Bonneville Power Administration

Final Environmental Impact Statement

THE EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM

U.S. Department of Energy

August 1984

Volume II

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DOE/EIS-095F
DOE/BP - 264

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INTRODUCTION

I. INTRODUCTION

ANALYSIS AND REVIEW

The BPA Expanded Residential Weatherization Program Draft Environmental Impact Statement (EIS), as well as a Summary of the EIS, was distributed for public review in September 1983. Approximately 2500 copies of the Draft EIS and 1500 copies of the Summary were sent to interested citizens and public agencies, including several foreign countries. BPA solicited comments until November 14, 1983. A total of 77 interested citizens, federal and state agencies, and private organizations submitted written comments on the Draft EIS. Seventy-one other individuals representing themselves or acting as spokespersons for various organizations asked questions and gave testimony at one of the seven BPA sponsored public comment meetings. The public meetings were held in Portland and Eugene, Oregon; Seattle, Richland, and Spokane, Washington; Missoula, Montana; and Burley, Idaho. The content of the oral and written statements varied from general to highly technical comments about the proposed BPA program expansion.

All comments were reviewed and considered. Comments that present new data, question facts or analysis, or raise questions or issues bearing directly on the alternatives or the environmental analysis are responded to in this Final EIS Volume. All of the letters received are reproduced in Chapter III. Also included are comments received by telephone during the comment period. The transcripts of the public meetings are not reproduced in the Final EIS but are available on written request to the Environmental Manager (see cover sheet, Volume 1).

The comments and responses are arranged by topic in Chapter II. There are ten topics:

- Environmental Process
- Decision Recommendations
- Indoor/Outdoor Air Quality
- Health Effects
- Energy
- Cost
- Program
- Assumptions and Format of EIS
- Mitigations
- Other Issues, Comments, and Clarifications.

A summary of what each topic encompasses is provided at the beginning of each topic section. Where several comments are related, they are grouped together and summarized as appropriate. Each comment is followed by a reference to the corresponding comment number(s), and then the response. Comment numbers refer to the letters in Chapter III.

The comment numbers were assigned by first giving each letter an index number (see next page, Listing of Comment Letters Received). The index number was coupled with another number that represented the individual comments within each letter (e.g., 1-1, 1-2, 2-1, etc.). This allows the reader to turn to Chapter III to identify the commentors and their specific comments.

LISTING OF COMMENT LETTERS RECEIVED

(WP-SJ-29190)

For any particularly long comment within an individual letter, the key idea of the statement is marked and numbered. When developing the response, consideration was given to both the key idea and the remaining background material. The comments have been paraphrased and, therefore, may appear to be different than originally written.

Comments raised during the public meetings are referenced by initials: Seattle (SE), Richland (RI), Spokane (SP), Eugene (EU), Portland (PO), Missoula (MS), and Burley (BR).

COMMENTS AND RESPONSES

II. COMMENT AND RESPONSES

ENVIRONMENTAL PROCESS

There was an interest in why BPA was doing an EIS and questions about the need for one on the Residential Weatherization Program. In addition, comments were made on BPA's ability to conduct analysis in the area of indoor air pollution and weatherization and on whether BPA had a responsibility to do such work.

Comment

Why is BPA evaluating a "worst case" situation in the EIS when the data are so uncertain?

Indoor air quality work such as that in the EIS is not an appropriate function for BPA.

Why is BPA even preparing an EIS when other federal agencies doing similar activities have not?

Believes uncertainty in data makes evaluation between alternatives difficult.

Corresponding comments: 28-1, 30-1, 48-3, 48-4, 57-1, 57-8, 65-1.

Response

As a federal agency, BPA is required by the National Environmental Policy Act of 1969 (NEPA) to examine the effects of its actions on the human environment. Furthermore, under NEPA, any action considered a major federal action significantly affecting the environment requires the preparation of an EIS. The proposed expansion of the present BPA weatherization program has been determined to be a major action that may have significant adverse effects, thus necessitating an EIS.

Preliminary analysis showed that with a full weatherization program, adverse health consequences might occur when air infiltration in a residence is reduced (Revised Environmental Assessment for BPA Regionwide Weatherization Program, Sept. 1981). NEPA requires BPA to analyze the environmental consequences of its actions and take steps to avoid significant impacts. Individual homeowners are free to do whatever they choose to improve indoor air quality, but because BPA is financing the weatherization measures, it has an obligation under NEPA to analyze the health consequences.

There is very little data available about indoor air quality in Northwest homes. Where data is lacking, NEPA regulations require that analysis of environmental impacts be based on reasonable worst-case assumptions (40 CFR 1502.22). The assumptions in the Draft EIS provide a worst case, which gives a reasonable indication of potential indoor air quality problems and the probability of such an occurrence based on present knowledge. In addition, BPA is obligated to try to obtain information, even if it is not readily available, that has a bearing on the decision to be made unless the overall cost of

obtaining it is exorbitant or the means to obtain it do not exist. This is the reason BPA is conducting research in indoor air quality.

This environmental information is available to public officials and citizens before decisions are made and before actions are taken. Accurate scientific analysis, expert comments, and public scrutiny are essential to the decision-making process. Based on information available to the BPA Administrator, the need for the proposed action will be weighed against the risk and severity of possible adverse impacts if the action were taken in the face of uncertainty.

Other federal programs are subject to the requirements of NEPA in the same way as BPA's programs. It is up to the individual program administrators to decide how to design their programs, based on the information available to them and the perceived significance of the impacts. Nonfederal programs are not subject to NEPA, but may be affected by local environmental requirements.

Comment

BPA should consider water heaters in their evaluation.

Considering the information provided in the EIS, what is the BPA doing about new homes?

Corresponding comments: 5-9, 28-2.

Response

BPA has several different energy conservation programs being planned or already underway. The installation of water heater wraps was the subject of environmental review under another program. Based on the review, BPA found water heater wraps to be clearly without any significant environmental effects. The new homes energy conservation program will be the subject of a separate environmental evaluation. When the environmental review is conducted, information obtained from this Residential Weatherization EIS will be incorporated as appropriate.

The scope of this EIS was limited to the measures identified as possibly having significant environmental effects in the Revised EA for BPA Proposed Regionwide Weatherization Program (Sept. 1981). Both the water heater wrap and new homes program are beyond the scope of this EIS.

Comment

The organizational order of the Draft EIS tends to obscure and confuse rather than provide information clearly. Chapter 2 of the Draft EIS only summarizes pollutant and health effects without providing a basis or context to assess the validity of the health effects.

Corresponding comments: 49-1, 49-2.

Response

The format for the EIS is set by the Council on Environmental Quality (CEQ) regulations for implementing the procedural requirements of the National Environmental Policy Act (40 CFR 1502.10). This format was established to encourage good analysis and clear presentation of the alternatives. Changes in the format can be made if there is a compelling reason to do so. BPA had no such reason and chose to follow the format as directed.

Chapter 2 in the Draft EIS was designed only to summarize the important effects so that a clear choice among alternatives could be made, and Chapter 4 was to be the scientific and analytic basis for that discussion (40 CFR 1502). The appendixes provide the technical background used in Chapter 4. Chapters 2 and 4 were not intended to duplicate one another but instead complement each other. The Draft EIS tried to accomplish this.

Comment

In view of the magnitude of the corrections necessary, BPA should revise the Draft EIS and resubmit it for public review.

The health hazards of house-tightening should be updated and made available to the public.

Corresponding comments: 52-5, 60-2.

Response

The changes necessary to respond to the comments received were not substantial enough to create the need to reissue another Draft EIS (40 CFR 1502.9). Meaningful analysis was possible for the alternatives identified and every effort was made to present and discuss the major points of view on the environmental effects. Ongoing research in the area of indoor air pollution is being conducted by BPA. Any significant new information discovered in this area will be presented in a supplementary EIS if it is relevant to the environmental concerns and has a bearing on the BPA weatherization activity. This is in accordance with the CEQ regulation.

Comment

We are troubled by the effect of BPA's declining to identify a preferred alternative in the Draft EIS.

The reports failed to indicate what mitigation would be undertaken if the Proposed Action is adopted.

Corresponding comments: 73-16, 76-2.

Response

At the time of the release of the Draft EIS, BPA did not have a preferred alternative. It was important to BPA, based on the controversy and number of uncertainties surrounding the issue of indoor air quality and human health,

that the public be given an opportunity to review and comment on our environmental analysis on the weatherization program before selecting a preferred alternative. Seven public meetings around the BPA service area and a written comment period were provided. The numerous comments received are reflected in this comment and response document. This Final EIS has identified BPA's Preferred Alternative based on public comment, technical and economic considerations, and what would be prudent agency action under the current circumstances. The Proposed Action represents the majority viewpoint of the public.

DECISION RECOMMENDATIONS

Most of the comment letters received and oral testimony given at the public meetings provide specific recommendations regarding the expansion of the current weatherization program and the BPA-Preferred Alternative. In some cases, other alternatives to the Proposed Action that were not evaluated in detail in the Draft EIS were proposed.

Comment

Favors Proposed Action with individual choice.

Favors Proposed Action with Mitigations-By-Action.

Favors Proposed Action as stated.

Favors the No-Action Alternative.

Favors the Proposed Action with all three Mitigations-By-Action measures.

Corresponding comments: 9-1, 10-1, 13-1, 17-1, 21-1, 28-4, 29-1, 29-2, 30-2, 31-2, 32-1, 36-1, 37-1, 37-7, 38-2, 40-1, 42-1, 42-3, 42-7, 43-1, 44-2, 44-4, 45-1, 47-1, 48-1, 50-1, 51-2, 53-1, 55-1, 56-4, 57-3, 57-4, 59-2, 60-1, 60-3, 62-1, 63-1, 66-4, 67-3, 73-2, 76-3, MS, SP, BR, EU, PO, SE.

Response

Twenty-one writers of the comment letters indicated that they favor the Proposed Action, with BPA providing various Mitigation-By-Action measures. Fifteen comment letters indicated that BPA should remove all restrictions regarding tightening measures, but should provide adequate information to allow homeowners to make their own choice regarding participation in the program. Eight of the letters stated the Proposed Action, as presented, was the best course of action for the region. Three letters indicated the No-Action Alternative should be adopted, as too little information on health effects is known. Finally, four letters indicated that all three Mitigation-By-Action measures should be adopted in conjunction with selecting the Proposed Action.

Comment

Believe the program should be made available to all utility customers.

Corresponding comment: 39-2.

Response

Under the Regional Act, BPA is required to offer weatherization measures, including tightening measures, to those residences with permanently installed electric space heating. The date for which this criterion applies is April 15, 1983.

The basis for this criterion is two-fold. First, establishment of a date eliminates the possibility of fuel switching. Large and rapid occurrence of fuel switching to electric space heating would damage the existing regional market for gas companies. Second, current and future BPA customers will share the expense of providing weatherization measures to the regional housing stock. However, residences with the highest use of electricity, those with electric space heating, will pay the largest percentage of increases due to conservation cost. BPA feels these homeowners should be the ones eligible to participate in the Residential Weatherization Program, since the largest savings will occur in these residences and be the most cost-effective.

Comment

BPA should implement a separate weatherization program for those residences currently excluded emphasizing delivery of services through non-utility organizations.

Corresponding comment: 40-3.

Response

Creating or implementing a separate program will increase program cost and create confusion among the region's homeowners. Currently, all electrically heated residences are eligible to receive weatherization measures (e.g. ceiling and floor insulation, unfinished wall insulation, duct insulation, clock thermostats, and dehumidifers). Only those residences free of major sources of indoor air pollution are eligible for tightening measures (e.g., caulking, storm windows, etc.). The audit performed by the utility includes the consideration of both weatherization and tightening measures. If a residence is currently ineligible to receive tightening measures, only the weatherization measures are offered. If the program is expanded, these residences may not require reauditing and will be offered tightening measures.

Nothing prevents BPA from offering the expanded program through a non-utility organization. However, BPA wants to have a single weatherization program, as proposed, which can cover all eligible customers.

Comment

Homes with wood heating should only be provided with double pane windows and not with air-to-air heat exchangers.

Corresponding comment: 47-3.

Response

Although energy savings would occur due to reduced heat loss through the windows, BPA feels the net energy savings would not make this option attractive to most homeowners. This is because the cost for double pane windows, including installation, would be high, and may in some cases require structural modifications to the residences. BPA feels that providing storm windows that reduce the air exchange rate in the residences and reduce heat loss through the window is an equally attractive and least costly measure to offer.

Comment

Tightening can be overdone, believe residences should not be made airtight.

Corresponding comment: 46-1.

Response

Indeed, tightening could be overdone, although it is very unlikely and not the intent of the Expanded Weatherization Program. Rather, the program will attempt only to reduce the natural air exchange rate in the residences and thereby reduce their electrical space heating needs. The maximum reduction in air exchange is estimated to be 30.7% from the normal rate. As shown in Appendix A, with all measures installed, a reduction of 30.7% would still provide an estimated 0.533 air exchanges per hour in a single-family detached residence. This amount provides adequate ventilation for the occupants.

Comment

Homes with likely pollutant sources should be excluded from tightening, unless the air quality is tested and pollutants are found present only at low levels.

Corresponding comment: 54-1.

Response

Implementing this type of option would be difficult because

- Program cost would increase dramatically.
- Monitoring all possible pollutants would be difficult, as adequate monitors for some pollutants have yet to be developed.
- Determining if representative concentrations were obtained during monitoring would be impossible because many pollutants in residences come from many sources at various emission rates.

The long-term health effects from a majority of the pollutants are unknown, making it hard to determine if a problem exists.

BPA, under its Preferred Alternative, proposes to allow the homeowner to decide if a residence should be monitored for the pollutant radon. If the measured levels are above an Action Level established by BPA, the homeowner will be offered an air-to-air heat exchanger to increase the air exchange rate in the residence back to the pre-weatherization level. A complete description of this alternative and the impacts associated within it can be found in Sections 2.19, 4.1.5,and 4.2.5 of Volume 1.

Comment

Acceptable levels of health impacts should be established.

Corresponding comment: 61-3.

Response

No acceptable levels of health effects have been established in this country. However, several organizations have suggested standards for various pollutants. These recommendations are reviewed in detail in Appendix N. Under the Preferred Alternative, BPA is considering establishing a standard for radon and is calling it an Action Level. If the measured radon concentration in the residence is above this level, then the homeowner will be eligible for an additional financial incentive that could be put toward the purchase of an air-to-air heat exchanger. (Details of radon monitoring are discussed in Sections 2.1.3 and 4.2.3, and the BPA's Preferred Alternative is discussed in Sections 2.1.9 and 4.2.5.

Comment

Believes information on health impacts and suitable mitigation techniques be provided to the public whether or not the program is expanded.

Corresponding comments: 61-4, 70-4.

Response

Homeowners participating in the present program receive a booklet describing various aspects of indoor air quality, including potential sources, how to detect an air quality problem within the residence, and possible mitigation measures. This booklet is provided to the homeowner whether or not tightening measures are installed. For those homeowners who have not participated in the present program but who anticipate participating in the expanded program, the same type of information will be available from their local utility.

Numerous reports are available through the federal and state agencies, research laboratories, magazine articles, and other publications. This information can supplement information given by BPA. In addition, a very complete bibliography is provided in the Final EIS. Additional copies of the Final EIS can be found in various university and college libraries throughout the region and are also available on written request to the BPA Environmental Manager.

Comment

Believes if a problem exists, an adequate mitigation technique exists (i.e. air-to-air heat exchangers).

Corresponding comments: 68-1, 69-1.

Response

BPA also believes that an adequate mitigation measure exists. However, it would not be cost-effective to provide each residence in the program with an air-to-air heat exchanger when the energy savings obtained from the tightening measures are considered. Instead, they should be provided only to those residences that have an indoor air quality problem. To determine this, monitoring of air pollutants is required.

Under the BPA Preferred Alternative, if a homeowner decides to have his residence monitored and the measured level of radon exceeds an Action Level established by BPA, then the homeowner will be offered an air-to-air heat exchanger. BPA will pay some percentage of the average regional cost for purchasing and installing the device. The homeowner can also elect not to have his residence monitored, but still receive tightening measures available under the expanded program.

Comment

Believe conditional weatherization as a mitigation with established criteria should be considered.

Corresponding comment: 77-1.

Response

BPA believes that conditional weatherization would be costly, create confusion among utilities, and perpetuate the conflict with existing state weatherization programs. In reality, BPA would have difficulty establishing criteria acceptable to all the utilities currently involved in the Residential Weatherization Program.

INDOOR/OUTDOOR AIR QUALITY

Some of the public letters expressed a belief that specific minimum air quality levels or air exchange rate standards should be established to eliminate the need to exclude specific types of residences. Other commenters believe mold and moisture should also be considered as indoor pollutants, since tightening measures will increase their levels within the residences.

Comment

Believe that mold and moisture is an indoor pollutant.

Corresponding comments: 26-1, 34-3, 54-5, 66-3, EU.

Response

Information on mold and moisture, including sources and potential health effects, have been included in the Final EIS. Section 3.1 of Volume 1 provides a description of sources and existing conditions, while Section 3.2 discusses potential health effects. Only qualitative discussions are included, as little information exists regarding the quantitative level of health effects resulting from mold and moisture.

Comment

Believe that BPA should establish a minimum air exchange rate, or at least some guidelines.

Believe that for each house the air exchange rate should be measured, and the minimum air exchange rate requiring an air-to-air heat exchanger be determined, and the house tightened to that level.

Corresponding comments: 12-1, 34-1, 40-5,73-14, SP, MS.

Response

Establishing a minimum air exchange rate, or even some guidelines for residences would be difficult, if not impossible because of the large variation in potential sources and emission rates of indoor pollution that could occur in a residence. For example, a minimum air exchange rate for one residence may produce acceptable air quality within the residence, while for another with large pollutant sources, unacceptable air quality could occur using the same criteria. Establishment of a minimum air exchange rate would also be administratively and technically difficult and would increase program cost markedly. BPA believes it is more appropriate either to eliminate those residences with known large pollution sources, or provide measures to return the air exchange rate back to the original levels after tightening measures have been installed. The latter would create a situation where no additional health effects are expected.

Comment

The Draft EIS should not reference the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) standard 62-1981.

Corresponding comment: 1-1.

Response

The acceptable levels of air quality contained in ASHRAE 62-1981 were referenced only as a pending guideline that could be later adopted in various building codes. It is recognized that the ASHRAE standard is controversial, and any reference to this standard does not condone its use.

Comment

Believe homes will not be as tight as estimated, and gas appliances will be ventilated in almost all cases.

Feel a more detailed description of the combustion process is desired.

Believe the methodology used to estimate pollutant concentrations is overly simplistic and more precise information could be obtained.

Feel it is misleading to indicate that BaP is the sole carcinogen of RSP.

Feel the values in Table 3.8 for NO2 and CO are high for rural areas of the region.

Feel that assumptions regarding calculation of the emission rates should be given.

Is the data contained in Table A.10 representative of the Pacific Northwest region?

Believe a distribution function should be used instead of averages.

How many cities obtain their water from wells? Would the same principles apply to those cities that apply to individuals?

Corresponding comments: 32-3, 41-2, 41-4, 41-22, 41-35, 49-21, 49-26, 49-29, 57-11, 62-2, RI.

Response

The information used in establishing the baseline air exchange rate in various residence types in the region is based on limited field studies completed in the region and information obtained in other parts of the country. Indeed, it is possible that average air exchange rates for the various residence types could be higher or lower. If they are higher, the estimated baseline health effects would be lower, but the incremental health effects from the Proposed Action would be higher. The data used in the analyses were the best available

and, therefore, are the basis for estimating health effects that would occur as a result of the Proposed Action or any other alternative.

A basic requirement of the CEQ guidelines is that the EIS address a reasonable estimate of the worst-case conditions when information is uncertain or lacking (see Environmental Process section in this volume). In response to this requirement, the estimated levels of oxides of nitrogen were based on the assumption that all gas appliances were unvented. In reality, most gas stoves and ovens are vented, as hoods are required under most building codes. However, most space heaters, fueled either by kerosene or propane, are not vented.

Appendix A provides a detailed description of assumptions regarding emission rates, duration of the emission, and methodology used in estimating air quality levels. In most cases, emissions would occur either from a single device (e.g. wood stove) or from a uniform source (e.g. the soil below or under the foundation of the residence). The only case where specific information could be expanded is emissions from gas stoves. For this source, one burner was assumed to be operating a total of 2 hours daily, while the oven was assumed to be operating for 1 hour per day. The data in this appendix are considered to be representative of the region.

The methodology, or approach, used to estimate pollutant concentrations is simplistic because information on average concentrations is required to estimate the risk of cancer. More precise approaches are appropriate to determine the acute concentration levels that may occur for only short periods of time. These approaches require more precise information regarding emission rates, use cycles, and other distribution functions, to provide meaningful results. Since such information is not available for the various sources and residence types considered, a simplistic approach was used. All pollutant sources were assumed to occur within the residence so that a reasonable estimate of the worst possible conditions be made for determining possible individual health effects. For those pollutants where risk factors are known, relating estimated concentrations to potential morbidity using the worst possible concentration would have yielded unreasonable results. Instead, the probability of occurrence of various combinations of emission sources was taken into account (See Appendix I).

Our regional health effects analysis assumed BaP was the substance in RSP that could cause cancer. In reality, RSP contains many carcinogens that are known or believed to cause cancer. However, few data are available on either the emission rate of these organic compounds or a risk factor that would allow us to relate exposure to the occurrence of cancer. Therefore, BaP was considered to be the sole carcinogen from RSP.

The data used to represent ambient air quality levels in the region are based on reported Environmental Protection Agency (EPA) data acquired at various monitoring locations in the region. Since these are the best available data, they are considered representative of the region. Since some of the monitoring locations are near major cities that have problems meeting current EPA ambient air quality standards, the reported values may not be representative of rural areas of the region. However, since ambient levels are assumed to be the same for both the baseline and Proposed Action cases, and health effects are based on incremental increases in indoor air quality, the value of the ambient levels

is not significant. The purpose in providing the data was to show that in some cases the indoor levels may be larger than levels encountered outside the residences.

