Kingdom, Australia, and New Zealand (WHO, 2004).

² EC = European Commission. Adopted ICNIRP (1998) guidelines but applied subject to: "This recommendation has as its objective the protection of the health of the public and it therefore applies, in particular, to relevant areas where members of the public spend significant time in relation to the effects covered by this recommendation" (p. 60, EC, 1999)

³ SSK = Swedish Commission on Radiological Protection. Adopted ICNIRP (1998) guidelines

⁴ ICES = International Commission on Electromagnetic Safety. Within power line rights-of-way, the MPE for the general public is 10 kV/m under normal load conditions.

⁵ ACGIH = American Conference of Governmental Industrial Hygienists

⁶ NRPB = National Radiological Protection Board of Great Britain. Adopted ICNIRP (1998) guidelines

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