One of the emission sources considered was radon emitted from well water use within the residences. If the water is drawn from a deep well, the radon contained within the water will be emitted to the atmosphere as the result of normal water use (i.e. flushing the toilet and taking a shower). The normal procedure to reduce the radon concentration in water is to aerate the water prior to use. This may or may not be done with a private well. For public water supplies, however, aeration is done if the radon concentration within the water is expected to be high. Public water facilities are continually monitored by the state to insure that EPA safe-drinking water standards are met. If a city water supply is from a deep well and is regularly monitored by the state, then residences connected to that supply are not considered to have well water, and the exclusion criterion does not apply.

Comment

Believe using the workplace or other standards as the basis for pollutant exposure of the general population is incorrect.

Corresponding comments: 49-9, 49-17, 49-34, 65-2.

Response

It was not the intent of the EIS to use workplace or other standards as the basis for pollutant exposure of the general population. These standards were only used as a point of reference, so readers or homeowners could judge if estimated concentration levels were acceptable to them. A discussion of standards, both national and international, is provided in Appendix N.

Comment

Believe formaldehyde levels in residences should be measured and values should not exceed 0.1 ppm.

Corresponding comment: 54-2, 54-3.

Response

Measurement of formaldehyde in all residences would increase the program cost markedly. Even if the concentration levels were above an established Action Level, no commercially available technology exists to reduce formaldehyde emissions. Only increased air exchange by the use of air-to-air heat exchangers could be used, and these devices would return the air exchange rate to its original level. BPA also feels the regional population as a whole will only be subjected to small additional risk because observable health effects regarding increased formaldehyde concentrations are lacking.

Comment

Believe that BPA should adopt the practices of foreign countries to meet indoor air quality standards after a residence has been constructed.

Corresponding comments: PO, SE.

Response

These air quality standards, reviewed in Appendix N, aid BPA in its decisions regarding formulation of the total conservation program for all building types. The EIS deals only with retrofitting weatherization and tightening measures in existing residences. Such a proposal would be the subject of the BPA New Homes Program.

Comment

Believe UFFI is not the largest source of formaldehyde in a residence.

Corresponding comment: 49-23.

Response

In some residences the largest source of formaldehyde may be wood products and carpets using urea resins as a bonding agent, if UFFI had not been installed recently. However, considering the requirement of a reasonable estimate of the worst possible conditions, it was assumed that UFFI had been recently installed as a weatherization measurement to estimate the maximum possible indoor concentration. Using the best available information on formaldehyde emission from UFFI, it becomes the largest source of formaldehyde in the residence.

Comment

Don't believe that nitric oxide reacts quickly to form nitrogen dioxide within residences.

Corresponding comments: 49-24, 52-4.

Response

Indeed nitric oxide will not react quickly to form nitrogen dioxide within the residence. Only emissions of nitrogen dioxide from gas stoves and space heaters are considered in estimating health effects from that pollutant.

Comment

Believe the concentration levels established for requiring air-to-air heat exchangers under Mitigation-By-Action 1 and 3 (radon and formaldehyde monitoring) are without merit.

Corresponding comments: 42-2, 42-4.

Response

The Action Levels chosen from formaldehyde and radon monitoring were based on levels used by either state or federal agencies for mitigation response to potential or perceived health effects. For example, the Action Level for formaldehyde, above which air-to-air heat exchangers would be required (0.4 ppm), is based on a standard proposed by the state of Wisconsin. The Action Level chosen for radon corresponds to an EPA standard for residences constructed on reclaimed lands containing uranium mill trailings. These levels were not meant to be absolute values, but levels used for discussion purposes to show how setting levels could affect the program. Appendix N provides a review of standards relating to indoor air quality.

Comment

The Draft EIS fails to recognize the different types of plywood used in manufacturing, and that certain types of resins used would not pose an air quality problem.

Corresponding comments: 71-1, 71-2.

Response

In the Draft EIS it was not clearly stated that all plywood and particle board contain urea resins. Information provided in the comment letters indicates that non-urea resins are widely used. Therefore, in Section 3.1 of Volume 1, plywood and particle board with urea resins are assumed to be located within the residence. Some plywood and particle board that use a phenal-urea formaldehyde adhesive have little, if any, formaldehyde emissions (see Section 3.1, Volume 1).

Comment

Note that the value for radon in well water is a factor of two greater than the U.S. average.

Corresponding comment: 76-1.

Response

Little information exists on the average concentration of radon in well water. A global average might well be modeled from average radionuclide contents of soil and estimated ground water volumes to be about one-half the value chosen for the EIS. However, local and regional averages may be very different. No scientific basis exists to assert that the value for radon in well water is a factor of two greater than the U.S. average. In the EIS, a value for radon in non-well water was based on an early estimated average value for the U.S. The value used for radon in well water was assumed to be a factor of 2.5 times that used for non-well water. More current estimates yield lower U.S. average concentrations; thus, the risk estimates based on the higher values represent a worst-case analysis.

Comment

Think the EIS should address the problem of how much air-to-air heat exchangers could help those living in mobile homes.

Corresponding comment: SE.

Response

Section 2.11 of Volume 1 points out that if formaldehyde monitoring were included in the program, all residences, including mobile homes, with formaldehyde concentrations above the stated Action Level of 0.4 ppm would receive air-to-air heat exchangers. These devices would return the air exchange rate in the residence after tightening measures were installed to the level that existed prior to installation. A residence with an air quality problem prior to installation would most likely still have one afterwards. The purpose of providing the air-to-air heat exchanger is to insure that no additional impacts occur.

Air-to-air heat exchangers will probably help, but it is not the purpose of this EIS to examine the effectiveness of air-to-air heat exchangers in correcting preexisting problems.

Comment

To effectively deal with potential health impacts, BPA should establish indoor air quality standards.

Corresponding comment: 40-2.

Response

Establishing indoor air quality standards is difficult because of the lack of acceptable or conclusive information on health effects related to indoor air quality and the levels at which various health effects occur. Nevertheless, under the BPA Preferred Alternative an Action Level will be established for radon concentration measured within a residence. If the annual measured concentration of radon exceeds the Action Level, then the homeowner will be offered an air-to-air heat exchanger with BPA paying some portion of the purchase price and installation cost. A discussion of additional information regarding pollutant standards can be found in Appendixes D and N.

Comment

The discussion of health effects would be aided by a discussion of the impact of the different levels of air changes per hour.

Corresponding comment: 55-8.

Response

An infinite number of air exchange rates occur in the residences throughout the region. Unfortunately, only a small sample of data is available; therefore, it

would be impossible to present a complete discussion of the health effects based on different levels of air changes per hour. The EIS does, however, provide a mechanism whereby a reader can compute concentrations for a residence (Appendix A) and obtain some information regarding health effects that might result (Appendixes D,E,F,H, and I).

HEALTH EFFECTS

Some of the comments received express a need for information regarding chronic effects from indoor pollutant levels. Other commenters feel the Draft EIS did not evaluate the relationship between price-induced conservation efforts and health effects, or the positive health effects that may result from a residential weatherization program. Still others had questions regarding the methodology and assumptions used in estimating the health effects.

Comments

Tightening would reduce the amount of polluted air from the outside entering a residence.

Nothing was done to show the positive health effects of the weatherization program.

Corresponding comments: 38-12, EU.

Response

Indeed, installation of tightening measures will reduce the rate at which the outside, or ambient, air is drawn into the residences. This is a benefit to occupants during periods of high-pollutant concentrations in the ambient air, which normally occur when atmospheric inversions are present. Installation of tightening measures on a regional basis is also thought by some to reduce the amount of wood burned within a residence, thus reducing amounts of pollutants emitted to the outside air. BPA believes the same amount would be burned, because most homeowners with woodstoves and fireplaces would burn nearly the same amount of wood anyway, and the heat emitted from a wood-burning fire would only supply a small portion of the heat requirement for a residence (see Appendix O). Other positive effects have also been included in the Final EIS in Section 3.5 of Volume 1.

Implementation of a weatherization program also reduces the need for construction of thermal generation facilities. If those plants are not constructed, positive health effects do occur (see Section 4.2.1 on thermal generation in Volume 1).

Comments

What is BPA's liability regarding increased use of unvented forms of heat in response to price increases due to conservation cost, and has BPA considered how its liability is affected by disclosing this information?

Consideration should be given to health effects expected from tightening measures installed with and without the BPA program.

Corresponding comments: 5-6, 42-8, 56-6.

Response

The purpose of preparing this EIS and issue alerts, and of holding public meetings, is to provide the public with the best available information regarding reduced indoor air quality levels that may occur after the natural air exchange rate within a residence is reduced after the installation of tightening measures. If residents install tightening measures outside the BPA program, they would experience the effects of indoor air quality without the benefit of knowledge provided in the BPA brochure on indoor air quality, its effects, and possible mitigations. It would be impossible to prohibit and enforce the use of some device that pollutes the air after a residence has been tightened. Existing or future homeowners could easily install a pollutant source within the residence.

For an answer to the question of price increases from conservation activities, the reader should refer to the BPA Rate EIS that is available from the BPA Environmental Manager. As a federal agency, the Bonneville Power Administration complies with the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. §§ 4321 et seq. (1982). Compliance with NEPA requires full disclosure of environmental effects, even though such disclosure may be used subsequently as evidence in a court of law. The possibility of liability, (e.g., tort liability) is not a limiting factor in disclosing effects under NEPA.

A federal agency may withhold disclosure of environmental effects in one circumstance -- where considerations of national security warrant confidentiality [Weinberger v. Catholic Action of Hawaii, 454 U.S. 139, 144 (1981)]. (The U.S. Navy need not disclose in a public EIS circumstances of possible nuclear weapons storage.) That circumstance does not apply here. BPA will disclose and discuss the risks of indoor air pollution to the fullest extent possible.

Comment

Health effects data and methodology raise more questions than they answer.

Treatment of health effects justification is inconsistent.

Question the use of Pike and Henderson's model in determining the impact associated with BaP concentration levels.

Question the assumption of considering the unattached fraction of radon daughters the same for the workplace as within residences, which oversimplifies the assessment of health effects from exposure to radon daughters in residences.

Why was an exposure period of 85 years used for radon risk estimates?

Believe appendix on health effects of oxides of nitrogen is dated.

Isn't the effect of cigarette smoking a nonlinear relationship to a strong degree?

Would like to note that both attached and unattached radon daughters can enter the lung.

The Draft EIS takes an inconsistent position with respect to the existence of threshold for health effects of indoor air pollution.

The Draft EIS does not address synergistic effects of air pollutants.

BPA has assumed a linear relationship between health risks and pollutant concentrations that indicates no concentration thresholds for pollutants exist. Because little information on concentration thresholds is available, the health effects presented in the EIS have considerable uncertainty associated with them.

The model used for risk estimates of indoor exposure to radon (Harley and Pasternack) is not scientifically sound.

Corresponding comments: 37-4, 41-19, 41-59, 41-60, 41-63, 41-65, 49-6, 49-10, 49-16, 58-1, 62-13, 73-5, 77-2, 77-5, SE.

Response

The methodology used to estimate the regional health effects resulting from radon, formaldehyde, and BaP is based on the best available information at the time the Draft EIS was prepared. As noted in the summary, some uncertainty is associated with the absolute numbers that were obtained. However, the values with the least uncertainty are those for radon. This is because a large amount of research has been directed toward health effects resulting from radon exposure.

The regional health effect estimates for radon, formaldehyde, and BaP assume that no threshold levels for risk exist for pollutants (see Section 3.2 of Volume 1). This approach was used so that a reasonable estimate of the worst possible conditions could be obtained.

At the time the Draft EIS was prepared, the risk factors used to relate concentration levels to health effects were the best available information. Since that time, additional information has been made available regarding formaldehyde. This information has been reviewed and is addressed in Section 3.2. The BaP risk factor was used because risk factors for other organic compounds emitted during incomplete combustion have yet to be developed.

The risk factors were used to estimate lifetime health effects. Comparison of that information to normal mortality statistics requires the lifetime risk be converted to annual risk. Since the risk factor for radon was based on data for a person up to 85 years, the lifetime health effect value in the Draft EIS was mistakenly divided by 85 to obtain an annual value. In the Final EIS a different value was used. Since lung cancer normally appears in people 40 or older, the annual value is then obtained by dividing the lifetime value by 45 (85 yr - 40 yr = 45 yr). The value of 45 years could be considered to be the time period during which lung cancer would be expected to appear. For BaP a similar approach was used, except that the risk factor was based on average

life expectancy, or 70 years. The annual risk of lung cancer due to BaP exposure was obtained by dividing the lifetime value by 30 years (70 yr - 40 yr = 30 yr). Exposure to increased formaldehyde levels may cause nasal cancer. Since this can occur at any age, the annual risk is obtained by dividing the lifetime risk by 70 years.

The estimated health effects are based on individual pollutant exposures. The estimated radon health effects in the EIS assume a certain fraction of attached and unattached radon daughters that was not identical for environmental and occupational exposure. We did not say that unattached daughters cannot enter the lung. Since we would consider the fraction to be essentially the same before and after installation of tightening measures, the value assumed is not important because incremental health effects are presented.

Sufficient data are not available to estimate health effects due to the synergistic effects of various pollutant levels (see Section 3.2).

Information on health effects resulting from nitrogen dioxide exposure was considered the best available at the time the draft was written. Since that time other information has been made available for review. Review of that new information did not indicate the need for the information contained in the Draft EIS to be changed in the Final EIS.

The model used to estimate risk associated with indoor radon exposure is consistent with the approach recommended by the National Council for Radiation Protection (NCRP). Since NCRP is a recognized worldwide governing body, this approach was considered the most appropriate for this EIS.

Comment

The Draft EIS should distinguish between voluntary and involuntary risk.

Corresponding comments: 3-1, 41-72, 44-3.

Response

Appendix J has been revised to indicate the difference between the different types of risk. The main text also reflects the information provided in Appendix J.

Comment

Risk from radon is ridiculously minimal.

Risk should be expressed in terms of annual occurrences per 100,000 population.

What is the maximum level of cancer risk that would be considered acceptable without mitigation by BPA?

The Draft EIS does not demonstrate a proper understanding of individual, average, and aggregate risk.

The upper value of risk on page D.5 implies that at a formaldehyde concentration of 7.69 $\mu g/m^3$, everyone develops cancer.

Believe the Draft EIS should be revised to include recognition of the uncertainties surrounding the absolute magnitude of the potential health risk resulting from "house tightening" measures.

Corresponding comments: 7-1, 38-3, 38-9, 44-1, 49-15, 49-30, 56-3, EU.

Response

The risks associated with exposure to radon, formaldehyde, and BaP have uncertainties associated with them. Various aspects of uncertainty, including the appropriate risk factor and the estimation of concentration levels, are discussed in the summary section of the EIS in Volume 1. Appendix J, as well as throughout the main EIS text, gives comparisons of the risks associated with radon, BaP, and normal voluntary risks. These risks are now given in terms of annual occurrences per 100,000 exposed persons as suggested by commenters. This allows comparison with standard mortality tables. The health effects analyses in the EIS for radon and BaP exposure assume there is no threshold level for risk. This means that some increase in risk is expected, no matter how small the increase in concentration levels of radon and BaP. However, the comparison of risks provided in Appendix J allows the reader to determine if the individual and cumulative risks associated with radon and BaP are acceptable in terms of other risks an individual chooses or faces.

Because there is an assumed risk associated with increased levels of radon under the Preferred Alternative, BPA may establish an Action Level for radon concentrations above which mitigation measures will be offered to the homeowner. The proposed mitigation measure, at this time, air-to-air heat exchangers, will assure that the original air exchange rate is maintained. Therefore, no additional risk will occur beyond the risk assumed to exist prior to installation of tightening measures.

The information in Appendix D does not indicate that everyone exposed to formaldehyde at or above 7.69 ug per cubic meter will develop cancer. Instead, some individuals may develop nasal cancer at these levels, while a majority of the population will not. This figure is a result of laboratory tests on rats and only indicates the potential for health effects at concentrations above this level.

BPA believes the information provided in the EIS represents the best information regarding individual and cumulative health effects associated with increased concentrations of radon, formaldehyde, and BaP. As pointed out in the summary, the techniques used to estimate health effects have yet to be accepted by the entire scientific community. However, BPA believes the analysis to be based on the best available information. The uncertainty of this approach was recognized and noted in the summary and elsewhere in the main text.

Comment

Risk of developing cancer from radon should be compared to real world activities.

Corresponding comments: 38-5, 48-2.

Response

Appendix J has been revised so that comparison can be more easily made. Information from this appendix has been summarized in Section 4.2.2 in Volume 1.

Comment

The number of cigarettes smoked per day is not an appropriate or recognized unit of risk.

Corresponding comment: 49-5.

Response

To some people it may not be. Appendix J has been revised so the risk from increased radon and BaP concentration can be compared to other daily activities, including smoking.

Comment

Believe that low-level, long-term concentrations of nitrogen dioxide may produce significant health effects (see Section 3.2 of Volume 1).

Corresponding comment: 49-27.

Response

The information available during the preparation of the Draft and Final EIS indicated no such health effects are known or expected.

Comment

A lack of emphasis exists in distinguishing between health effects that may arise under existing conditions, with or without the existing BPA weatherization program or expansion.

Corresponding comment: 70-3.

Response

Information on health effects associated with the No-Action Alternative, which includes the baseline conditions prior to installation of any tightening measures, and on the present BPA Weatherization Program, can be found in Section 4.2.1 of Volume 1. Information regarding health effects associated with the expanded program can be found in Section 4.2.2. Health effects

arising from price-induced conservation activities were not computed directly. For information on price-induced conservation, refer to the BPA Rate EIS. The main focus of the expanded Residential Weatherization EIS was on health effects associated with the expanded program, since this would be associated with BPA's involvement in residential weatherization.

Comment

Difference in breathing rates between workers in the mining industry and for the general public should be accounted for to realistically estimate cumulative exposure.

Corresponding comment: 77-6.

Response

The risk factor for radon is based on the approach used by the National Council for Radiation Protection (NCRP). The factor incorporates breathing rates appropriate for the general public (see Appendix F).

Comment

The EIS does not provide information on chronic effects from indoor pollutants.

Corresponding comments: 34-2, 38-4, 42-11, 49-3, 73-13, SE.

Response

Additional information on chronic health effects due to indoor pollutants has been included and can be found in Volume 1, Section 3.2.

ENERGY

Some of the comments requested clarification of how the energy savings of the proposed action were calculated. Others felt the impacts associated with producing the energy to replace foregone savings were not adequately addressed.

Comment

Parts of the analysis performed in Appendix K were difficult to follow, and energy savings were underestimated.

Corresponding comments: 38-6, 38-7, 41-26, 62-5.

Response

Appendix K has been modified in an attempt to make the presentation clearer. The amount of energy saved is considered to accurately reflect results of the tightening measures and equals BPA's Standard Heat Loss Methodology. The Regional Power Council, using a different procedure, has also estimated the energy savings from regional conservation programs and, if used, different results would be obtained. This difference has been identified in Appendix K.

Comment

Final EIS should provide estimates of potential energy savings that will be permanently lost if the No-Action or Delayed Action Alternatives are implemented.

Corresponding comment: 42-9.

Response

The Final EIS, in Sections 4.3.1 and 4.3.3 of Volume 1, provides an estimate of the potential energy savings if the No-Action or Delayed Action Alternatives are implemented. These are potential energy savings permanently foregone and do not include the impact of price-induced conservation. Little information is available that would allow us to estimate the penetration of price-induced conservation activities that would occur in the absence of a BPA program.

Comment

The Final EIS should address the impacts resulting from central generation facilities that will be needed if all the conservation resources are not acquired.

Corresponding comments: 37-6, 42-10, 55-5, 56-1, 61-2, 62-4, 62-8, 67-1, 70-1, 73-4, 73-12, EU.

Response

The information was expanded to include impacts associated with operating generation facilities. This additional information has been included in Section 4.2.1 of Volume 1 along with impacts associated with mining and transportation activities.

Comment

Table 2.4 on page 2.14 should include Radon-222 emissions from coal plants.

Corresponding comment: 41-11.

Response

At this time, scientifically accepted information could not be obtained on Radon-222 emissions from coal plants.

Comment

The impacts of coal plants are felt by a different set of individuals than those experiencing impacts from weatherization.

Corresponding comment: 57-5.

Response

Impacts from a coal plant affect the population in the immediate area of the plant. The risk of impacts from the construction and operation of a coal plant are considered to be involuntary. The effects of weatherization measures, on the other hand, could be spread over the entire region and are voluntary on the part of the home owner. A resident agreeing to have the measures installed accepts the risk voluntarily. Under either circumstance, the same set of individuals can experience both impacts.

Comment

Price increases do not enlarge the number of eligible participants in conservation.

Corresponding comment: 5-5.

Response

True. The number of eligible participants is considered a constant value for the purpose of the impacts analysis. Any price increase of electricity may increase the number of homeowners who wish to participate in the program. The number of participants is considered the penetration rate. The analysis assumes 85% of the number of homeowners eligible to receive tightening measures will actually have them installed by the time the program is completed. It is not known if this percentage will actually be achieved, as program activities are limited by BPA budgeted funds for each utility.

COST

Of particular importance to various commenters was the cost-effectiveness of the Proposed Action. For comparison, they requested that the cost in the Final EIS be expressed in cost-per-kilowatt-hour and a clear distinction made between this and the cost to be paid by the homeowner for installed weatherization measures. Several commenters also expressed concern that conservation measures provided to residences in the region would have an adverse effect on the electric rates charged by BPA.

Comment

Is it cost-effective to proceed with the Proposed Action and the mitigations?

The EIS should be revised so the estimation of cost-effectiveness can be clearly followed and compared to the Power Council estimates.

Corresponding comments: 28-5, 38-8, 42-6, 61-1, BR.

Response

BPA believes that at the current buy back rate for energy saved, 29.2 cents per kilowatt-hour up to 85% of the total expenditure for installation of weatherization and tightening measures, is cost-effective in comparison to purchasing additional power. A comparison of the total program cost, which includes cost paid by BPA and the homeowner for the Proposed Action, for mitigations to the Proposed Action, and for the other alternatives, is provided in Table 2.1 of Volume 1. A discussion of how these costs were obtained is provided in Appendix L. Appendix L was revised so the reader could compare program cost to similar estimates made by the Power Council.

Comment

All cost should be expressed in terms of cost per megawatt-hour or cost per kilowatt-hour.

Corresponding comments: 37-5, 42-6, 55-7.

Response

The requested changes have been made; see Appendix L and Table 2.1 in Volume 1.

Comment

The Program cost for the Proposed Action seems unrealistically high.

Corresponding comment: 62-11.

Response

The program cost includes cost paid by BPA and by the consumer; therefore, it represents a regional cost. The figures include purchase and installation of the tightening measures. Information in Appendix L provides a breakdown of the

cost estimated to be paid by the consumer and BPA. These costs are based on experience from the pilot program, present program, and information obtained from weatherization contractors within the region.

Comment

The figure of 4 cents per kilowatt-hour underestimates the residential cost of electricity in coming years.

Corresponding comment: 57-6.

Response

This value was used to provide a magnitude of energy savings benefits. It was chosen as a reference number and was not intended to represent any specific cost in future years. Any cost could have been used for comparison.

Comment

Has BPA considered the full cost of the program if it implements a monitoring and mitigation program?

Corresponding comments: RI, MS.

Response

Yes, see information contained in Sections 2.4-2.14, 2.18, and Table 2.1 of Volume 1. The cost of providing the monitoring and mitigation program under the BPA Preferred Alternative is $55.3 to $97.3 million and will increase the total program cost by 6 to 7%.

Comment

Are the BPA wholesale rates or utility retail rates going to be affected by costs associated with providing additional weatherization measures?

Corresponding comments: 31-1, 31-3, 39-1.

Response

The cost for providing conservation measures, both weatherization and tightening, are already included in the latest BPA rate filing. These costs are completely recovered through customer rates. For an in-depth discussion of the conservation cost, review the "BPA Rates EIS".

PROGRAM

Public comments on the Mitigation-By-Exclusion criteria were split, with some people believing that they should be considered and others saying they are too restrictive. These comments were typically contained within letters that also expressed other opinions about various aspects of the current BPA conservation program.

Comment

A Mitigation-By-Exclusion category should be added for residences with attached garages to avoid pollutants that may be released by an automobile, etc.

Corresponding comment: 11-3.

Response

Little information exists on the number of residences in the region with attached garages. Any potential pollutant source within a garage is considered small and infrequent, making a separate Mitigation-By-Exclusion category unwarranted.

Comment

The Mitigation-By-Exclusion category for mobile homes should be modified to include only those homes manufactured after June of 1976 or those that do not meet recently proposed HUD manufactured home construction and safety standards. The latter would regulate formaldehyde emissions from plywood and particle board materials.

Corresponding comments: 20-1, 41-14.

Response

BPA recognized the differences and is considering them in deliberations concerning adding mobile homes to the program. However, because of the confusion this type of restriction would create, BPA decided to include all mobile homes, regardless of age or construction standards. Once the HUD proposed standards are adopted, BPA will examine them and assess their impact on program decisions.

Comment

The EIS shows bias by lumping residences with gas stoves into the category of 'unvented combustion appliances'.

Corresponding comment: 52-1.

Response

Information regarding what percentage of the unvented combustion appliances are gas stoves has been provided in Appendix I. Although the impacts from unvented combustion appliances are given as one value, it is clearly stated that a large

majority of the impacts are due to unvented space heaters (see Section 4.2.1 in Volume 1). Review of information in Appendix A provides additional information on pollutant emissions from gas stoves and space heaters.

Comment

Mitigation-By-Exclusion strategies deny the homeowner the chance to make an informed choice.

Corresponding comments: 14-1, 17-3, 73-3.

Response

True. That is why under BPA's Preferred Alternative, which is being proposed, homeowners will be given the opportunity to make their own choice on weatherization, tightening measures, monitoring, and mitigation.

Comment

Implicit in the EIS is the assumption that BPA or the utility, rather than the homeowner, is responsible both for assessing the health risk for each home and making the decision to tighten the residence.

Corresponding comment: 73-8.

Response

This was not the intent of the EIS. Under the BPA Preferred Alternative, the homeowner will have an important responsibility in deciding risks, participating in the program, deciding whether monitoring is to be done and whether mitigation measures are necessary. More detailed information on this alternative is provided in Section 2.18 of Volume 1.

Comment

Program should be changed so that low income homeowners, or those on a fixed income, be provided tightening measures at no cost.

Corresponding comment: BR.

Response

Low income homeowners can receive weatherization and tightening measures at no cost, up to an incentive level of 37.8 cents per kilowatt-hour. Low income persons have been included in the EIS analysis. These homeowners should contact their utilities or state about this program.

Comment

Several thousand homeowners have already participated in the program, before publication of the Draft EIS, without knowing the health effects that may result.

Corresponding comment: 5-8.

Response

Under the present program, all eligible residences can receive weatherization measures, primarily insulation. Those residences with no major pollutant sources can also receive tightening measures. Residences that receive weatherization measures only (e.g., insulation) will not be subject to any reduced air quality or associated health effects. The estimated adverse health effects under the present program for residences receiving tightening measures are considered insignificant (see Environmental Process Section in this volume). In addition, all residents who participate in BPA's present program receive a booklet that addresses indoor air quality, potential health effects associated with indoor air quality levels, ways to monitor pollutant levels, ways to reduce them, and reference sources where more information is available.

Comment

Would like to receive credit for insulation of residence done prior to the initiation of this program.

Corresponding comment: 13-2.

Response

If the insulation was installed under a pre-existing utility program, then retroactive payments may be available. Otherwise, there are no provisions for credit or reimbursement. Installation of insulation prior to this program expansion has already provided a credit in the form of energy savings and reduced cost.

Comment

Believe storm doors save energy and would not increase indoor air pollutants.

Corresponding comment: 16-1.

Response

Storm doors do save energy, but their effectiveness is relatively short-term, as they bend and lose their seal. For a measure to be included in the program, it must be cost-effective. One aspect of cost-effectiveness is that the measure must save energy for a long period of time. Since the energy savings from storm doors are relatively short-term, they are not considered cost-effective, and they have little effect on air quality within the home. They have been included in the EIS to provide an overall perspective, and will not be available unless proven to be more effective.

Comment

Believe exclusion criteria items like wood stoves may not eliminate air quality problems because a homeowner could add them after tightening measures are carried out.

Corresponding comment: 45-2, 57-2.

Response

True. This issue was raised in the Revised Environmental Assessment for the BPA Regionwide Residential Weatherization Program, dated September 1981. The use or installation of wood stoves after house tightening measures are provided by BPA are beyond our control. Under the BPA Preferred Alternative, these exclusion criteria will be eliminated, and the homeowner will assume the responsibility for the indoor air quality effects of adding a wood stove or taking some other action.

Comment

Various other simple and cost-effective weatherization measures should be included in the program to increase effective energy savings.

Corresponding comment: 66-2.

Response

BPA provides only those weatherization measures that are commercially available, proven to save energy, and are cost-effective. BPA does not want to continually add to or change the measures provided because of the administrative burden for the utilities and BPA.

ASSUMPTIONS AND FORMAT OF EIS

Various letters received and statements made at public meetings requested that the format of the EIS be changed to increase its readability. Others commented on the assumptions employed to produce the results presented in the EIS. Several commenters felt these assumptions were incorrect or should be modified.

Comment

Believe that apartment data was not handled correctly in the EIS.

Corresponding comments: 17-2, 57-18

Response

No data was available to change the analysis presented in the Draft EIS. BPA realizes that assumptions associated with apartments are overly simplistic and may not be realistic, but in order to evaluate the program on a regional basis, general assumptions had to be made.

Comment

There are no clear indications that wall insulation reduces air leakage.

Corresponding comment: 49-35.

Response

Published data and technical reports indicate the possibility that wall insulation reduces leakage. However, only a limited amount of work has been done to verify the actual amount of reduction. The effect of reduced air exchange, based on limited available data, has been included in the health effects analysis in the EIS. This data is used to allow for a worst-case condition. Wall insulation is scheduled to become part of the tightening measures available under the Proposed Action and, therefore, has been included in the Final EIS.

Comment

Assumptions regarding pollutant emission characteristics are without merit and cause the results presented in the EIS to be very conservative and, thus, not comparable to the No-Action Alternative.

Corresponding comment: 57-16.

Response

Assumptions regarding pollutant emission characteristics are based on the best available information and are considered representative of conditions throughout the region. Emission characteristics are assumed to be the same for both the No-Action Alternative and Proposed Action. Therefore, a fair comparison is possible, although no comparison is necessary because the influencing factor is the reduced air exchange rate between the No-Action and Proposed Action Alternatives.

Comment

Are coal and nuclear plants the proper type of generation to replace what is not achieved through conservation?

Corresponding comment: 57-17.

Response

Although other resources may be available, these were selected to represent the worst-case conditions concerning generation to replace energy savings gained through conservation. They define one extreme of environmental impacts for acquiring electrical resources. For example, conservation requires no construction of facilities, whereas a massive amount of building is required for a nuclear plant.

Comment

The 75% occupancy figure seems unrealistic.

Corresponding comment: 57-20.

Response

The 75% occupancy figure refers to the amount of time the average person is within the house, 18 hours per day. This figure may apply to only a limited number of persons. It is an average value for populations and provides a reasonably conservative estimate for indoor risk projections. It is also in agreement with figures used by many national and international authorities, who occasionally use a 90% occupancy figure (see Appendixes F and G).

Comment

The weatherization program would reduce wood combustion and thus reduce outdoor air pollution.

The assumptions regarding wood stove use and indoor air quality should be like those used in BPA's Standard Heat Loss Methodology.

Corresponding comments: 62-10, 55-2.

Response

A discussion of the impact of the expanded program on reduced wood combustion and outdoor air quality is provided in Appendix O. Assumptions on wood use are in conformance with the BPA Standard Heat Loss Methodology.

Comment

The estimate that 70% of the residence in the region are currently unable to get tightening measures may be low.

Corresponding comment: EU.

Response

The region impact analysis is based on the latest available information, the second Pacific Northwest Residential Energy Survey (PNWRES) that was completed in the summer of 1983. The value of 70% was an estimate for the region based on the first PNWRES survey completed in the late 1970s. Information on the estimated number of residences presently excluded from receiving tightening measures can be found in Appendix K.

Comment

The use of the words "typical" and "typical residence" is confusing.

Corresponding comments: 37-2, 37-3, 38-13, 49-13, 49-22, 57-15, 67-2, EU.

Response

The words 'typical concentration' have been changed to 'reasonable worst-case concentration'. The term 'typical residence' has been changed to 'average residence'.

Comment

BPA should comply with Section 106, 36 CFR Part 800.

Corresponding comment: 8-1.

Response

See information provided in Section 4.8.2 of Volume I, which summarizes a Programmatic Memo of Agreement (PMOA) with the Advisory Council on Historic Preservation and the eight State Historic Preservation Offices concerning historic preservation.

Comment

The format of various tables and figures should be changed to provide more helpful information.

Corresponding comments: 11-1, 11-2, 32-2, 38-14, 38-15, 41-12, 42-12, 77-3, RI.

Response

Changes were made in several tables.

Comment

There is not enough clear data to be sure that any estimated side effect would occur.

Corresponding comment: 48-3.

Response

Health effect data regarding indoor air quality is mixed. For some pollutants, namely radon, a lot of information exists and various research projects are underway. For others, little, if any, information exist. BPA is required through the EIS to provide information on possible health effects based on the best available information (see the Environmental Process Section of this volume).

Comment

The main body of the report fails to incorporate information contained in the appendixes or its implications.

Corresponding comment: 49-4.

Response

This is intentional. Under CEQ requirements the EIS begins with a summary and moves toward more detailed analyses. The process is outlined under the section "Environmental Process" of Chapter II of this volume.

Comment

The comparison of risks in Appendix J is actually a normalization of the estimated risks, which is not appropriate.

Corresponding comment: 49-7.

Response

There are no formal guidelines for conducting risk assessments. Normalization is one commonly used technique. However, we have revised Appendix J to provide a more understandable comparison of voluntary risks.

Comment

The Draft EIS does not adequately explain its methodology and assumptions so that readers can review it properly.

Corresponding comment: 52-3.

Response

It is difficult for BPA to synthesize the extremely diverse information regarding tightening measures, their relationship to indoor air quality and health effects, and still provide a document that is useful to the general public, decision makers, and technical experts. For that reason, a more detailed discussion of the technical aspects of indoor air quality, health effects, program cost, and socioeconomics is provided as appendixes. The more technically oriented readers who want to make a critical review of the program should use

these appendixes in making their evaluation. The general public and decision makers, however, are provided with a summary and description of the program and various alternatives for evaluation.

Comment

One area where the Draft EIS could be improved is in the comparison of health effects.

Corresponding comment: 55-6.

Response

The section on chronic health effects was expanded in the EIS (see Section 3.2 in Volume 1). Additional information on health effects associated with thermal generation have been provided (see Sections 4.2.1). A comparison of the various health effects is provided in Table 2.1 and is also described in Section 2.1.5. Appendix J has been expanded and the information included in the main body of the EIS (see Section 2.2).

Comment

Standard calculations and measures of risk were not demonstrated clearly in the document.

Corresponding comment: 59-1.

Response

The main body of the EIS uses the conclusions of the appendixes and may, in some cases, obscure the rationale in developing the conclusion. Many changes were made in the Final EIS for the sake of clarity in both the main body of the EIS and the Appendixes to improve the presentation of health risk.

Comment

The Draft EIS fails to adequately address the No-Action Alternative.

Corresponding comment: 70-2.

Response

BPA feels the No-Action Alternative is adequately discussed, as all effects were examined. The section on alternative generation resources (Section 4.2.1 of Volume 1) has also been updated and expanded.

Comment

BPA's presentation fosters the misconception that residential weatherization will only be obtained at the expense of human health.

Corresponding comment: 73-7.

Response

BPA believes the reverse is true, that human health will not be compromised for energy savings. The purpose of the EIS is to present, based on best available information, the possible environmental impacts, including health effects, that could occur as the result of expanding the present BPA Residential Weatherization Program. The EIS is required by CEQ guidelines to present a reasonable assessment of the worst possible conditions. This EIS attempts to present an objective analysis on all effects. There is no indication as to whether the magnitude of health effects estimated will or will not actually ever occur.

Based on the information provided in the EIS, both the decision maker and the public will be better able to evaluate their situation and make an informed decision about what will be necessary for protecting health in their situation.

Comment

EIS should have focused on the changes in indoor air quality that can be attributed to house tightening.

Corresponding comment: 73-9.

Response

Estimating the changes in indoor air quality is the main focus of the EIS, see Chapter 2 of Volume I discussion of Baseline and Present Program (Section 2.1), and Proposed Action (Section 2.2).

Comment

A review of the current scientific literature indicates tightening of homes is not a problem.

Corresponding comment: EU.

Response

BPA feels there is sufficient accepted information that indicates potential problems from tightening certain types of residence. Because of this, BPA feels justified in examining the issue for the region and providing the public with current information concerning tightening residences. Indeed, conflicting data does exist, and the EIS tries to present both sides.

Comment

Information contained in Appendix J should be eliminated because nobody believes the data.

Corresponding comment: SE.

Response

BPA believes that information contained in Appendix J is vital for real-life comparison between the potential changes in indoor air quality resulting from reduced air exchange rates in residences and more commonly acceptable voluntary risks. Appendix J has been modified to make this comparison more understandable.

MITIGATIONS

Various comment letters and public statements requested additional information on air-to-air heat exchangers. This information was requested so their cost and effectiveness could be judged by the general public. Other comment letters also indicated that other forms of active mitigation devices should be considered.

Comment

More information should be provided on air-to-air heat exchangers, including current data on cost.

Corresponding comments: 3-2, 42-5, 47-2, 54-4, 62-9, 70-6, 73-6, PO, SE.

Response

Appendix P has been added to the EIS to describe various aspects of air-to-air heat exchangers, including availability, technical specification, and cost. In estimating the cost for implementing the Mitigation-By-Action options and the BPA Preferred Alternative, two costs were used. The low cost ($550) represents the average installed cost for a window unit, while the high cost ($1350) is for a whole house unit. If an air-to-air heat exchanger is required in a residence, the actual size required will depend on many factors, including size of the residence, which tightening measures were installed, and the number and strength of pollutant sources within the residence. Therefore, the cost of an air-to-air heat exchanger for a specific residence will probably lie between these two figures.

Comment

The homeowner should pay more of the cost of air-to-air heat exchangers.

Corresponding comment: 54-6.

Response

This consideration will be negotiated by BPA, the utilities, and the states.

Comment

Other active devices and methods besides air-to-air heat exchangers should be considered as a Mitigation-By-Action measure.

Corresponding comments: 5-7, 33-1, 38-11, 55-4, 56-2, 56-5, 57-12, 59-3, 66-1, 73-10, 74-1, 77-4.

Response

Appendix M on other mitigation techniques has been added to the EIS. Other mitigation techniques such as air ionizers, sub slab ventilation, sealing, ammonia fumigation, and spot ventilation are discussed. From a program viewpoint, BPA must have a standard, relatively simple, and commercially available

mitigation approach. Of the various mitigation measures available, the air-to-air heat exchanger fits these requirements the best. BPA does hope to help develop better mitigation techniques, particularly for radon.

Comment

BPA focuses on Mitigation-By-Action measures that increase ventilation rates, while overlooking approaches that attack indoor air pollution at the source.

Corresponding comments: 62-3, 62-7, PO.

Response

BPA agrees that attacking the source would be the best approach; however, in some cases that is impracticable. For example, no commercially available technique attacks the source of radon. It must first be determined whether there is a problem. Also, installation of a wood stove is the choice of the homeowner, and it is unlikely they would remove it. The same situation exists for formaldehyde, where sources are generally furniture and other wood products in the home. That is not to say the source cannot be attacked. It would involve homeowner choice or probably new laws against installation of pollutant sources in the residence or additional consumer product laws. Both are beyond the responsibility of BPA. Therefore, as an active mitigation technique, the air-to-air heat exchanger is the best possible way to improve indoor air quality.

Comment

Beyond disclosure, BPA could explore case-by-case approaches to mitigation.

Corresponding comment: 73-11.

Response

This approach would increase the program cost markedly, and be impractical from a program operation point of view. It would also require a certain amount of scientific expertise to evaluate each residence, which is difficult to provide. It may also require the use of sophisticated monitoring equipment, which is costly and difficult to maintain.

Comment

As another mitigation measure, BPA should inquire about the occupants' health prior to tightening the residence.

Corresponding comment: 35-1.

Response

This is an important point, but BPA believes the occupants within the residence and their personal physicians are the best judge of the occupant's health. BPA provides, and will continue to provide, information on indoor air quality and related health effects to all participants in the program. Consideration will also be given to updating the indoor air quality information for the expanded

program to include a section on whether weatherization, including tightening measures, might aggravate the pre-existing health conditions.

Comment

The EIS is set up in such a way that it is virtually impossible to determine the most cost-effective and appropriate measures to both protect health and reach conservation goals.

Corresponding comment: 73-15.

Response

The EIS is not a judgement document, but presents an objective analysis of the facts. Table 2.1 in Volume 1 is provided so the reader can make a comparison of the various alternatives. The ultimate decision concerning the expanded program will be a balance between competing effects(i.e., health versus cost versus energy saved).

Comment

The proposed Mitigation-By-Action measures should be lumped together as one Mitigation-By-Action approach.

Corresponding comment: SE.

Response

BPA feels it is important to examine each Mitigation-By-Action measure separately because of emphasis on different pollutants and levels of health effects. This separation is important when considering cost and also to underline the fact that not all residences have the same type or number of pollutant sources and may, or may not, be affected by the Mitigation-By-Action measure considered.

OTHER ISSUES, COMMENTS, AND CLARIFICATIONS

In several comment letters, various suggestions were made or clarification requested to improve the EIS. These comments occasionally reflected various viewpoints concerning indoor air quality in general, or expressed perspectives concerning the cause of indoor air pollution. Various typographical errors in the main text or appendixes were also noted, along with suggestions for editorial changes in the document.

Comment

Favors additional or continued research into indoor air quality.

Corresponding comments: 40-4, 41-1, 59-4, 65-4, BR, EU, PO.

Response

BPA has an obligation to continue investigating indoor air quality problems associated with conservation measures. Currently BPA is conducting research on residential indoor air quality, mitigation techniques, detailed radon mapping for the region, and new home indoor air quality. BPA also maintains active review of scientific literature and participates in important symposia and technical meetings.

Comment

Tightening measures are not the cause of indoor air pollution.

Corresponding comments: 38-1, 51-1, 70-5, 73-1, BR.

Response

Indeed, tightening measures are not the cause of indoor air pollution. Tightening measures reduce the air exchange rate so pollutants released by sources within the residence will remain there for a longer period. This causes increased pollutant concentrations and reduced indoor air quality in the residence. This is pointed out in the Summary and Section 2.0 of Volume 1.

Comment

Although Appendix F on lung cancer risk from radon daughters constitutes a substantive review of this question, the discussion of radon levels, risks, and standards elsewhere in the Draft EIS is not sound.

Corresponding comment: 49-11.

Response

The key points of Appendix F are used to develop the analysis presented in Chapters 2 and 4. Whenever the amount of detail presented in Appendix F is condensed to provide the general public an understandable discussion, the presentation of the material must become more simplistic.

Comment

Consideration should be given to biokinesiologic muscle testing to determine acceptable pollutant levels for the body.

Corresponding comment: 5-4.

Response

No sound technical information on this subject was found, and therefore could not be considered.

Comment

Conservation measures will help to reduce wood heat pollution because a well weatherized house will need to burn much less wood than an old, drafty, unweatherized house.

Corresponding comment: 43-2.

Response

This may be true, but would be difficult to quantify. A discussion of the effect of conservation measures on wood burning is presented in Appendix O.

Comment

Occupants of a house may well settle for a lower thermostat setting so that the energy savings go beyond those estimated.

Corresponding comment: 57-7.

Response

This is possible. BPA has made assumptions about the indoor temperature settings considered normal in the large majority of residences. Some settings will be higher, some lower.

Comment

The Draft EIS doesn't address asbestos pollution.

Corresponding comment: 62-12.

Response

Asbestos is found infrequently in residences. Installation of tightening measures has no effect on asbestos concentration within a residence. Problems arise from asbestos when it is moved or disturbed and, therefore, is beyond the scope of the EIS.

Comment

Request clarification of material presented in the Draft EIS.

Corresponding comments: 34-4, 38-10, 41-3, 41-10, 41-13, 41-15, 41-17, 41-20, 41-23, 41-25, 41-30, 41-32, 41-33, 41-36, 41-46, 41-55, 41-77, 41-78, 49-8, 49-25, 49-28, 49-31, 49-33, 52-2, 55-3, 62-6, 63-2.

Response

Numerous clarifications were added made in the Final EIS. The section in question should be consulted.

Comment

Indication of typographical errors in main text or appendixes or suggestion of editorial change.

Corresponding comments: 5-1, 5-2, 5-3, 28-3, 38-16, 41-5, 41-6, 41-7, 41-8, 41-9, 41-16, 41-18, 41-21, 41-24, 41-27, 41-28, 41-29, 41-31, 41-34, 41-37, 41-38, 41-39, 41-40, 41-41, 41-42, 41-43, 41-44, 41-45, 41-47, 41-48, 41-49, 41-50, 41-51, 41-52, 41-53, 41-54, 41-56, 41-57, 41-58, 41-61, 41-62, 41-64, 41-66, 41-67, 41-68, 41-69, 41-70, 41-71, 41-73, 41-74, 41-75, 41-76, 49-12, 49-14, 49-16, 49-18, 49-19, 49-20, 49-32, 57-9, 57-10, 57-13, 57-14, 57-19, 65-3.

Response

All indicated typographical errors were corrected. Numerous editorial changes were made throughout the EIS. The section in question should be consulted.

COMMENT LETTERS

GUIDE TO COMMENT RESPONSES

This list provides a cross-reference between the comment letters which follow and the responses that are given in Chapter II.

LETTER NUMBER		COMMENT NUMBER/ PAGE NUMBER WHERE RESPONSE APPEARS
1	Lawrence G. Spielvogel Inc.	1. II-12
2	Oregon Intergovernmental Relations	No response required
3	Univ. of Illinois at Urbana-Champaign	1. II-22 2. II-43
4	Metropolitan Service District	No response required
5	Neely, John C.	1. II-49 2. II-49 3. II-49 4. II-48 5. II-28 6. II-19 7. II-43 8. II-33 9. II-2
6	Weiner, Joe	No response required
7	Williams, John	1. II-23
8	Colorado State Historic Preservation Officer	1. II-37
9	Gervais, Allena	1. II-5
10	Holvse, Alice	1. II-5
11	State of New York Dept. of Public Service	1. II-37 2. II-37 3. II-31
12	Edington, Larry	1. II-11
13	Washington State Parks & Recreation Comm.	1. II-5 2. II-33
14	Maher, John	1. II-32
15	Wyoming State Energy Conservation Officer	No response required
16	Douglass, Phillip F.	1. II-33
17	Phillips, Wendell M.	1. II-5 2. II-35 3. II-32
18	California State Clearinghouse	No response required
19	US Army Corps of Engineers North Pacific Div.	No response required

LETTER NUMBER		COMMENT NUMBER/ PAGE NUMBER WHERE RESPONSE APPEARS
20	Ferguson, E. A.	1. II-31
21	American Gas Association	1. II-5
22	Kranz, Sara	No response required
23	Yakima Valley Conference of Governments	No response required
24	Metropolitan Service District	No response required
25	Arnett, Telma	No response required
26	Morse, Geraldine P.	1. II-11
27	Oregon State Clearinghouse	No response required
28	Friends of the Earth	1. II-1 2. II-2 3. II-49 4. II-5 5. II-29
29	OSPIRG	1. II-5 2. II-5
30	City of Portland, City Commissioner	1. II-1 2. II-5
31	Unity Light & Power	1. II-30 2. II-5 3. II-30
32	Theodor D Sterling LTD	1. II-5 2. II-37 3. II-12
33	Erbstoesser, John S.	1. II-43
34	Air X Change	1. II-11 2. II-25 3. II-11 4. II-49
35	Cleairmont, J.	1. II-44
36	American Lung Assn.	1. II-5
37	City of Eugene Municipal Utilities	1. II-5 2. II-37 3. II-37 4. II-21 5. II-29 6. II-27 7. II-5
38	Puget Sound Power & Light Co.	1. II-47 2. II-5 3. II-23 4. II-25 5. II-24 6. II-27 7. II-27 8. II-29 9. II-23 10. II-49 11. II-43 12. II-19 13. II-37 14. II-37 15. II-37 16. II-49
39	McCormick, J.	1. II-30 2. II-5

LETTER NUMBER		COMMENT NUMBER/ PAGE NUMBER WHERE RESPONSE APPEARS		
40	City of Corvallis Community Dev. Dept.	1. II-5	2. II-17	3. II-6
		4. II-47	5. II-11	
41	Tennessee Valley Authority	1. II-47	2. II-12	3. II-49
		4. II-12	5. II-49	6. II-49
		7. II-49	8. II-49	9. II-49
		10. II-49	11. II-28	12. II-37
		13. II-49	14. II-31	15. II-49
		16. II-49	17. II-49	18. II-49
		19. II-21	20. II-49	21. II-49
		22. II-12	23. II-49	24. II-49
		25. II-49	26. II-27	27. II-49
		28. II-49	29. II-49	30. II-49
		31. II-49	32. II-49	33. II-49
		34. II-49	35. II-12	36. II-49
		37. II-49	38. II-49	39. II-49
		40. II-49	41. II-49	42. II-49
		43. II-49	44. II-49	45. II-49
		46. II-49	47. II-49	48. II-49
		49. II-49	50. II-49	51. II-49
		52. II-49	53. II-49	54. II-49
		55. II-49	56. II-49	57. II-49
		58. II-49	59. II-21	60. II-21
		61. II-49	62. II-49	63. II-21
		64. II-49	65. II-21	66. II-49
		67. II-49	68. II-49	69. II-49
		70. II-49	71. II-49	72. II-22
		73. II-49	74. II-49	75. II-49
		76. II-49	77. II-49	78. II-49
42	Sierra Club NW Regional Conservation Comm.	1. II-5	2. II-15	3. II-5
		4. II-15	5. II-43	6. II-29
		7. II-5	8. II-19	9. II-27
		10. II-27	11. II-25	12. II-37
43	Weiner, J.	1. II-5	2. II-48	
44	US Dept. of Health & Human Services	1. II-23	2. II-5	3. II-22
		4. II-5		
45	Jones, L.C.	1. II-5	2. II-34	
46	Buscher, David	1. II-7		
47	State of Oregon Dept. of Environmental Quality	1. II-5	2. II-43	3. II-6
48	Viking Industries Inc.	1. II-5	2. II-24	3. II-1 & II-37
		4. II-1		

LETTER NUMBER		COMMENT NUMBER/ PAGE NUMBER WHERE RESPONSE APPEARS		
49	Lawrence Berkeley Laboratory	1. II-2	2. II-2	3. II-25
		4. II-38	5. II-24	6. II-21
		7. II-38	8. II-49	9. II-14
		10. II-21	11. II-47	12. II-49
		13. II-37	14. II-49	15. II-23
		16. II-21 & II-49		17. II-14
		18. II-49	19. II-49	20. II-49
		21. II-12	22. II-37	23. II-15
		24. II-15	25. II-49	26. II-12
		27. II-24	28. II-49	29. II-12
		30. II-23	31. II-49	32. II-49
		33. II-49	34. II-14	35. II-35
50	Washington State Planning & Community Affairs Agency	1. II-5		
51	Pacific Power & Light	1. II-47	2. II-5	
52	American Gas Assn.	1. II-31	2. II-49	3. II-38
		4. II-15	5. II-3	
53	Meyer, N.	1. II-5		
54	Blue Sky Testing Lab	1. II-7	2. II-14	3. II-14
		4. II-43	5. II-11	6. II-43
55	Public Power Council	1. II-5	2. II-36	3. II-49
		4. II-43	5. II-27	6. II-39
		7. II-29	8. II-17	
56	NW Power Planning Council	1. II-27	2. II-43	3. II-23
		4. II-5	5. II-43	6. II-19
57	Attneave, C.	1. II-1	2. II-34	3. II-5
		4. II-5	5. II-28	6. II-30
		7. II-48	8. II-1	9. II-49
		10. II-49	11. II-12	12. II-43
		13. II-49	14. II-49	15. II-37
		16. II-35	17. II-36	18. II-35
		19. II-49	20. II-36	
58	Formaldehyde Institute	1. II-21		
59	Pacific NW Utilities Conference Committee	1. II-39	2. II-5	3. II-43
		4. II-47		
60	City of McMinnville Water & Light Dept.	1. II-5	2. II-3	3. II-5

LETTER NUMBER		COMMENT NUMBER/ PAGE NUMBER WHERE RESPONSE APPEARS
61	State of Oregon, Dept. of Energy	1. II-29 2. II-27 3. II-7 4. II-8
62	Natural Resources Defense Council	1. II-5 2. II-12 3. II-44 4. II-27 5. II-27 6. II-49 7. II-44 8. II-27 9. II-43 10. II-36 11. II-29 12. II-48 13. II-21
63	Rundle, Marcia	1. II-5 2. II-49
64	State of Washington Dept. of Ecology	No response required
65	Lane Regional Air Pollution Authority	1. II-1 2. II-14 3. II-49 4. II-47
66	Gilmore, Richard L.	1. II-43 2. II-34 3. II-11 4. II-5
67	Northern Plains Resource Council	1. II-27 2. II-37 3. II-5
68	Brunsdon, Harry L.	1. II-8
69	Washington State Senate Energy & Utilities Commission	1. II-8
70	Washington State Energy Office	1. II-27 2. II-39 3. II-24 4. II-8 5. II-47 6. II-43
71	American Plywood Assn.	1. II-16 2. II-16
72	Idaho State Historical Society	No response required
73	Seattle City Light	1. II-47 2. II-5 3. II-32 4. II-27 5. II-21 6. II-43 7. II-39 8. II-32 9. II-40 10. II-43 11. II-44 12. II-27 13. II-25 14. II-11 15. II-45 16. II-3
74	Rush-Hampton Industries Inc.	1. II-43
75	Queirolo, Patricia	No response required
76	Dept. Of Health & Human Services	1. II-16 2. II-3 3. II-5
77	US Environmental Protection Agency Region X	1. II-9 2. II-21 3. II-37 4. II-43 5. II-21 6. II-25

LAWRENCE G. SPIELVOGEL, INC. CONSULTING ENGINEERS

WYNCOTE HOUSE • WYNCOTE, PENNSYLVANIA 19095 215-887-5600

September 19, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Admin.
P.O. Box 3621-SJ
Portland, OR. 97208

Re: Draft Environmental Impact Statement

Dear Mr. Morrell:

Following please find my comments on your Draft Environmental Impact Statement for the Bonneville Power Administration Expanded Residential Weatherization Program.

1 In various locations in the document you make reference to ASHRAE Standard 62-1981 "Ventilation For Acceptable Indoor Air Quality". Any reference to this document should be deleted because it is not a national voluntary concensus Standard.

There is a great deal of controversy surrounding this Standard. ASHRAE Standard 62-1981 was formally rejected by the American National Standards Institute. When ASHRAE was offered the opportunity to appeal the rejection, it declined.

In addition, almost immediately upon ASHRAE issuance of this Standard they began a revision, which is currently underway. However, due to the controversial nature of this Standard, and its rejection by the American National Standards Institute, it would appear that these revisions will not be completed for several years.

If indeed this Standard purports to be a concensus, any necessary revisions should be capable of being accomplished promptly. This is not the case.

Adoption of ASHRAE Standard 62-1981, or portions thereof, has been proposed in various Building Codes around the country. In most of these cases, it has been rejected by the Building Code group. Two recent examples this past summer include the State of Minnesota and the Building Officials Conference of America Code which covers most of the northeast, mid-atlantic and midwest States.

I am a Consulting Engineer, registered to practice in Washington, Oregon, Idaho and Montana. For the past 9½ years I was Chairman of Panel 5 of ASHRAE Standard 90, which was responsible for adopting the ventilation and air contamination requirements as a part of ASHRAE Standard 90, which is used as the basis for Building Codes in most States in the country. I have no financial or business interest in the outcome of this Environmental Impact Statement.

III-1

1

However, I urge you to reject any reference to ASHRAE Standard 62-1981.

Very truly yours

LAWRENCE G. SPIELVOGEL, INC.

L. G. Spielvogel, P.E.

LGS:bhs

2

OREGON PROJECT NOTICE ACKNOWLEDGEMENT

State Clearinghouse
Intergovernmental Relations Division
155 Cottage Street N.E.
Salem, Oregon 97310

Phone (503) 378-3732 or Toll Free in Oregon 1-800-452-7813

APPLICANT: BPA

PROJECT TITLE: THE EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM

DATE RECEIVED: SEPTEMBER 20, 1983

PNRS # OR 830920-021-4

Your project notice has been assigned the file title and number that appear above. Please use it in correspondence and, if applicable, enter it in Block 3A on the 424 form for the project. Your project notice must also be submitted for review to any affected areawide clearinghouse.

A. FEDERAL GRANTS

/ / Initial 30 day review of your notice of intent to apply for grant funds began on above date.

/ / 30 day review of your final grant application began on above date.

B. HUD HOUSING

/ / Initial 30 day review began on the above date.

C. DIRECT FEDERAL DEVELOPMENT

/ / Initial 30 day review.

D. ENVIRONMENTAL IMPACT STATEMENT

/ / Initial 45 day review of draft EIS began on above date.

/ / 30 day review of final EIS began on the above date.

E. STATE PLAN/AMENDMENT

/ / 45 day review began on above date.

State Clearinghouse use only:
St. Agency Due Date: _____
Federal Agency: _____
County: _____

PNRS #6
Revised 6/82

Your project notice was circulated to state agencies checked below:

ECONOMIC DEV. & CONSUMER SVCS
__ Agriculture
X Soil and Water
__ Economic Development
__ Fire Marshal
X Housing
__ Labor
__ Real Estate
EDUCATION
__ Education
__ Educ. Coordinating
__ Higher Education
EXECUTIVE
__ Budget
HUMAN RESOURCES
__ Adult and Family Services
__ Children's Services
__ Community Services
__ Corrections
__ Employment
__ Health
__ Mental Health
__ Senior Services
__ Vocational Rehabilitation
NATURAL RESOURCES
X Governor's Office
X DEQ
X Energy
X Fish and Wildlife
X Forestry
X Geology
X Lands
X LCDC
X Water Resources
TRANSPORTATION
__ Aeronautics
__ Director
__ Highway Division
X Historic Preservation
__ Parks Division
__ Public Transit
MISCELLANEOUS
__ Dev. Disabilities Council
__ Extension Service
__ Other

3

University of Illinois at Urbana-Champaign

OFFICE OF ENERGY RESEARCH · 105 OBSERVATORY BUILDING · 901 SOUTH MATHEWS AVENUE
URBANA, ILLINOIS 61801-3682 · (217) 333-7734

OFFICIAL FILE COPY
No. SEP 23 1983
Action Taken
☐ ANS. ☐ NO REPLY
By Date

September 20, 1983

Peter T. Johnson, Administrator
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

Dear Mr. Johnson:

This is in response to your letter (SJ) of September 14th, in which you transmitted a copy of the draft Environmental Impact Statement for the Expanded Residential Weatherization Program. The purpose of this letter is to transmit my comments on the statement, and request that they be made part of the formal record.

1 I find the statement deficient in two principal respects. First, the statement should adequately distinguish between voluntary and involuntary risks. The risks associated with this program are voluntary in the sense that individual participants have the right to refuse participation in the program. This situation contrasts greatly with other "major federal actions" such as the construction of power plants or dams that may have a significant environmental impact and subject individual citizens to involuntary risks.

2 The second major deficiency is the lack of emphasis on heat exchangers that would allow maintenance of adequate levels of ventilation, while at the same time significantly reducing energy consumption. If such measures were included in the program, and adequate incentives were provided, most of the cited environmental impacts would disappear.

Thank you for the opportunity to comment on this action.

Sincerely,

Clark Bullard

Clark Bullard
Director

CWB:v

METRO

METROPOLITAN SERVICE DISTRICT
Providing Zoo, Transportation, Solid Waste and other Regional Services

Rick Gustafson
Executive Officer

Metro Council

Cindy Banzer
Presiding Officer
District 9

Bob Oleson
Deputy Presiding Officer
District 1

Richard Waker
District 2

Charlie Williamson
District 3

Corky Kirkpatrick
District 4

Jack Deines
District 5

George Van Bergen
District 6

Sharron Kelley
District 7

Ernie Bonner
District 8

Bruce Etlinger
District 10

Marge Kafoury
District 11

Gary Hansen
District 12

527 SW Hall St
Portland, OR
97201
503/221-1646

DATE: September 26, 1983

PROJECT TITLE: Weatherization

APPLICANT: Bonneville Power Administration

ATTN: Anthony R. Morrell, Environmental Manager

METRO FILE: 839-3

REVIEW COMPLETION DATE: 10/24/83

Metro has received your Notification of Intent to apply for federal funds for the project listed above. Copies of the project summary have been sent to local jurisdictions and interested agencies in the region for their review and comment.

Any comments received through this review, as well as a letter from Metro, as the Areawide Clearinghouse, will be forwarded to you within 30 days. These should accompany your final application to the funding agency, along with a statement indicating that any comments received have been considered in development of the application. If your final application has already been submitted, the comments may be forwarded under separate cover.

If you have any questions regarding our review, please do not hesitate to contact Mel Huie, A-95 Review Coordinator.

Sincerely,

Dan LaGrande
Public Affairs Director

DL:MCH:srb
GL0004 (A)

Mr. Anthony R. Morrell
Environmental Manager, BPA
P.O. Box 3621-SJ
Portland, Oregon 97208

September 24, 1983

Re: SJ - Reviewer response pertaining to BPA's August 1983 Draft Environmental Impact Statement; the Proposed Action.

Dear Mr. Morrell:

1 Tabular totals in TABLE I.5. are so selectively, obviously inaccurate. This resulted adding the horizontal figures to obtain, then add the right-hand total column, the overage-underage netting at 5,000 persons less being in the total represented in this DRAFT.

2 Also on this page I.7 is the statement, "The total life-time number of radon-induced cancers in all eligible residences is the sum of the numbers in Table I.7, or 4824. Because the calculation of risk coefficient is based on an 85-year lifespan, about 57 lung cancers are estimated to occur annually from radon exposure." Is this INCREASED radon exposure as the result from 'house tightening'? Or, being based on an 85-year lifespan, the connotation appears to include 'normal' radon cancer incidence with the 'house tightening' total of 57.

3 The principal reason for this reference is that Table I.5 is said to be multiplied by appropriate factors in Table I.6 in obtaining the results in Table I.7; this table, summed in the vertical columns of figures, then summing those columns totals, has been also inaccurate from 4808.651, or 4809, or 15 more than accuracy allows. Interestingly, these have tended to cancel-out-each-the-other at 56.514-to-57, or only less-than-one-half person-factor.

Any informed lay person will accept this, based within the frank, plain, honest and obvious limitations imposed by the scientific 'cummunity'. Assistant Health Professor William Anderman, Oregon State University, has said that innovations, based in newer and more reliable information, are often not accepted by that so-called 'community' for about twelve years. Across-knowledge studying has revealed Mr. Anderman's projection to be conservative, yet optimistic.

This is one way in which to compliment this DRAFT's conservative estimate being more realistic in 20-to-40-years not producing more than those years of energy losses and still not be less uncertain in the relative affects from radon, BaP and formaldehyde await when the scientific-community is assured/passified. We lay persons are not limited to awaiting any such 'lordly pronouncements'.

This DRAFT has (pg. xviii), "...,little experience in public participation in conservation programs and resulting energy savings exists." True, and it will continue to be true for too many more years, if the scientific-cummunity includes orthodoxy. Its SUMMARY does not include their iatrogenicities as part of the metabolizing hazards which can be, mistakenly, attributed to 'house tightening'. Their 70% iatrogenicities are hardly complimentary.

Consider, as an example, the increasing incidence in abdominal sectioning at childbirth. Those females may be considered to have not the metabolic balance required to provide the elements for collagen factors adaptation to allow the necessarily affected joints to pull apart sufficiently to provide space for normal birth. Infants born under such conditions have had the placenta rob the host body of the available nutrients to help protect it during the first few days to months for its adaptive sequence. This DRAFT reports less cancer incidence in all infants, then increased cancer incidence as they age. The pitiful fact is presented that neither parent is aware in having to become healthy before conception. This would reduce all incidences of illness.

Too-soon-oldt-und-too-latd-smart is one rule which assures another: Genetic Flaws Rule. Metabolic imbalances produce the genetic ruling of flaws. Such flaws will be tried to be included as the results from 'house tightening'.

My sister and I have learned, as results from trauma non-corrections and complicated by iatrogenic dominance, How to help ourselves, from necessity and belatedly. We have adapted the Goodhart muscle testing method to be included in biokinesiologic methods. We are now able to test ourselves, individually or each the other for the nutritional factors in which we are short - even down to a fraction of a tablet. This even includes clothing fabrics and colors - our environment.

On the basis of this experience-level, some suggestions are tendered for BPA's consideration:

cont'd.

1. Consider that this single-family detached residence is 52 + years old, has a basement, and that, except for my four-plus years in WW II, we have lived here continuously. This is far more stability than this DRAFT allows for the general public mobility. We are also in the nomineralized Oregon area. This could make for some interest-statistics, if we were not so knowledgeable pertaining to our environmental precautions and our nutritional supplements needs. They vary from myriad reasons, but some of them are essentially constants - depending upon the types of foods ingested at any particular time.

   So, basically, one consideration for people in nonmineralized areas would be to test for need for such as sea kelp for minerals. This could be enough for "healthy" people. The amount or number would be depending on the type, strngth and origin of such supplementation. This would be for augmenting protection from radon.

2. For protection from benzo-(a)-pyrene (BaP), the basic recommendation could be the ingestion of Vitamin C - ascorbic acid. Again, the amount should be daily tested with biokinesiologic muscle testing. Short of testing, the general rule-of-thumb is to gradually increase use of Vitamin C until intestinal catharsis is evident, then just slightly reduce that quantity. This also loosens the mucosa of the air passages, which produces expectoration. This helps remove the pollutants trapped in that mucus. To help facilitate this removal, there are certain pressure points on the inside of the fore-arms, just up from the wrist joint on each arm. They will be sensitive to deep-touch/noticeable pressure. Vitamin C dissolved in the mouth helps loosen nasal mucosa.
3. The other organic/carbon-containing fractions could be alleviated with the carbohydrates normal to naturally grown fruits and vegetables - raw or lightly steamed, then drink the juice also. Pouring the folic acid out does not help the inner person.

4

This DRAFT says, "Carbon monoxide affects mental and physical processes." True, a fair example could be in the fact that the Eugene Water and Electric Board is located in down-town Eugene. A recent newspaper article contained the information that EWEB is backing BPA bonding to reduce interest costs to BPA, and presumably this type of financing the Proposed Action is the reason. The EWEB members seem to be affect from being downtown, in low residual negative ions, with considering the EWEB credit-use is only not costing EWEB, unless BPA goes bankrupt.

EWEB's credit rating has tangible value. BPA should be ashamed in taking advantage of that board in its presumed mental condition. The EWEB rates should be lowered for the equivalent number of MWs saved via the increased weatherization/'house tightening' which results from the EWEB bonding participation. Call it an energy buy-back, just as is accorded DSIs when they go off-line for firm power demands on the system. California wants more power. Make it pay EWEB for helping to make that power available sooner. The real 'governor' in energy use is the price. Varying it certainly does control demand. A demand control should be with power exported to outside the Northwest. It should be sufficiently high-priced to allow cost reductions within the Region - not go for more cost within the Region. Price increases do not enlarge the number of eligible participants in conservation.

5

Consider this question: What is BPA's liability resulting from price increases after 'house tightening' which result in the residence occupant having to install unvented other form of heat? Also, a heat exchanger, air-t-air, is costly and reduces MW savings at the same time. This should assure the ones going to other forms of heat would remain with the unvented heat source. Ergo, the question of liabilities rears-its-ugly-head. Considering that much of the BPA supply area is nonmineralized and, of that area which is Oregon with three times the national average hazard from waterborne diseases, the potentials for liabilities-associations surely could compound. This is particularly active when the complainant - or beneficiary (ies) have this DRAFT for reference in court.

6

BPA has not sufficient statistical information to provide sufficient defense before a jury of other forms of heat owners, nor (probably) of electrically heated houses. The possibilities for including the BPA personnel and DSIs and export power recipients could become extensive and expensive.

This house is scheduled to be 'tightened' under this new program - Prior Program. We are in an excellent position to record our supplementations now. Then we could keep our record of supplementations, after 'house tightening', and compare the increase or decrease or variation from our present schedule. This should be indicative of the type (s) of supplementations which could be effective in similar catagory structures.

cont'd.

III-4

Obviously, we are not going to volunteer this information when considering this new 'house tightening' may increase our paidouts for additional same-kind or other factors. Also, the energy cost increases could become more than we may have saved via becoming involved with this program. This would have us taking risks solely for the DSIs and for other exported energy customers. This one is said as though we did not know how to help protect ourselves - as would be the situation with most of the 'house tightening' participants.

People, from avarice and/or necessity, are attuned to the leverage in what is called economics. It is considered as an inducement to try 'something', even without really in full-knowledge-of-consequences possession. Most of these situations are now covered with explicit or implied warranties. Some smart lawyers, those who are not around too much negative ion depletion for long at a time, could create unanticipated costs against BPA. Ah, well, such is economics.

7

The suggestion is offered to consider the potentials in providing a negative ion houshold-type generator, if the MWs are not too extensively depleted with so many. Or, consider providing a type of passive polarizer for the participants. These could be considered as mitigating measures in lieu of more precise knowledge from the total in the potential probabilities resulting from participation in the Proposed Program.

BPA should keep open its 1983 wholesale and transmission rates for enough longer to include considering the potentials in the above. If the rates to purchasers of the wholesale and transmission are no more accurate than that which has to-date been discovered in this DRAFT, a thorough review seems to be indicated. They certainly are not going to tell BPA that errors were made costing lower prices to them.

Also consider the fact this DRAFT includes references to and acknowledgement in the reduction in concentration of non-beneficial metabolizing components can increase their detrimental effects. This derives from the known potentials of individual human systems having varying protection detection attributes. Those with poorly maintained detection systems would allow more of the harmful factor(s) to cumulatively reside in the body before it cranks-up its defenses to excommunicate the intruder(s). This is called illness, while the illness started when the intruder(s) started accumulating in the physiological, metabolizing systems. These prepathologies are reminders to our dirth of knowledge.

8

BPA could become involved with the I-haven't-changed-anything-I-do-except-what-you-did routine, when probabilities are that the no-other-change only needed this new catalyst to start the elimination of disease process, what so ever its name may be. The probabilities in a judge instructing a jury to exclude claims of parties signing up for conservation practices, after this DRAFT became available to them, could be moderate. Locally, several thousand house owners have signed prior to issuance of this DRAFT. Our house is one of them.

Shortly after participating in the local water heater insulating program, our water heater sprung-a-leak. I removed the coverings, down to the tank to be able to locate the pinhole-size electrolysis-indused hole. It was in the bottom of the tank. I plugged it with a small sheet metal screw with a Chicago Faucet washer for the seal between the tank and screw head. How many people with a similar condition surfacing would have gone into the you-did-it routine, forgetting that they had recieved far more years service from the unit than the manufacturer's warranty implied?

This Fowler Manufacturing Company 42-gallon double-element water heater was installed in 1950. Thirty-three years of no-problems certainly should not be terminated just for electolysis-induced hole-in-the-tank. As long as the heating elements and controls do continue functioning properly, the least I can do is to patch pinhole-size leaks. Even then, replacing element (s) and Control(s) would be less costly than the price of a new electric heater.

9

We fully intend to continue participating in the weatherization and conservation program. We will need to trust BPA to continue being as open in its decisions and its limitations as is exemplified in this DRAFT. We are sufficiently knowledgeable to be able to offset any of the slight hazard-increases or adaptations required to protect ourselves.

One other point relating to this house: The county employee who checked this house noted the knob-and-tube original electric wiring installation in the floor beams, noted from the basement. He said they do not like to insulate around such wiring. I agree this to be preferred to be left open. This necessarily means that this house will not have the radon protection. Sincerely, John C. Neely, Jr., 1600 Horn Lane, Eugene, OR 97404 J.C.N.

6

U.S. DEPARTMENT OF ENERGY — BONNEVILLE POWER ADMINISTRATION
CONFERENCE AND TELEPHONE CALL REPORT

Date 9/29/83

cc: [X] Official File - ALP
[ ]
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[ ]

TO: Rusty Alton - SJ

FROM: Joe Case - ALP Jcase

Include all telephone calls and conferences of importance bearing upon policies, customer or public relations, but excluding those purely technical in nature.

OUTSIDE CALLER OR CONFEREE	SUMMARY OF DISCUSSION
Joe Weiner 2555 Van Buren Eugene, OR 97405	Phone call on 9/26/83 Wanted to make the following comment for the record: He lived in an "air-tight" house and experienced no air quality problems. Was very impressed with the house and his utility bills were low.

BPA 15 REV. NOV. 1980

ENERGY — BONNEVILLE POWER ADMINISTRATION, PORTLAND, OREGON

7

U.S. DEPARTMENT OF ENERGY — BONNEVILLE POWER ADMINISTRATION
CONFERENCE AND TELEPHONE CALL REPORT

Date September 26, 1983

cc: [ ] Toll-Free Line Log
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

TO: Rusty Alton - SJ

FROM: Ruth Hiraki - ALP R Hiraki

Include all telephone calls and conferences of importance bearing upon policies, customer or public relations, but excluding those purely technical in nature.

OUTSIDE CALLER OR CONFEREE	SUMMARY OF DISCUSSION
John Williams Ashland, Oregon	Re: Weatherization EIS Mr. Williams read the newspaper ad on the Weatherization EIS. He was refused financial assistance from the City of Ashland, a BPA customer, for storm window installation, because his residence in on a slab foundation. Mr. Williams feels that the radon risk is "ridiculously" minimal and should not be a reason for BPA to withhold weatherization assistance. He added, for the record, that he is an energy auditor.

1

BPA 15 REV. NOV

ENERGY — BONNEVILLE POWER ADMINISTRATION, PORTLAND, OREGON

Advisory Council On Historic Preservation

1522 K Street, NW
Washington, DC 20005

Reply to:

730 Simms Street, Room 450
Golden, Colorado 80401

September 27, 1983

Mr. Anthony Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

REF: Draft Environmental Impact Statement (DEIS), "The Expanded Residential Weatherization Program", August 1983

Dear Mr. Morrell:

On September 22, 1983, we received a copy of the above referenced DEIS for review and comment. We commend BPA for the expansion of this Program, as it should benefit many historic and cultural properties included in or eligible for the National Register of Historic Places in Montana, Washington, Oregon, and Idaho.

We have reviewed this document and note that on page 4.51, subsection 4.9.3, it is acknowledged that implementation of this Program could affect historic and cultural properties included in or eligible for the National Register of Historic Places. Further, it is stated that "BPA will prevent adverse effects to such characteristics (characteristics that qualify a property to the National Register) through consultation with the State Historic Preservation Officers (SHPO) and the Advisory Council on Historic Preservation in accordance with 36 CFR Part 800". Regarding this latter statement, we would like to point out that BPA is obligated by Section 106 of the National Historic Preservation Act and the Council's regulations to afford the Council an opportunity to comment on the undertaking's effects on historic and cultural properties impacted by the implementation of this Program. We presume from this statement that BPA intends to comply with Section 106 and 36 CFR Part 800 on a property-by-property basis, as it is determined that historic and cultural properties will be affected by implementation of this expanded program. 1

8

Rather than achieving compliance in this property-by-property manner, we believe that it would be preferable to do so under a Programmatic Memorandum of Agreement, as was done with the recent PMOA for various BPA residential, commercial, and institutional energy conservation and weatherization programs for the eight-state area of the Pacific Northwest. We have considered the administrative framework, the types of activities involved, and their effects on historic and cultural properties from implementation of this expanded residential program. We believe that this program could be considered as part of this recent, larger BPA Conservation and Weatherization PMOA. It seems that most of the residential weatherization activities discussed in the DEIS could be considered as part of the Exempt list attached to the existing Conservation and Weatherization PMOA, and therefore not require review by either the Council or the State Historic Preservation Officers (SHPOs). Thus, project processing and implementation would be very efficient.

We suggest that you and your staff discuss this with the Montana, Idaho, Washington, and Oregon SHPOs and acquire their written concurrence to making use of the existing Conservation and Weatherization PMOA for this expanded residential program. Should any of the four SHPOs disagree with such an approach, we can discuss developing an alternative PMOA. Accordingly, the FEIS should be modified to reflect whatever is the resultant approach toward programmatic compliance with Section 106, the Council's regulations, and other pertinent historic preservation authorities.

If you have any questions or wish to discuss this further, please contact Ms. Marjorie Ingle of my staff at (303) 234-4946, an FTS number.

Sincerely,

for Louis S. Wall
Chief, Western Division
of Project Review

9

U.S. DEPARTMENT OF ENERGY — BONNEVILLE POWER ADMINISTRATION
CONFERENCE AND TELEPHONE CALL REPORT

Date 9/29/83

TO: Rusty Alton - SJ

FROM: Joe Cade - ALP

cc: [X] Official File ALP
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[ ]
[ ]
[ ]

Include all telephone calls and conferences of importance bearing upon policies, customer or public relations, but excluding those purely technical in nature.

OUTSIDE CALLER OR CONFEREE	SUMMARY OF DISCUSSION
Allen Gervais 4915 NW. 259th St. Richfield, WA 98642 1	Phone call on 9/27/83 Responding to newspaper ad. People should be able to make their own choice about whether or not to participate in the program. Make the program simple to manage by making all the conservation measures available to everyone.

BPA 15 REV. NOV. 1980

ENERGY · BONNEVILLE POWER ADMINISTRATION, PORTLAND, OREGON

10

U.S. DEPARTMENT OF ENERGY — BONNEVILLE POWER ADMINISTRATION
CONFERENCE AND TELEPHONE CALL REPORT

Date 9/29/83

TO: Rusty Alton - SJ

FROM: Joe Cade - ALP

cc: [X] Official File - ALP
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Include all telephone calls and conferences of importance bearing upon policies, customer or public relations, but excluding those purely technical in nature.

OUTSIDE CALLER OR CONFEREE	SUMMARY OF DISCUSSION
Alice Holvse 126 Taylor Cutoff Road Sequim, WA 98382 1	Phone call on 9/26/83 Saw the ad in the newspaper. Feels a person should be able to make their own choices regarding the conservation measures to put in their house. BPA's weatherization program should be done on a house-to-house basis.

BPA 15 REV. NOV. 1980

ENERGY · BONNEVILLE POWER ADMINISTRATION, PORTLAND, OREGON

STATE OF NEW YORK DEPARTMENT OF PUBLIC SERVICE

THREE EMPIRE STATE PLAZA, ALBANY 12223

PUBLIC SERVICE COMMISSION

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ROSEMARY S. POOLER

DAVID E. BLABEY
Counsel

JOHN J. KELLIHER
Secretary

September 21, 1983

Mr. Anthony R. Morrell
Environmental Manager
P.O. Box 3621-SJ
Portland, OR 97208

In Reply to: SJ

Dear Mr. Morrell:

The enclosed comments concern the draft EIS titled, "The Expanded Residential Weatherization Program," dated August 1983. I would like to note that these comments reflect my views and do not necessarily reflect the views of the Department of Public Service.

General Comments

Overall, I believe that BPA's staff have done an excellent job in analyzing and presenting the possible relationships between house tightening and health impacts. The following suggestions are intended to further improve the usefulness and understanding of the information presented in the DEIS.

1 1. In Section 2.1, or elsewhere, the inclusion criteria should be specified. This information could be included as a technical appendix, as was done in the Revised Environmental Assessment, dated September 1981.

2 2. Appendices A and B make extensive reference to four residence types (single-family detached, single-family attached, mobile homes, and apartments). The characteristics of these residences are not explicitly provided. Although some technical information concerning these residence types can be obtained from the numerical examples and Table A.2., it would be helpful to include a table containing all relevant specifications that describe a residence

2 type. For example, does the EIS's concept of a single-family detached residence apply equally well to residences constructed in the 1940's as well as those constructed in the 1980's? I believe this type of information could be useful to future readers of the EIS who wish to make comparisons between the hypothetical examples provided in Appendices A and B and a specific existing residence. The importance of variations in construction styles within a "residence type" is not clear. Reference to Point 3 further explains this concern.

3 3. Appendices A and B discuss single family residences (attached and detached). Single-family residences sometimes have garages incorporated as an integral part of the structure. For example, a typical "raised ranch" style single-family residence often consists of a ground-level garage with living areas located immediately above and alongside the garage. Any air pollutants released within the (closed) garage may either diffuse into living areas or be drawn into living areas by infiltration. Assuming that the garage is used, the family automobile may become a significant intermittent source of air pollutants within the living areas. Automobile exhaust contains significant amounts of carbon monoxide, nitrogen oxide, respirable suspended particulates, and benzo-(a)-pyrene. (Emission factors can be obtained from the EPA's "Complication of Air Pollutant Emission Factors," AP-42). Perhaps more importantly, for several hours during cool-down, automobiles release various hydrocarbons resulting from the volatilization of gasoline and lubricating oils. Volatilization of gasoline from carburetors on older automobiles without vapor recovery systems is a particular problem. Thus, garages which are an integral part of a residential structure may constitute an "identifiable source" of indoor air pollution not currently recognized in the draft EIS. Consideration of this possible source of indoor air pollution should be evaluated as a possible additional "mitigation-by-exclusion" item or receive other appropriate treatment.

Errata

1. The table of contents should be updated to include a "Section 9 - References."

2. The reference to Harrje and Born 1982 on page 2.55 should be checked against the citation in the reference section.

3. Page A.5, the equation symbol "M" should be "$\dot{M}$".

4. Page A.10, the equation A.2 should be corrected (in the denominator) to read: V*I.

Thank you for this opportunity to comment upon the draft EIS (DOE/EIS-0095). If you have questions concerning these comments, I may be reached at (518) 474-5363.

Sincerely,

Alan J. Domaracki

ALAN J. DOMARACKI, Ph.D.
Associate Air Quality
Policy Analyst
Office of Environmental
Planning

AJD/kao

cc: R. Vessels

10/3/83

In response to our newspaper advertisement,

the following question was received:

1 "Has there been any factor set for a min.

air change?"

from:

Larry Edington
625 Woodruff #12
Spokane WA 99206

JOHN SPELLMAN
Governor

JAN TVETEN
Director

STATE OF WASHINGTON
WASHINGTON STATE PARKS AND RECREATION COMMISSION
7150 Cleanwater Lane, KY-11 • Olympia, Washington 98504 • (206) 753-5755

September 23, 1983

TO: Barbara Ritchie, NEPA Coordinator
Department of Ecology
Lacey PV-11

FROM: David W. Heiser, E.P.
Chief, Environmental Coordination

RE: Draft EIS - Bonneville Power Administration -
"The Expanded Residential Weatherization Program"
(35-2650-1820/E-2590)

1 Staff of the Washington State Parks and Recreation Commission have reviewed this DEIS and offer the following comments. Washington State Parks has been engaged in a program to conserve energy by retro-fitting existing buildings and concurs with BPA's proposed action. We believe there are substantial energy savings yet to be made by such a program.

2 Secondly, we would like to be able to receive credit for insulation of residences done prior to the initiation of this program. We are currently engaged in a program which will place blankets on all hot water heaters and utilize other "house tightening" measures.

Thank you for the opportunity to provide comment on this program.

bh
cc: ~~Bonneville Power Administration~~
Kris Kauffman, WSP&RC

9/29/83

The following comment was received in

response to the newspaper advertisement:

1 He is against some of the statements and reasons for qualification. Doesn't qualify due to slab grade--feels he should.

From:

John Maher
7201 56th Ave NE
Seattle WA 98115

SEP 30 1983

SEP 22 1983

WYOMING
EXECUTIVE DEPARTMENT
CHEYENNE

ED HERSCHLER
GOVERNOR

NAME OF ACTIVITY: The Expanded Residential Weatherization Program

RESPONSIBLE FEDERAL AGENCY: Bonneville Power Administration/DOE

STATE IDENTIFIER NUMBER: 83-130

TO: Mr. Nick Gill, Energy Conservation Office

DATE OF REFERRAL: September 21, 1983

The enclosed statement has been submitted to the Wyoming State Clearinghouse for review as provided for in the National Environmental Policy Act of 1969 and the Office of Management and Budget Circular A-95. We would appreciate your review and comments on this project. All comments should be transmitted to the Clearinghouse by NOVEMBER 4, 1983. If an extension is necessary, please inform the Clearinghouse. The Clearinghouse will assume the responsibility of passing all comments on to the Governor for his review and then to the federal agency. Refer to the State Identifier Number in all future correspondence.

TYPE OF ACTION;

Assessment ☐ Review ☐ Plan ☐ Draft ☒ Final ☐

PLEASE RETURN THIS REFERRAL TO THE CLEARINGHOUSE WITHIN THE REVIEW PERIOD AND CHECK ONE OF THE FOLLOWING:

No Comment ☐ Comments Attached ☒ Agency Concurs ☐

State Planning Coordinator
Wyoming State Clearinghouse
2320 Capitol Avenue
Cheyenne, Wyoming 82002

Fill in the Blank (Optional)

Man-Days Spent in Review ½

III-11

15

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Energy Conservation Office

(307) 777-7131
25TH & PIONEER

CAPITOL HILL OFFICE BUILDING

CHEYENNE, WYOMING 82002

September 28, 1983

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

Based on program eligibility guidelines, the Wyoming Energy Conservation Office would offer only one minor comment.

The area served in Wyoming by BPA utilities is very limited. Due to this factor, it is anticipated that this sparcely populated portion of Western Wyoming would participate minimally in the Expanded Residential Weatherization Program.

Sincerely,

Nick Gill
Director

NG:ssg

Bonneville Power
Administration

We are some of the People who live in the Northwest where we appreciate Insulation due to our Extreem Cold — Your BPA Program will help Many of the People here in Wyo and area =

We inquired thru Power Light of Afton Wyo - we were refered to Mr Kent Stevenson who said your Program in this area does not include Storm doors — however we read article in Local Paper Including Storm Windows and Doors in Your BPA Program.

Mr Kent Stevenson then refered Me to Mr Lester Hale of Afton Wyo who told Me the Man in Charge of this Program in Jackson Wyo did Not think storm doors Helped and they did Not Install them that was Mr Jim Klayman We are Senior Citizens 75 yrs — and are sure Storm Doors on Front + Rear Would help

1 on electric usage. — With no danger of Indore Pollutants —

Phillip Douglas
Box 301 THAYNE Wyo
83127

Wendell Phillips
615 So. Phillippi St.
Boise, Idaho 83705

October 15, 1983

Bonneville Power Administration
P. O. Box 3621-SJ
Portland, Oregon 97208

Attn: Anthony R. Morrell

Gentlemen:

Thank you for the opportunity to comment on the draft EIS for the expanded Residential Weatherization Program. I believe you have presented a full assessment of the environmental considerations for the proposed program within the limits of the state of the knowledge on the potentially hazaradous effects of "tight" houses.

1 I urge you to implement the Proposed Action plan with the contingency of adequate follow through on the mitigation strategies to rectify the impacts by restoring the effected environment as proposed in Sections 2.11, 2.12, 2.13 and 2.14.

Not only will this approach to conservation tend to maximize the benefits of residential conservation of energy; but, if you are diligent in the follow through activity, it will minimize any detrimental effects to the residents of the homes. Also, it will broaden the scope of information available to others who are concerned with the "tightening" of residences within acceptable levels of risk.

2 In Section 2.10 you raise the possibility that apartments be excluded from the tightening measures. I assume you are refering to the larger apartment complexes where most of the units have joint walls and inside corridors--in which case your assumptions seem to be valid. However, I doubt if those situations are typical to the majority of apartments in the Region. In Boise, at least, there are many, many apartments that have at least two outside walls and outside entrances. Most of the owners of these less expensive units are only minimally concerned with the heat loss--unless they furnish the heat, which is not typical. Even then, many find it more beneficial to pay energy bills than to weatherize their buildings. Where heat is not furnished, who cares?

3 I urge you to take another look at this proposed course of action and determine whether this exclusion is justified.

broad

Sincerely,

Wendell M. Phillips

Wendell M. Phillips

From:

Office of the Governor
Office of Resources, Energy, and
Permit Assistance
State Clearinghouse
1400 Tenth Street, Room 121
Sacramento CA 95814

ACKNOWLEDGEMENT

State of California
Project Notification and Review System
State Clearinghouse
(916) 445-0613

TITLE: EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM
STATE CLEARINGHOUSE NUMBER: 82010810
REVIEW STARTS: 10/04/83
REVIEW ENDS: 11/11/83
CONTACT: PRICE WALKER
(REVIEW STARTS ON NEXT DAY WHEN DOCUMENT IS RECEIVED AFTER 10:00 A.M.)

Please use the State Clearinghouse Number on future correspondence with this office and with agencies approving or reviewing your project.

This card does not verify compliance with environmental review requirements. A letter containing the State's comments or a letter confirming no State comments will be forwarded to you after the review is complete.

OCT 1 PM SACRAMENTO, CA

Rev. 8/83

19

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208

October 12, 1983

REPLY TO
ATTENTION OF:

Environmental Resources

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

This is in response to Mr. Peter Johnson's September 14 letter requesting our review of the draft environmental impact statement (DEIS) regarding the expanded residential weatherization program.

We have reviewed the above mentioned DEIS and we have no comments. Thank you for the opportunity to review and comment on this document.

Sincerely,

James H. Wagman
Colonel, Corps of Engineers
Acting Division Engineer

COMPLIANCE SYSTEMS PUBLICATIONS INCORPORATED

October 17, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

In accordance with the Federal REgister notice of September 20, 1983, p 42847, I am requesting information on the BPA Expanded Residential Weatherization Program. In addition to the draft EIS I am requesting a copy pf the proposed program.

As I understand the proposed program, it will encourage air infiltration (tightening) of all electrically heated residences in the BPA service area. If this is correct, I offer the comment that you should not suggest such tightening to owners/occupants of manufactured homes manufactured under the HUD standards program. This includes all manufactured homes produced since June 1976. Tightening of new manufactured homes (less than one year old) is to be particularly avoided since these homes may have very low operating air infiltration rates. 1

Cordially,

Earl Ferguson

Earl A. Ferguson

EAF:iw
CC: Frank Walter, MHI
Howard Snyder, WMHI
L.C."Bud" Merta, Moduline International

Suite 222, 3071 Peachtree Road, N.E., Atlanta, Georgia 30305, 404-233-4125

American Gas Association

1515 Wilson Boulevard, Arlington, Va. 22209
Telephone (703) 841-8450

Louis A. Serkes
Staff Vice President
Engineering

October 17, 1983

Mr. Anthony R. Morrell
Environment Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

I have received and reviewed a copy of your Issue Backgrounder booklet, "The Health Impacts of Home Weatherization". In general, it is well written and clearly explains this complex technical issue.

However, I would like to point out several statements that I feel are misleading or are contrary to the most recent findings of indoor air research.

First, on page 17, the last paragraph states that "EPA's standard for maximum allowable concentration of nitrogen dioxide in outside air is .05 ppm." In fact, the EPA standard of .05 ppm is an annual average and the standard-setting process takes into consideration that peak concentrations can exceed this level by an order of magnitude and still meet the standard. It also includes a margin of safety to protect asthmatics. I am afraid that the statement, as currently written, would give the reader the impression that EPA has determined that short-term exposures to NO_2 in excess of .05 ppm are harmful. This should be corrected to prevent such misinterpretation.

Second, on page 19, gas appliances are listed as a source of respirable suspended particulates (RSP) and benzo-(a)-pyrene (BaP). I'm aware that at least one study reported finding these pollutants in gas combustion products. You will be intested to know that a study of the pollutant emissions from gas appliances conducted by Dr. Demetrios Moschandreas at Illinois Institute of Technology Research Institute is nearing completion. He has found total suspended particulate levels comparable to those found by Lawrence Berkeley Laboratories, which are insignificant compared to cigarette smoke and wood burning stove emissions. He also tested for a range of polynuculear aromatic hydrocarbons (PAH), including benzo-(a)-pyrene, and found levels comparable to or in cases lower than the background levels in the room air. These results agree with my intuitive feeling that a simple molecule like methane will not be transformed into complex chemicals such as PAH in a flame.

In light of these findings and statements in the recently released BPA Draft Environmental Impact Statement, which downplay the contribution of gas appliances on indoor RSP and BaP levels, I feel that it is misleading even to list gas appliances as a source of these pollutants. Including them along with wood stoves and tobacco smoke implies that the source

strengths are of the same order of magnitude, which is not the case. Also, since gas appliances are insignificant contributors to indoor RSP and BaP levels, venting the appliances would have insignificant impacts on indoor RSP and BaP levels. Therefore, I would suggest that you consider deleting this recommendation from the ways to reduce BaP and RSP exposure listed on page 21.

1 Finally, I question BPA's decision to declare homes with unvented gas appliances ineligible for weatherization. While I don't argue that gas combustion does not produce several substances that are considered pollutants, I do argue that gas appliances are not the worst sources of indoor pollution and that they do not deserve to be singled out by BPA. I was pleased to see that BPA's recent draft EIS covers a proposed action to remove this restriction. A.G.A. will be filing comments in support of BPA's proposed action.

I appreciate your consideration of my comments. Actually, considering the size and scope of the Issue Backgrounder, and the sensitivity of this subject, I feel it is a tribute that I have only these few points of contention. Overall, it is an objective, balanced presentation. I hope that my comments are helpful to you in your future efforts.

Sincerely,

L. A. Sarkes

Louis A. Sarkes

LAS:rco

Sarah Marie Kranz
1405 West Chestnut Avenue
Yakima, WA 98902-3830

10-25-83

Dear Mr. Morrell,

Thank you for the excellent ~~information~~ on EIS for BPA's Expanded Residential Weatherization Pgm. I learned a great deal from reading the contents; so should every one!

Would you please send the complete information to the following who have expressed interest:

1) Mark R. Kranz, Mgr.
Pay 'n Pak Store
1729 So. First St.
Yakima, WA. 98901

2) Robert M. Dew, M.D.
1015 S. 40th Ave.
Yakima, WA. 98908

2. -

I am sorry to learn of the overturn of the ban on formaldehyde foam insulation. (This must be a political move.)

Thank you.

Sincerely,

(Mrs.) Sarah M. Kranz

YAKIMA VALLEY CONFERENCE OF GOVERNMENTS

104 North 1st Street, Room B-32/Yakima, Washington 98901 (509) 575-4372 or 1-800-572-7364

October 27, 1983

Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

RE: Project # 78-3-10-4 The Expanded Residential Weatherizaiton Program

Dear Mr. Morrell:

The Yakima Valley Conference of Governments, as the District Clearinghouse for Yakima County, has reviewed the project listed above. Our Executive Committee's review indicates that the project does not conflict with regional plans and goals.

In conducting our review, the Conference of Governments followed the procedures established by the Washington State Clearinghouse System. Accordingly, the project was published in COG's monthly newsletter, which is distributed to local agencies and governments. The project notification was also sent to Washington State's Planning and Community Affairs Agency, which in turn circulated the information to district, state and federal agencies.

The Clearinghouse review is now complete. If we have received any comments on the project, they are attached to this letter. This letter, along with any attachments, should be forwarded to the funding agency with your application.

Sincerely,

YAKIMA VALLEY CONFERENCE OF GOVERNMENTS

Shirley Doty

Shirley Doty, Chairperson

SD/msm

METROPOLITAN SERVICE DISTRICT
Providing Zoo, Transportation, Solid Waste and other Regional Services

October 31, 1983

Mr. Anthony Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 97208

Dear Mr. Morrell:

Re: Areawide Clearinghouse Review
Weatherization
Metro File 839-3

Circular A-95 Revised of the Federal Office of Management and Budget requires Areawide Clearinghouse review of numerous federally assisted projects. Metro serves as the designated Areawide Clearinghouse for the Portland metropolitan area. The primary purpose of this review is to assure coordination of proposed projects with state, areawide and local plans and policies. This assists the federal agencies to allocate our federal tax dollars in a way that is as consistent as possible with local views.

The proposed project has been reviewed by interested jurisdictions and agencies within the region. It has been determined that the project does not violate any adopted regional plans or policies and appears to be consistent with existing local plans and policies. Therefore, Metro recommends favorable A-95 action on this project.

If we can be of further assistance in processing this matter, feel free to call our A-95 Review Coordinator, Mel Huie.

Sincerely,

Dan LaGrande
Public Affairs Director

DL/MCH/gl
0239C/D5

NOTE: Your organization is responsible for forwarding a copy of this letter to the federal agency that it is dealing with.

527 SW Hall St.
Portland, OR
97201
503/221-1646

Mr. Morrell;

I need more information on the polluted air + how long, etc., to open the doors to clear this air from a house in winter time. One of the workers told me to air it out, but no info. on how often. I had forgotten about it until I kept having headaches in spite of getting allergy shots. I'm taking Prednisone + Feldene for a muscle + artery disease which keeps me from having headaches normally. Also my eyes feel as if they have sand in them. I've always tried to stay inside + keep the pollution outside but I suppose I'll have to learn a new method of handling the things I'm allergic to, so if you have any pamphlets, hints, ideas or anything that might help please send them to me. The draft EIS may be of some help, I have been puzzled why I am so short of breath and some pain in chest and upper back, which heat has seemed to help. All of this may not be from the "tightened" house, but blood tests show sediment rate in test is better than it's been for years, due to medication I'm taking, which should help instead of making me feel worse.

Thank you,

Debra Arnett
1020 WEST "N" St.
Springfield, Or.
97477

RETYPED FROM ORIGINAL LETTER

Nov. 2, 1983

BPA
Environmental Manager:

As a private homeowner having weatherized under PGE's plan in 1980 and immediately becoming extremely ill, I am grateful for this attention you are giving to the health issues. We now have a fully weatherized home and are keeping windows open and a fan blowing cold "fresh?" air into our home. We had concluded a heat exchanger would perhaps be an important piece of equipment to us.

Under your present program we would not be acceptable for your total weatherization. In a way I am grateful for the weatherization because it brought to my attention a particular sensitivity to these chemicals. I am very concerned about the many air pollutants we put into our homes in building materials, carpets, paints, etc.

1 One problem you have not addressed in this meeting but that we have found to be a particular problem to our family since weatherization is mold.

Keep up the good work. Keep informing us of the hazards in our homes. I commend you and thank you for your interest.

/s/ Geraldine P. Morse
22382 S. Fellows Rd.
Beavercreek, OR 97004

OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

STATE CLEARINGHOUSE

Intergovernmental Relations Division
155 Cottage St NE , Salem, Oregon, 97310
Phone Number: 378-3732

PNRS STATE REVIEW Rec'd 9/22/83

Project #: 830920-021-4 Return Date: OCT 28 1983

ENVIRONMENTAL IMPACT REVIEW PROCEDURES

If you cannot respond by the above return date, please call to arrange an extension at least one week prior to the review date.

ENVIRONMENTAL IMPACT REVIEW
DRAFT STATEMENT

( ) This project has no si nificant environ ental impact.

( ) The environmental impact is adequately described.

( ) We suggest that the following points be considered in the preparation of a Final Environmental Impact Statement.

( ) No comment.

Remarks

We will submit our comments directly to BPA.

Agency DEQ By Maureen E. Fitzgerald

PNRS #8

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VICTOR ATIYEH
GOVERNOR

Executive Department

155 COTTAGE STREET NE., SALEM, OREGON 97310

November 1, 1983

Anthony Morrell
Environmental Manager
BPA
P.O. Box 3621-SJ
Portland, OR 97208

SUBJECT: The Expanded Residential Weatherization Plan
PNRS# OR830929-021-4

Thank you for submitting your draft Environmental Impact Statement for State of Oregon review and comment.

Your draft was referred to the appropriate state agencies for review. The Department of Environmental Quality will be submitting comments directly, which should be addressed in preparation of the final Environmental Impact Statement.

We will expect to receive copies of the final statement as required by Council of Environmental Quality Guidelines.

Sincerely,

INTERGOVERNMENTAL RELATIONS DIVISION

Dolores Streeter

Dolores Streeter
Clearinghouse Coordinator

DS:bm
Enclosure

28

FRIENDS OF THE EARTH

TESTIMONY OF THE N.W. OFFICE
FRIENDS OF THE EARTH
ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT
ON BONNEVILLE POWER ADMINISTRATION'S
PROPOSED EXPANDED RESIDENTIAL WEATHERIZATION
PROGRAM

PRESENTED TO
THE BONNEVILLE POWER ADMINISTRATION
DEPT OF ENERGY

PUBLIC HEARING
3 November 1983
Seattle, WA

Northwest office 4512 University Way NE Seattle, Washington 98105 (206) 633-1661

This is rec

28

Good Evening. My name is David E. Ortman, Conservation Representative for the N.W. office, Friends of the Earth, 4512 University Way N.E., Seattle, WA 98105. Friends of the Earth is a national environmental organization with approximately 3,000 members in WA, OR and ID.

The following are the comments of N.W. FOE on the draft environmental impact statement (EIS) on Bonneville Power Administration's (BPA's) proposed Expanded Residential Weatherization Program.

GENERAL COMMENTS

We are very pleased to note in the SUMMARY (p. i) that BPA has, fourteen years after its passage, discovered the National Environmental Policy Act (NEPA) and the regulations of the Council on Environmental Quality (CEQ). Never before have we seen such deference shown to NEPA by BPA. It is a quite a change from the normal BPA analysis which consists of a one page environmental assessment stating no significant environmental impacts will occur.

We are further impressed that, according to the SUMMARY (p. v), this draft EIS does not identify a preferred alternative. "BPA believes that public review and comment on this environmental analysis is necessary before determining the preferred alternative." This too is a welcome change, never before aeen in BPA's decisionmaking process.

1 We are less impressed with other aspects of the Reagan Administration's environmental policies which reflect directly on the matters contained in the indoor air pollution DEIS. For example, the Justice Department is refusing to take seriously the impacts from formaldehyde foam on indoor air pollution and has refused to seek a Supreme Court review

28

to reinstate a formaldehyde foam ban for home insulation. Does BPA, with its indoor air-pollution data represent the same Administration as the Justice Department?

1 Similarly, EPA has recently published unimpressive standards for air-borne radon. Is this now the same Administration calling radon a deadly indoor air pollutant? We would appreciate having a consistent Administration position on these matters.

More specific DEIS Comments are as follows:

2 SUMMARY p. viii. We would like to point out in the last paragraph that under the No-Action Alternative, while indoor air pollutant concentrations may not change due to lack of tightening measures, no corrective measures to handle this problem in new home construction would take place either.

p. 2.40. The following statement:

3 A summary of the environmental effects associated with (Formaldehyde Monitoring) is given in Table s.13. Under the Proposed Action, HCHO concentrations were estimated to exceed 480 ug/m^3 in the typical apartment and single-family attached residence. However, this estimate assumed that the typical residence had UFF1. According to Table 1.3, no appartments in the region have UFFI. Under this condition, the average concerntration in apartments is below 480 ug/m^3 and only single-family attached residences would experience HCHO concentratons above the acceptability level. In reality, any of the four residence types could have HCHO concentrations above the 480 ug/m^3 level.

may be many things, but readable and understandable it is not.

4 The bottom line is this. We support the Proposed Action to expand the present weatherization Program by providing tightening measures to all eligible electrically heated residences and to mitigate the possible increased indoor air pollutant concentrations by mitigation actions 1-3; Formaldehyde monitoring, air-to-air heat exchangers for wood stoves and radon monitoring. We request BPA

to supply us with figures showing the cost-effectivness of providing the measures set against the benefits of MW saved. In other words, 5 is it still cost-effective to weatherize using the three mitigation measures listed above? If so, than we expect to see BPA proceed with all good speed on an aggressive weatherization program.

Thank you for the opportunity to make these comments.

OSPIRG

OREGON STATE PUBLIC INTEREST RESEARCH GROUP
027 SW Arthur St
Portland, OR 97201
(503) 222-9641

COMMENTS

of

OSPIRG

on

BPA DRAFT EIS

"The Expanded Residential Weatherization Program"

presented by

ERIC STACHON

OSPIRG Energy & Utility Program Coordinator

November 2, 1983

OSPIRG

OREGON STATE PUBLIC INTEREST RESEARCH GROUP
027 SW Arthur St
Portland, OR 97201
(503) 222-9641

TESTIMONY of ERIC STACHON
OSPIRG ENERGY & UTILITY PROGRAM COORDINATOR
NOVEMBER 2, 1983

OSPIRG appreciates the opportunity to comment on BPA's proposed expansion of its weatherization program. We're also glad that Bonneville is taking a serious look at the issue of indoor air quality. We only wish that BPA had taken this kind of cautious, careful analysis before it jumped into the WPPSS fiasco. If you had, certain crises could have been avoided.

At the outset, let me say that OSPIRG acknowledges that there currently exists a problem with respect to indoor air quality in many homes in the Northwest. However, we feel very strongly that expansion of BPA's weatherization program (to those homes currently ineligible) should not be viewed as a health threat but rather as an opportunity to both improve the air quality in newly-weatherized homes and, at the same time, capturing the energy savings that otherwise would go to waste.

In its draft Environmental Impact Statement (EIS), BPA has outlined 3 options for its weatherization program: No Action (leave the program as is); Proposed Action (expand program); and Delay Action (wait 3-5 years before expanding program). For a number of reasons, OSPIRG believes that expanding the current program is the most logical, common sense approach. It is also the option that most clearly follows the main goals of the Regional Power Act - acquisition of cost-effective, environmentally sound energy resources.

1

Consider the problems with the current program - in addressing these problems, we are essentially criticizing both the No Action and Delay Action options outlined in the draft EIS.

70% of the electrically-heated homes in the region are thought to have potentially significant indoor pollution problems. Thus these homes are ineligible, under the current BPA program, for "house tightening" measures - items like storm windows, caulking, and weatherstripping.

On the surface, this approach seems to make sense. If you reduce the ventilation in homes (by installing "tightening measures) with indoor air problems, you trap the pollutants inside and increase the problem. However, actions can be taken to minimize and/or reduce these risks. These actions include monitoring and mitigation, both of which I'll touch on later in my testimony.

1

One cannot overlook the fact that indoor air pollution is a problem which exists in certain homes regardless of whether or not those homes become weatherized. By not installing house-tightening measures in these homes, you do nothing to eliminate an already existing problem. If, however, you combine these measures with a properly designed monitoring and mitigation program, you can actually increase the air quality inside these "problem" homes.

By ignoring this potential, you no doubt increase the likelihood that indoor air quality will worsen in many of these homes as homeowners act on their own to install these low-cost measures. In fact, I heard a story on the radio just 2 days ago (10-31-83) that over 50% of home remodeling jobs in the US are done by the homeowners themselves. 10 years ago, this figure was less than one-third; 10

years from now, it is expected to be over two-thirds. One can assume that a major factor in this trend is the cost savings of "doing it yourself". As energy costs increase, so will the number of homeowners who install "tightening" measures on their own. It is probable that an overwhelming number of these homeowners will not install either monitoring or mitigation measures. The problems here are twofold: greater health impacts for these homeowners and energy savings that BPA cannot accurately predict - savings which may not allow BPA to defer obligating the region's ratepayers to pay for costly power from thermal plants.

That brings me to another problem with the current program: the potential energy savings that go "uncaptured". According to BPA's own estimates, 74 average megawatts of energy savings will be lost to the region by not expanding upon the current program. Whatever the replacement resource - hydro, coal, or nuclear - significant health and environmental impacts will result. Of course, all of these resources are more expensive than conservation. Thus, the region's ratepayers suffer financially as well.

Finally, there's the conflict with other existing conservation programs and current Oregon law. The conflict and confusion that result send a mixed signal to the consumer - they don't know how or if they're supposed to conserve. Needless to say, the credibility of BPA and participating utilities is not enhanced under the status quo.

Again, we cannot overemphasize what we see as the dual benefits of expansion of the weatherization program: the opportunity to both increase energy savings and enhance the air quality in homes currently excluded from the BPA program.

The most effective way of ensuring adequate air circulation in "tightened" homes is the installation of air-to-air heat exchangers. According to the Model Power & Conservation Plan developed by the Northwest Conservation Act Coalition, it is cost-effective to install heat exchangers in all weatherized homes. However, this is probably not necessary and OSPIRG is not suggesting that this be done. Inexpensive monitoring devices are available to measure radon, formaldehyde, and nitrogen dioxide levels. These monitors should be installed in homes in which any of these pollutants may be a potential problem. Heat exchangers should be installed in those homes which, after monitoring, have been identified as having air quality problems.

2

As for electrically-heated homes with wood stoves, we recognize the problem with combustion particles as a health hazard. At this time, we would recommend heat exchangers for all homes with wood stoves under the BPA program. The increased installation of wood stoves in the Northwest represent a trend that cannot be ignored. A sizeable number of these installations have probably been done in ways which exacerbate the air quality problem. These homes, more than any others in the region, represent that opportunity that I have referred to several times in my testimony - the ability to both increase indoor air quality and achieve significant energy savings. Until some type of effective monitoring program can be developed, we think it more prudent to weatherize & mitigate than to continue excluding these homes.

In summation, I would repeat our position that BPA has an opportunity here to achieve 2 goals consistent with those of the Regional Power Act - to acquire cost-effective resources with

page 5 - OSPIRG TESTIMONY on INDOOR AIR QUALITY EIS

minimum impact upon the environment.

We have not addressed technical questions like, "What's a safe level (in parts per million) of exposure to formaldehyde?" For us, the more significant question is one of policy - "How serious is BPA in carrying out the priorities of the Regional Power Act?"

Certainly there are technical concerns, but in this case there are no technical limitations. The fact is that measures exist to help solve the problem of indoor air quality. The bottom line is to what extent Bonneville is prepared to slice through its bureaucratic inertia to deal with the situation. The clock is ticking and we're running behind. We need to act now if we want to catch up.

REMARKS OF CITY COMMISSIONER MIKE LINDBERG
BPA PUBLIC HEARING, NOVEMBER 2, 1983
RESIDENTIAL WEATHERIZATION PROGRAM AND INDOOR AIR QUALITY

I APPRECIATE THE OPPORTUNITY TO SPEAK WITH YOU TONIGHT ON THE SUBJECT OF BPA'S FUTURE RESIDENTIAL WEATHERIZATION PROGRAM AND THE ENVIRONMENTAL IMPACT STATEMENT ADDRESSING INDOOR AIR QUALITY.

BEFORE I COMMENT ON THE SPECIFIC PROGRAM OPTIONS AND RECOMMENDATIONS CONTAINED IN THE EIS, I WOULD LIKE TO STEP BACK FOR A MOMENT AND REFLECT ON THE LARGER CONTEXT OF REGIONAL RESIDENTIAL CONSERVATION ACTIVITIES AND INDOOR AIR QUALITY.

FROM THE FIRST TIME I BECAME AWARE OF THE ISSUE OF INDOOR AIR QUALITY PROBLEMS RESULTING FROM CONSERVATION, I QUESTIONED BPA'S MOTIVATION FOR DELAYING FULL PROGRAM DEVELOPMENT AND UNDERTAKING SUCH AN IN-DEPTH ANALYSIS. TO A LARGE EXTENT, I AM STILL CURIOUS ABOUT WHAT IS DRIVING BONNEVILLE TO SUCH GREAT LENGTHS TO EXAMINE AND PUBLICIZE AN ISSUE WHICH HAS BEEN ACKNOWLEDGED AS A POTENTIAL PROBLEM, BUT

WHICH APPEARS ALSO TO HAVE A NUMBER OF CLEAR SOLUTIONS. THESE SOLUTIONS APPARENTLY SATISFY THE POWER PLANNING COUNCIL AND OTHERS IN THE REGION, IF NOT THE NATION. NO ONE DISPUTES THE APPARENT FACTS THAT THE PUBLIC MAY REQUIRE PROTECTION. SUCH PROTECTION CAN BECOME AN INTEGRAL PART OF ANY WEATHERIZATION PROGRAM, AND NOT BECOME A REASON FOR THE ELIMINATION OR REDUCTION OF RESIDENTIAL WEATHERIZATION EFFORTS.

FOR EXAMPLE, HOW IS IT THAT SINCE 1977, THE OREGON LEGISLATURE HAS CONTINUALLY REQUIRED UTILITIES TO PURSUE FAR MORE AGGRESSIVE ENERGY CONSERVATION PROGRAMS FOR THEIR RESIDENTIAL CUSTOMERS THAN THAT
1 WHICH IS BEING DEFINED NOW BY BPA? THE STATE'S PROGRAM HAS ALLOWED, AND EVEN NOW ALLOWS FOR THE INSTALLATION OF "HOUSE TIGHTENING MEASURES" WHICH ONLY BPA EXCLUDES.

BPA ATTESTS THAT THE POWER COUNCIL IS NOT A FEDERAL AGENCY AND THEREFORE DOES NOT FALL UNDER THE REQUIREMENTS OF THE NATIONAL

ENVIRONMENTAL ~~PROTECTION~~ POLICY ACT. HOWEVER, WHY IS IT THAT OTHER FEDERAL AGENCIES, SPECIFICALLY THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT AND THE DEPARTMENT OF ENERGY, HAVE MANAGED TO PROVIDE HOUSE TIGHTENING AND OTHER WEATHERIZATION SERVICES FOR THE NATION'S RESIDENTIAL HOMEOWNERS AND APARTMENT DWELLERS FOR THE LAST SEVEN YEARS? HOW
1 IS IT THAT THESE OTHER FEDERAL AGENCIES DO NOT COME UNDER THE SAME NEPA REQUIREMENTS AS BPA WHEN IT COMES TO ENSURING THAT ENERGY IS SAVED IN THE RESIDENTIAL SECTOR? OUR OWN SUCCESSFUL PORTLAND ENERGY SAVING CENTER PROGRAM HAS BECOME A NATIONAL MODEL FOR FINANCING HOME WEATHERIZATION, AND THIS PROGRAM HAS BEEN EXCLUSIVELY FUNDED BY HUD, WHICH, WHEN LAST I CHECKED, WAS STILL A FEDERAL AGENCY.

NATIONALLY, BPA IS THE ONLY AGENCY TO HAVE SPENT THIS MUCH TIME AND MONEY EXAMINING THE ISSUE OF INDOOR AIR QUALITY, AT THE EXPENSE OF UNDERTAKING A FULL-BLOWN RESIDENTIAL CONSERVATION PROGRAM. I CAN'T HELP BUT NOTICE THAT BPA IS ALSO THE LAST OF ALL SUCH PURVEYORS OF WEATHERIZATION SERVICES TO COME ON BOARD. I WONDER WHETHER BPA

WOULD DEVOTE THIS MUCH TIME TO THE ISSUE OF INDOOR AIR POLLUTION WERE IT NOT FOR THE CURRENT ELECTRIC POWER SURPLUS, THE RECESSION, OR PERHAPS WPPSS. IF BONNEVILLE EMBRACED CONSERVATION WHOLEHEARTEDLY, IT COULD CHOOSE TO EMPHASIZE SOLUTIONS TO INDOOR AIR QUALITY PROBLEMS, AND NOT PUBLICIZE DANGER AND RISK PUBLIC BACKLASH OVER THE BENEFITS OF CONSERVATION. SOMEBODY, SOMEWHERE IN BPA DISCERNED THAT REPEATED PLACEMENT OF ONE-QUARTER PAGE ADVERTISEMENTS IN THE PAPER ON THE "POTENTIAL HEALTH EFFECTS" OF HOME WEATHERIZATION WAS MORE IMPORTANT FOR THE PUBLIC TO KNOW ABOUT THAN AN EIS ON A WPPSS PLANT, OR AN EIS ON UPGRADING A 700 KILOWATT LINE TO 800 KILOWATTS, NEITHER OF WHICH HAD COMPARABLE PUBLICITY IN THE REGION'S DAILY NEWSPAPERS.

PUTTING ASIDE THIS CURIOSITY ABOUT WHY THIS EIS ON CONSERVATION IS MADE MORE VISABLE TO THE PUBLIC THAN ANY OTHER TO DATE, I WILL ADDRESS ITS CONTENT. BPA IDENTIFIED THREE POSSIBLE COURSES OF ACTION IN THE EIS: NO ACTION, DELAYED ACTION AND PROPOSED ACTION. NO ACTION IS NOT AN ALTERNATIVE TO ME. NOT WITH THE POWER PLANNING COUNCIL'S

PLAN DIRECTIVES AND NOT WITH THE TRACK RECORD AND EXPECTATIONS ALREADY CREATED IN THE RESIDENTIAL SECTOR. RESIDENTIAL PROGRAMS HAVE BEEN, AND WILL CONTINUE TO BE, IMPORTANT SOURCES OF CONSERVATION SAVINGS. SOME LEVEL OF EFFORT MUST BE MAINTAINED AND ESCALATED AS THE CURRENT SURPLUS OF POWER DIMINISHES.

AS THE EIS STATES, DELAYED ACTION DOES NOT NECESSARILY GUARANTEE THAT ADDITIONAL OR DIFFERENT INFORMATION WILL BECOME AVAILABLE THAT WILL ALTER THE INDOOR AIR QUALITY CONCLUSIONS RESULTING FROM THIS EIS. IF SUCH A PROGRAM OPTION WERE SELECTED, THE COSTS OF RE-STARTING THE PROGRAM WOULD SPAN EVERY ASPECT FROM PUBLIC UNDERSTANDING AND ACCEPTANCE OF THE NEED TO CONSERVE ENERGY TO HAVING THE ENERGY SAVINGS "ON-LINE" WHEN THEY ARE NEEDED. THE TRADE-OFF WOULD BE THE CREATION OF MANY MORE IMPLEMENTATION PROBLEMS, WITHOUT ANY ASSURED SOLUTIONS FOR INDOOR AIR QUALITY BEYOND THOSE ALREADY KNOWN.

2 I AM IN SUPPORT OF THE PROPOSED ACTION RECOMMENDATION, PROVIDED THAT THE COUNCIL'S RECOMMENDATIONS FOR MITIGATING INDOOR AIR QUALITY

POLLUTANTS ARE FOLLOWED IN CONJUNCTION WITH THE IMPLEMENTATION OF ANY RESIDENTIAL BPA WEATHERIZATION PROGRAM. LIKE BPA, THE COUNCIL IS CONCERNED ABOUT INDOOR AIR QUALITY IMPACTS OF RESIDENTIAL 2 WEATHERIZATION PROGRAMS. THE COUNCIL'S SOLUTION IS WHAT NEEDS TO BE EMPHASIZED, AND IT DOES COINCIDE WITH ONE OF THE MITIGATION ACTIONS IDENTIFIED IN THE EIS. THE POWER PLAN READS:

> "THE COUNCIL DECIDED THAT HEAT EXCHANGERS COULD ADEQUATELY MITIGATE THESE AIR QUALITY IMPACTS IN THAT THEY PROVIDE ADEQUATE VENTILATION WITHOUT SACRIFICING MUCH HEAT... WITH THIS MITIGATION, THE COUNCIL BELIEVES THAT CONSERVATION IS ATTRACTIVE FROM AN ENVIRONMENTAL PERSPECTIVE."

UPON FURTHER CHECKING WITH THE POWER PLANNING COUNCIL, I CONFIRMED THAT THE INCLUSION OF AIR-TO-AIR HEAT EXCHANGERS AS PART OF THE RESIDENTIAL WEATHERIZATION PROGRAM WOULD NOT JEOPARDIZE THE OVERALL COST-EFFECTIVENESS OF THIS EFFORT.

AS PART OF THE PROPOSED ACTION RECOMMENDATION, I WOULD ALSO SUPPORT 2 BPA MONITORING OF THE HOMES WHICH ARE RETROFITTED TO RESIDENTIAL PROGRAM STANDARDS. COUNCIL PLAN ACTION 1.8 READS:

> "BONNEVILLE SHALL DESIGN AND IMPLEMENT A RESEARCH PROGRAM TO ASSESS (A) THE EFFECT OF REDUCED AIR INFILTRATION IN WEATHERIZED HOMES ON THE PRESENCE OF INDOOR AIR POLLUTANTS, AND (B) THE EFFECTIVENESS OF MITIGATION TECHNIQUES."

I NOTE THAT THE COUNCIL'S PLAN DOES NOT MENTION ANYTHING ABOUT NO ACTION OR DELAYED ACTION IN THE RESIDENTIAL SECTOR.

I AM CONCERNED OVER THE LIST OF SEVEN ITEMS WHICH THE EIS IDENTIFIES AS "MITIGATIONS-BY-EXCLUSIONS". FIRST, I AM PUZZLED BY THE DESCRIPTIVE TITLE, FOR THIS IS NOT REALLY A LISTING OF "MITIGATIONS" AT ALL, BUT INSTEAD A LISTING OF CONDITIONS WHICH WOULD ALTOGETHER ELIMINATE PARTICIPATION OF 70% OF THE REGION'S RESIDENTS. SECOND, I AM NOT CLEAR FROM THE READING OF THE EIS, BUT I AM ASSUMING THAT ONLY ONE

OF THESE CONDITIONS NEED BE PRESENT IN A HOME BEFORE BPA WILL EXCLUDE THAT HOME FROM THE BENEFITS OF RESIDENTIAL WEATHERIZATION. IT SEEMS THAT THE MEASURES BEING PROPOSED AND DESCRIBED AS "MITIGATION ACTIONS" ARE WHAT DESERVE EMPHASIS OVER "MITICATION-BY-EXCLUSION." I WOULD HOPE THAT INCLUDING THESE MITIGATION ACTIONS WOULD ALLOW FOR INCREASED PARTICIPATION OF THOSE WHO ARE NOW EXCLUDED UNDER "MITIGATION-BY-EXCLUSION."

IN PARTICULAR, I AM THINKING OF "MITIGATION-BY-EXCLUSION" CRITERIA NUMBER 7, RELATING TO APARTMENTS. IT IS UNCLEAR TO ME AS TO WHAT INFORMATION THERE IS FOR IDENTIFYING POLLUTANT CONCENTRATION LEVELS IN APARTMENT BUILDINGS AS HIGHER THAN SINGLE-FAMILY HOMES. I WOULD FIRST WANT MORE INFORMATION AS TO WHY THIS CONCLUSION WAS DRAWN, AND THEN MORE ATTENTION PAID TO WAYS OF PROTECTING AGAINST THIS HIGHER POLLUTANT LEVEL. A BLATANT DISMISSAL OF SUCH A LARGE CATEGROY WITHIN THE RESIDENTIAL SECTOR IS SIMPLY NOT ACCEPTABLE.

THE PROBLEMS WITH WEATHERIZING THE MULTI-FAMILY SECTOR ARE ALREADY MANY, WITHOUT THE ADDED DISADVANTAGE OF INDOOR AIR QUALITY PROBLEMS. IS IT NOT TOO PREMATURE TO CONCLUDE THAT THERE ARE NO IDENTIFIABLE MITIGATION MEASURES FOR NEARLY HALF OF THE RESIDENTIAL POPULATION OF THE PACIFIC NORTHWEST WHICH HAPPENS TO DWELL IN MULTI-FAMILY HOUSING? CAN WE AFFORD TO ADD A TECHNICAL PROBLEM TO A LIST OF ECONOMIC AND SOCIAL PROBLEMS ALREADY FACING THOSE IN OUR MIDST WHO ARE LEAST SERVED BY CONSERVATION AND WHO NEED THE ENERGY AND DOLLAR SAVINGS THE VERY MOST?

BONNEVILLE WOULD BE HARD-PRESSED TO JUSTIFY THE EXCLUSION OF THIS MUCH OF THE POPULATION ON THIS BASIS ALONE, PARTICULARLY IN LIGHT OF THE COUNCIL'S DIRECTIVE FOR EQUALITY OF SERVICE FOR ALL RESIDENTIAL CUSTOMERS. NOR WOULD THE COUNCIL'S CONSERVATION TARGETS EVER BE REALIZED WITHOUT THE INCLUSION OF THE MULTI-FAMILY HOUSING STOCK.

AS I AM RECITING THESE COMMENTS, I QUESTION WHETHER ANY OF THEM HAVE ANY RELEVANCY GIVEN THE EVENTS OF THE LAST FEW WEEKS.

BPA'S FORECAST HAS BEEN CRITICIZED, THE CONGRESS IS ACTIVELY ON THE TRAIL OF BPA'S REPAYMENT OF THE FEDERAL DEBT ON THE HYDROELECTRIC SYSTEM, AND THE OFFICE OF MANAGEMENT AND BUDGET HAS CUT $50 MILLION FROM BPA'S CONSERVATION PROGRAMS. I COULD ACCEPT ALL OF THIS AS BAD NEWS, IF THE WORST NEWS HADN'T COME TWO DAYS AGO, NAMELY THE LACK OF REGIONWIDE PARTICIPATION BY THE MAJOR UTILITIES IN BPA CONSERVATION PROGRAMS.

WE MAY SIT HERE SURMISING THE PROBLEMS OF INDOOR AIR QUALITY AS THEY AFFECT ONE RESIDENTIAL WEATHERIZATION PROGRAM, BUT THE GUTS OF REGIONAL POWER ACT ARE SPILLING OVER EVERY UTILITY, BUSINESS, RATE-PAYER AND CITY IN THE REGION. ONE BPA STAFF PERSON DESCRIBED BONNEVILLE YESTERDAY AS "RECOVERING FROM THE SHOCK OF THE INVESTOR-OWNED UTILITIES NOT PARTICIPATING UNDER LONG-TERM BPA CONSERVATION CONTRACTS." SHOCK?! THE UTILITIES HAVE REPEATEDLY IDENTIFIED CONCERNS OVER THOSE CONTRACTS SINCE LAST MAY, AND THE NEWS OF THEIR UNWILLINGNESS TO PARTICIPATE UNDER BONNEVILLE'S RULES IS ANYTHING BUT A SURPISE.

I SUBMIT THAT THE OVERALL, LONG-TERM CONSEQUENCES OF LOSING A COOPERATIVE REGIONAL APPROACH TO PLANNING FOR FUTURE ENERGY NEEDS THROUGH REGIONWIDE PARTICIPATION IN BPA CONSERVATION PROGRAMS FAR OUTWEIGH ANY CONSEQUENCES FROM PROCEEDING WITH THE IMPLEMENTATION OF A RESIDENTIAL WEATHERIZATION PROGRAM WHICH INCORPORATES AIR-TO-AIR HEAT EXCHANGERS. WITHOUT THE OPPORTUNITY TO PLAN TOGETHER TO MEET THIS REGION'S ELECTRIC ENERGY FUTURE, WE MOST SURELY WILL REGRESS TO INDEPENDENT ACTIONS WHICH WILL ALLOW FOR THE CONSTRUCTION OF THERMAL POWER PLANTS AND WITH THAT, ALL OF DOCUMENTED ENVIRONMENTAL DEGRADATION THAT GOES WITH THEM. THE CUMULATIVE IMPACT OF THIS APPROACH WILL BE FAR GREATER THAN ANY MISSED OPPORTUNITY ENVISIONED BY CONGRESS AND UPHELD BY THE POWER PLANNING COUNCIL WHEN THE REGIONAL ACT BECAME LAW THREE YEARS AGO.

LET US HOPE THAT BONNEVILLE WILL DEVOTE ALL THE TIME AND RESOURCES NECESSARY TO RECONCILE RELATIONSHIPS WITH THE REGION'S UTILITIES, AND ALLOW FOR THE BENEFITS OF THE REGIONAL POWER ACT TO FLOW TO THE

REGION'S BUSINESSES, RESIDENTS AND CITIES. LIKE THE CONSERVATION CONTRACT CHARGE, NEPA CAN READILY BE CONSTRUED AS AN OBSTACLE AND LIMITATION TO THE ACHIEVEMENT OF CONSERVATION,A REASON WHY CONSERVATION WILL NOT BE PURSUED AS ORIGINALLY INTENDED UNDER THE REGIONAL ACT. IT NO LONGER BECOMES A QUESTION OF WHETHER BONNEVILLE REACHES 30% OR 85% OR 100% OF THE REGION'S RESIDENTS, WHEN BONNEVILLE HAS ONLY A HAND-FULL OF THE REGION WORKING WITH IT FOR THE ACHIEVEMENT OF CONSERVATION GOALS. THE RESOLUTION FOR PROCEEDING WITH THE RESIDENTIAL WEATHERIZATION PROGRAM IS COMPARATIVELY SMALL AND IN-HAND. NEGOTIATING THE LARGER POLITICAL AND ECONOMIC SOLUTIONS TO REGIONAL UNITY ARE WHAT NEED BPA ATTENTION, FLEXIBILITY AND LEADERSHIP NOW.

THANK YOU.

Unity Light & Power
P.O. BOX 1247
Burley, Idaho 83318

Re: Comments on Draft EIS

Dear Sirs:

My comments on the draft of the EIS will deal primarily with some of the problems we foresee involved in the implementing of additional energy saving measures at this date in the Present Program.

The major concerns to deal with as we see them are these;

1. Production and Sale of power at the lowest possible rate.
2. Making the end use consumer aware of the advantages and risks involved in the weatherizing, and specifically the tightening of his residence.
3. To determine whether or not the additional energy -30%- is economically sound or even necessary at this point in time.

Production of Power

After participating in the Pilot Program, the Short Term Program, the present Long Term Program, and after an evaluation of the EIS, we are convinced that both insulating and house tightening are viable methods of conserving electricity. It is also clear that conservation can be the least expensive alternative source of additional power production. It appears that it would also be the cleanest method of production . It is certain that conservation, all things considered, would have the least impact on the overall environment, of all sources of production. All this can only be true however if costs of handling such programs are accurate and the results are predictable, both of which seem to be difficult to achieve. The question to be answered at this point then is, is adding more energy saving measures to the present ones, (ie.) house tightening measures, going to help current rates remain stable during a period of power surplus? We feel that this is not the time to increase that surplus through additional conservation. 1

In the event however that economic change creates the need for the extra 74 MW's of power or a portion thereof, house tightening seems to be a good means of providing it. That will bring us to our second concern.

Making the Consumer Aware

As a utility we were involved in the Pilot Program. Consequently we weatherized many homes, without knowing the total impact that the installed measures, including house tightening, might have on our consumer. At the time we were schooled to thought that the affects would be minimal. Of those involved in the Pilot Program we have had no complaints about health problems created from tightening their residences. This evidence is inconclusive by itself, but it does show that the homeowner, who is now aware of some of the risks involved is not overly concerned. Through information attainable from the utility the homeowner can find out how to resolve his IAQ problems. If printed information is also available on the subject it can be distributed.

Our feelings after examining the EIS draft is that the additional health risks are not that great. We also feel that the homeowner being the independent sort that he is will create the indoor environment that he feels he can best live with . In other words whether we help him or not he will still have his house how he wants it, with a wood stove ,kerosene heater or whatever. So why exclude him from helping in the conservation effort.

2 We feel that there are few decisions left to be made by the consumer in his participation in conservation. Because of this it seems clear that the decision of living with the inherent risks involved should definitely be left only to the homeowner, who being informed can feel responsible for his own decision. The question to resolve now is. How can we inform the consumer without stifling the advantages or belittling the risks? To this we have no real answer.

The consumer may best participate in the conservation effort if he feels that he is contributing to the overall stability of the rate he pays for his electricity. His means of understanding his position in the concern is through the utility representative and the local media. Quite often however, these seem to contradict each other. As an example, the utility says that we must conserve to stabilize the rates. The media in turn says that conservation is what is driving the rates up. We feel that we are doing our part from the utility standpoint. The media dwells on the fact that conservation costs everyone right now but fails to recognize the fact that it also may be the means of keeping electricity flowing in future times. It seems that utilities , especially small ones will have a big problem diseminating the whole story to the public. This is where BPA may be able make major contributions. Before approaching this problem however we must address a third one.

3 To determine whether the additional enrgy savings created by house tightening -30%- is economically sound or even necessary at this point in the program.

We have participated now for some time in the conservation effort. We still feel somewhat compelled to lower power production costs through properly timed conservation of our present sources of electricity. We also feel compelled because of the BPA being mandated to produce power through conservation. Both of these efforts should be aimed at gaining the most for the production dollar spent.

In any case,the point to be made is this. We are required to conserve in a time of excess. If we control the timing of the introduction of house tightening measures into the present program, it will prevent adding to those surpluses and the problem of selling those same surpluses. If we cannot control such timing, then the ultimate decision, as to house tightening, should lie completely with an informed individual homeowner.

Sincerely,

Merlin L. Wilson
Conservation Specialist

John L. Jones
Manager
Unity Light & Power

November 7, 1983

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Dr. Morrell:

Re: Draft Environmental Impact Statement: The Expanded Residential Weatherization Program

Thank you for sending a copy of the Draft Environmental Impact Statement of the Expanded Residential Weatherization Program. I am a research architect and director of building research for Theodor D. Sterling Limited, a Vancouver based firm. I am a professional member of the Canadian General Standards Board Committee on Test Measures for Air Quality in Buildings and am also a consulting member of the American Society of Heating, Refrigeration and Air Conditioning Engineers Special Projects Committee reviewing Standard 62-1981 "Ventilation for Acceptable Indoor Air Quality". Since 1977 I have been involved in various studies including those conducted by the Lawrence Berkeley Laboratory monitoring the effects of indoor air quality upon occupant comfort in homes and office buildings in California and more recently similar studies of health and comfort of building occupants conducted by Theodor D. Sterling Limited in New York City and Vancouver, British Columbia.

1 I have severe reservations regarding the Expanded Residential Weatherization Program proposed by the Bonneville Power Administration (BPA). After reviewing the three alternatives as described I see no evidence to support any but the No Action Alternative and therefore recommend that no action be taken. It is my understanding that the present BPA Weatherization Program excludes certain types of residences from receiving air infiltration reducing (tightening) measures due to the results of an Environmental Impact Assessment, which indicated that as a result of proposed tightening measures indoor air pollutant concentrations would rise, increasing the risk of adverse

2 health effects to occupants to some weatherized residences. Considering that the original concern was with risks of adverse health effects associated with elevated indoor levels of pollutants it would

.../2

TDS THEODOR D STERLING LIMITED
SUITE 70, 1507 W. 12th AVENUE, VANCOUVER, B.C., CANADA V6J 2E2 (604) 733-2701

seem to be incumbent on the BPA to seek the advice of the health community in this matter. However, upon reviewing Appendix 5 "List of Preparers" of the Draft Environmental Impact Statement of the Expanded Residential Weatherization Program, I see no medical expertise, epidemiologists, or physiologists listed. Further, apparently no public health agencies were involved or even consulted prior to preparation of the draft document. 2

It would be in the best interests of the Pacific Northwest community for BPA to undertake yet another environmental impact statement, this time seeking the advice of the health community.

In addition to inadequately addressing potential health effects, the Draft Environmental Impact Statement also contains certain assumptions which may have been nothing more than conjecture at best and wishful thinking at worst. Two examples of concern include: 3

1. In general, houses will not be as tight as predicted after weatherization, and
2. People who have mechanical ventilation systems (ie. exhaust fans) use them when using a gas appliance.

To my knowledge there is little or no data available to support either of these very important assumptions.

The justification for increasing health risks to a large proportion of the Pacific Northwest population appears to be primarily economic. There is some strength to this argument particularly in light of predicted future shortages of energy. However, a decision to increase health risks must have firm basis in scientific and technical data. The Draft Environmental Impact Statement does not provide this basis. The action proposed has potentially far reaching consequences to public health and well being in the Northwest. I suggest that the Pacific Northwest community is not well served by the Draft Environmental Impact Statement of the Expanded Residential Weatherization Program. Thus, no action should be taken.

Sincerely,

Elia M. Sterling
Director of Building Research

EMS/ddp

cc: W.F. Sandusky

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GENE M. ERBSTOESSER *Manufacturers Representative*

3218 - 17TH AVE. SO. - SEATTLE, WASH. 98144 - TELEPHONE EAST 2-8766

7 Nov 1983

Mr. Anthony R. Morrell, Environmental Mgr.
Bonneville Power Administration
PO Box 3621-SJ
Portland, Or. 97208

Dear Mr. Morrell:

Both Frank Brown and Rusty Alton of the BPA have informed me that you are the person to whom I should write requesting a one week extension of the November 14th deadline for receiving public comments on the draft EIS for the Expanded Residential Weatherization Program. Consider this a formal request for such an extension.

Erbstoesser Sales Co. will be submitting a somewhat detailed statement requesting that mechanical filtration, and specifically, Rush-Hampton Indoor Air-Treatment Systems, be given a lot more thorough consideration as a mitigation-by-action alternative to air-to-air heat-exchangers. Section 2.17 of the EIS virtually writes off anything except heat-exchangers as a mitigation-by-action solution. This is unfair. The public, the BPA, and local utilities all need to be aware that cost-effective alternatives are available. With 300,000 or so [illegible] residences being possible candidates for receiving some sort of air treatment devices, no one involved can afford to dismiss a whole industry (mechanical filter fans for treatment of indoor air pollution) with such short shrift as does section 2.17 of the EIS. 1

The technical and legal people at Rush-Hampton Industries also will be generating a rather detailed statement to be included in the final EIS, and again due to the late date at which we entered the process, will also need a one-week extension. Their statement will be separate from mine , but both myself and our factory need and hereby request the one-week extension.

Please call me if this presents a problem.

Sincerely,

John S. Erbstoesser

AIRXCHANGE

November 9, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SF
Portland, OR 97208

Dear Mr. Morrell:

Thank you for the opportunity to review the draft environmental impact statement for the BPA Expanded Residential Weatherization Program. We view the E.I.S. as a significant contribution toward recognition of the adverse affects of indoor air pollution that has existed since man started his first fire in a cave, and we are pleased to offer a few comments for your consideration as follows:

1. Energy conservation efforts and energy efficient housing designs implemented after 1973, reduced air infiltration rates from the order of one or more air changes per hour to one half or less as the most cost effective means to reduce the twenty five to fifty percent of total energy consumed to heat or cool a home. Had the adverse health effects of such action been documented in 1973, it is reasonable to believe that responsible agencies and home suppliers would have looked for a means to maintain ventilation rates but at reduced energy costs, rather than to simply reduce ventilation in order to save energy. The E.I.S. and proposed weatherization program indirectly validate the policy of reduced ventilation in that mitigation by action provides an amount of energy efficient ventilation only equal to that lost by any one or all of the seven conservation measures in those homes already believed to have inadequate ventilation. It is our recommendation that all such homes should be offered mitigation by action with a minimum amount of at least .7 air changes per hour (energy cost of .18 air changes per hour) so that revised E.I.S. calculations could show an improved environment for all existing and proposed actions, rather than a degraded environment.

1

AIRXCHANGE, INC. • 30 POND PARK ROAD • HINGHAM, MA 02043 • (617) 749-8440
HEAT RECOVERY AND VENTILATION PRODUCTS

Mr. Anthony R. Morrell
Page two
November 9, 1983

Although not submitted as scientific evidence, the two enclosed testimonials to one air change per hour (at an energy cost of .25 ACH) speak most eloquently to this point and indicate the type of goodwill that could further accrue to your program.

2. Although the E.I.S. documents cancer incidents from specific concentrations of three pollutants, and cites symptoms from other pollutants, we do not believe that it adequately addresses the overall environmental impact that reduced ventilation has on both health and comfort. For example, the E.I.S. estimates cancer incidents for formaldehyde, but makes no reference to the effect of formaldehyde on the central nervous system, circulatory system, respiratory system or eye irritation, all of which are well documented. Also not included are excessive indoor moisture levels that can result in structural damage and fungal growth with attendant health problems and increased indoor airborne infection resulting from decreased ventilation. We believe that the inclusion of clinical data within the E.I.S. showing a wide range of chemical sensitivity among the general population would further dictate against reduced ventilation without mitigation by action.

2
3

3. The E.I.S. lists a median installed cost of $650 for air-to-air heat exchangers. We believe that this figure should be closer to $550 in light of the current recommended list price of $450 for 70 to 200 CFM ducted units. Window or wall mounting of units as well as volume production in a growing and competetive market should result in further substantial reductions of equipment and installation costs.

4

In summary, we believe that any weatherization program and E.I.S. in support of such a program, should attempt to wring the maximum public benefit from each dollar spent. Dr. Jonathan Miller, the noted author and scientist, observed that the doubling of human life span in the past two centuries is almost solely attributable to improved nutrition, drainage and ventilation. We believe the conflicting interests of health, energy and comfort can best be reconciled by provision of energy efficient ventilation over which the occupant can exercise control to meet his particular health and comfort needs. Our sincere belief in this premise is our corporate reason for being.

Thank you again for this opportunity to comment.

Sincerely,
AIRXCHANGE, INC.

Donald F. Steele
President

MEMORANDUM March 2, 1983

TO: Bill Butterworth

FROM: Ed Steele

SUBJECT: Installation - Thomas Eldridge mobile home - Ola, Arkansas, February 26, 1983

This home is a single wide 3 bedroom 14 x 76, approximately one year old. Stains are evident around the perimeter from roof condensation, and the windows have condensation on them every day. The owners use the stove exhaust fan whenever cooking and open windows for ventilation when weather permits. The dryer is exhausted outside the skirt. There are six adult occupants, two of them smokers. Mr. Eldridge has had heart by-pass surgery and experiences breathing difficulties. His 24 year old daughter has allergies causing constant eye and nose irritation.

The inside relative humidity at 10:15 am was 69% -outside relative humidity 44%.

Our unit was installed in the master bedroom walk-in closet following Airxchange retrofit installation instructions. All windows were closed at 2:30 pm to stabilize indoor conditions. Our unit was turned on at 3:30 pm. The relative humidity at this time was 57%. The following data was taken:

	3:45p	4:05p	4:30p
O.S. Air (at intake)	50	49	48
I.S. Air (at unit)	72	71	70
Supply Air (at Grille)	66	67	67
Dry Bulb Kitchen	72	74	73
Wet Bulb	62	60	58
R. H.	57%	44%	40%

Note: The increase of dry bulb temperature at 4:05 p was caused by increased people in the kitchen and a pot of coffee made.

When we left the job, Mr. Eldridge was pleased with the installation. He commented on how quiet the unit was when operating and the fact that there were no drafts caused by the unit.

2/27/83 - Called Mr. Eldridge at 9:30 am. He ran our unit on low speed overnight. He reported no moisture for the first time on the windows. Wet area on ceiling over sink was drying up. He also reported the family felt a very noticeable change in the air. His daughter had best night sleep in a long time. Her eye and nose irritation was clearing up. He was very pleased.

III-34

RECEIVED

MAR 1 3 1983

AIRXCHANGE

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Thomas and Jean Eldridge,
Box 141,
Ola, Arkansas, 72853.

Dear Mr. Steel,

We just wanted to let you know how happy we are to have AirXchange in our home. I don't believe we have ever owned anything which worked so well, and does it's job so efficiently. As you know we had a big problem with condensation in our home, and this has all been taken care of by the AirXchange unit. We no longer have this problem, even the storm windows stay completely moisture free on cold nights. There were many other added benefits from this unit, we thought we just had to let you know how we felt about AirXchange. Two of our children had asthma as small children, and are still sensitive to many things in the air, such as pollens and cigarette smoke, and odors from synthetic materials. Just a few hours after the AirXchange unit was installed our daughter could tell the difference in the air, and our son who is prone to bronchitis, has a much easier time breathing. These were benefits we had not been expecting, and so we are delighted with these results! The air inside the house is fresh and clean, even cooking odors don't linger. We just wanted you to know how happy we are with AirXchange, and would highly recommend it to anyone. We can do nothing but praise AirXchange for the great job it does.

Thank you for a truly wonderful product!

Yours sincerely,

Thomas and Jean Eldridge.

Thomas Eldridge

and

Jean Eldridge

MEMORANDUM May 10, 1983

TO: C. W. Butterworth

FROM: Bill Steele

SUBJECT: Installation of Airxchanger unit in a mobile home in Juneau, Alaska

The enclosed pictures depict the severe moisture problem in the mobile home prior to the installation of an Airxchanger unit; you can see the ceiling stains which were general wherever the ceiling met an outside wall. Additionally, the heavy accumulation of condensate on the inside of the windows is evident; this moisture has dripped down onto the interior sill and delamination has started.

May 3rd: The weather that morning was: estimated 400 ft overcast, steady light rain, temperature (at 10 a.m.) 45°F, wet bulb temp. 44°F, relative humidity 94%. Indoor conditions at the same time were: temperature 69°F, wet bulb 60°F, relative humidity 59%.

The installation of the exchanger was completed at 3:15 p.m. (four hours installation time). The Airxchange unit was turned on at 3:15 at which time (prior to turning it on) the temperature in the house was 68°F and the relative humidity was 58%.

May 4: The following conditions existed at 10:15 a.m. the next day after 19 hours of operation of the Airxchange unit.

INDOORS	Dry Bulb 70°F	Register Air Temp	64°F
	Wet Bulb 57°F	Temp at Exhaust Grill	67°F
	Relative Humidity 44%		
OUTDOORS	Outside Inlet Temp 45°F		
	Outside Dry Bulb 44°F		
	Outside Wet Bulb 41°F		
	Relative Humidity 78%		

Most of the condensation had cleared up and continued to improve. The increased comfort level in the house was very evident. The dealer and his customer were delighted with the results.

At lunch with the dealer he indicated he wanted Airxchange units built into all of their mobile homes in the future. He ordered an Airxchange unit for his own conventional house and another to be installed in a mobile home they are about to order.

WAS:ms

Enclosures

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AIRXCHANGE Full text of letter received from user in Juneau, Alaska

July 18, 1983

Mr. William A. Steele
Airxchange, Inc.
Air Park East #220
1551 West 13th Street
Upland, CA 91786

Dear Bill:

It's been three months since you and Pioneer Sales installed our Airxchange unit. It has greatly altered our life-style in terms of comfort. You saw first hand what Juneau weather was all about. We are finally comfortable in our new home since the humidity is controlled. The unit has worked very good even at temperatures as high as 65°. We also have the added benefit of fresh air 24 hours a day. You might say we enjoy the great outdoors indoors because of the Airxchanger. I think the benefit of the fresh air alone would make the unit worthwhile since S.E. Alaskans spend so much time inside their home due to weather. The unit removes cooking odors and any other impurities. I use the word impurity because my wife no longer wakes up with red eyes and swollen sinuses.

My wife and I feel you have an excellent product for our part of the country and would recommend it to anyone whether they own a mobile home or conventional housing. In this climate, your product will probably add to the life of a mobile home and slow down or stop much of the deterioration caused by the moisture.

If there is anything I can do to help your sales effort, please let me know.

Sincerely,

Edward M. Macri

U.S. DEPARTMENT OF ENERGY — BONNEVILLE POWER ADMINISTRATION

CONFERENCE AND TELEPHONE CALL REPORT

Date November 1, 1983

cc: [X] J. Cade - ALP
[X] F. Brown - OS
[ ]
[ ]
[ ]
[ ]
[ ]

TO: Rusty Alton - SJ

FROM: Ruth Hiraki - ALP

Include all telephone calls and conferences of importance bearing upon policies, customer or public relations, but excluding those purely technical in nature.

OUTSIDE CALLER OR CONFEREE	SUMMARY OF DISCUSSION
Jude Cleairmont 13314 - 74th Avenue E. Puyallup, WA 98373 206/535-4089 (Customer of Tacoma City Light) RE: Response to Weatherization EIS Newspaper Advertisement	Ms. Cleairmont had her home weatherized under BPA's weatherization program. She now finds that the home is so tightly sealed that it is causing serious complications to her existing medical conditions, such as severe headaches and respiratory problems. She finds that she has to sleep at neighbors' homes several times a week, mildew collects rapidly on the walls, odors linger, and her house plants have died. She has communicated her problem to Tacoma City Light and is working with employees of Tacoma City Light. She stressed that these employees have been extremely courteous and helpful and have admitted that the home has an indoor air quality problem. "Roof Vents" and air-to-air exchangers have since then been installed. However, the problem is still not solved. She also feels that these features will hurt the marketability of her home. Ms. Cleairmont conveyed several points: 1. She feels that the contractor (or any contractor) cannot accurately assess the existing air-tightness of any home, and what is needed. 1 2. No one thought to ask if there were any medical/respiratory problems before weatherization efforts began. 3. The contractor was basically incompetent. For example, they blew insulation into her bathroom fan; "fixed" the problem and now the fan makes a tremendous amount of noise. The contractor subcontracted the ceiling insulation to another contractor who is now out of business; now the quality of the insulation is in doubt. 4. Now that her home is too air tight, the mitigation efforts cause drafts, loss of heat, and affect the future marketability of her home. 1 5. She is concerned about senior citizens who may have their home weatherized, and have similar problems. They may be unaware of the hazardous health affects, or may be afraid to complain. 6. She will not let the problem rest and feels that BPA is accountable for setting the standards and setting up the mechanism for home weatherization programs.

BPA 15 REV. NOV

ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON

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Headquarters Office: 216 Broadway East, Seattle, WA 98102
(206) 322-7110 or toll free 1-800-732-9339

AMERICAN LUNG ASSOCIATION *of Washington*

November 11, 1983

CONTACT: Janet Chalupnik, Director of Environmental Health Programs
American Lung Association of Washington
1515 Dexter Ave. N., 3rd Fl.
Seattle, WA 98109

COMMENTS ON THE BPA DEIS ON EXPANDED WEATHERIZATION AND INDOOR QIR QUALITY

The American Lung Association of Washington recognizes that indoor air pollution can be a serious problem which can impact persons with lung disease. We also recognize that weatherization measures involving tightening of residences can restrict air flow to the extent that ventialtion is inadequate to disperse pollutants arising from the indoor environment. Therefore, we recommend a cautious, case-by-case approach to tightening homes.

1 The DEIS indicates that current inclusion criteria restrict the program to 30% of the potential residences that might be eligible to participate. We regard this as an overly restrictive policy. The real problem to be addressed is ventilation, rather than a single feature such as the presence of a woodstove. However, we do not support expansion of the program to all residences, regardless of potential indoor air quality problems. A more appropriate action would be to develop an inclusion/exclusion criteria based on ventilation rates and actual concentrations of indoor pollutants. We recognize that this will require further study. In the interim, the program could prehaps be expanded by employing mitigation-by-action measures and retaining the exclusions for mobile homes and homes with unvented combustion appliances.

Thank you for the opportunity to comment.

MUNICIPAL UTILITIES
EUGENE WATER & ELECTRIC BOARD
500 EAST 4TH AVE. - P.O. BOX 10148 - EUGENE, OREGON 97440 - 503-484-2411
ENERGY CONSERVATION CENTER
HULT PLAZA ANNEX - 399 EAST 10TH - EUGENE, OREGON 97401 - 503-484-1125

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KEITH PARKS, Gen. Mgr.

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November 11, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

Enclosed are comments, prepared by EWEB staff, on BPA's Draft Environmental Impact Statement.

In reviewing the draft EIS, EWEB has identified a number of assumptions and assessments that significantly impact the findings presented. The comments which follow address these concerns and identify areas where clarity is needed to avoid misinterpretation of the potential health effects.

We appreciate the opportunity to comment on the draft EIS. We hope that these comments will be found useful to BPA staff as they prepare the final EIS.

Sincerely,

Mathew W. Northway, P.E.
Assistant Conservation Manager

sdk

Enclosure

EUGENE WATER & ELECTRIC BOARD

COMMENTS ON THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT
EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM

General Comments

Conservation is the most economical investment that the Bonneville Power Administration can make to meet the region's future resource needs. By purchasing this conservation resource, BPA is helping to ensure the availability and cost stability of electricity in the region.

It has been implied that weatherization can adversely affect the indoor air quality of homes in the Region. It is vitally important for Bonneville to recognize that weatherization is not the source of indoor air pollutants. The sources of potential air pollutants (when they exist in a home) are present prior to home weatherization. Fortunately, these sources can be identified and, in most cases, the level of concentrations can be detected with simple, inexpensive tests.

1 EWEB feels that a regional program should be implemented which provides consumers with information about the sources of potential pollution and the measures which can be taken to minimize any effects. By doing this, Bonneville can acquire the most cost-effective energy resource which is available to the region. If Bonneville does not move to acquire all of this available resource, the region will be forced to look at alternative generation sources which have higher generation costs and greater environmental risks.

Specific Comments

Typical Residence:

The typical home is defined as having: "a wood stove, a gas stove, a

portable space heater, one person who smokes, urea-formaldehyde foam insulation, well-water, and is built slab-on-grade or with a basement, or with an unventilated crawl space." Therefore, the typical home is assumed to have all of the items BPA has identified as possible sources of air pollutants. This assumption is used to estimate the pollutant concentrations for each residence type. As the EIS admits, this assumption does not represent the most likely condition which would be found in the northwest's housing stock. Because of this exaggerated assessment, pollutant concentrations are admittedly overestimated.

Critical decisions will be made based upon the information presented in the final EIS. Unfortunately, the EIS does not adequately emphasize the degree of overestimation resulting from the assumptions used in the study. EWEB feels that it is important to clearly state in the final EIS the overestimation resulting from the typical house assumption to avoid misinterpretation of the information.

2

Determination of Regional Health Effects:

The determination of regional health effects is not clearly described. Although it is stated that adjustments have been made to account for the probability of various pollutant sources occurring in combination, the EIS does not clearly state how the pollutant concentrations used to determine regional health effects differ from the concentration occurring in the "typical residence."

3

Also, the term "typical" is used in Appendix I to describe the "typical" pollutant value for the region. This appears to describe a different value than is used in describing the "typical residence." This adds to the

uncertainty about which concentration levels are being used to calculate regional health effects.

3

Dose-Response Function:

BPA has assumed a linear relationship between health risks and pollutant concentrations. In addition, there are assumed to be no concentration thresholds for pollutants. Little information exists regarding the negative health effects due to low level pollutant concentration exposures or whether concentration thresholds exist. This results in considerable uncertainty regarding the health effects presented in the draft EIS.

4

Program Costs and Energy Savings:

BPA states in the EIS that all alternatives examined would result in resource acquisition costs of 35 mills/kWh or less. The EIS does not clearly describe the calculation of energy savings for the options described or the cost-effectiveness calculations used to determine the costs. EWEB questions the additional costs cited for the expanded program. The $793.6 million estimated additional cost is an increase of 145 percent over the present program cost. EWEB's own expanded weatherization program is only 70 percent greater than the costs presently covered by BPA. The Appendices which describe energy savings and costs calculations should be revised so that the estimation of cost-effectiveness can be clearly followed.

5

Alternative Resource Impact Assessment:

The decision to provide an expanded program will ultimately be based upon the impacts resulting from house tightening as they compare to the impacts resulting from alternative resource acquisition. The draft EIS does not provide adequate information for such a comparison. Without this comparison,

the benefits and risks cannot be clearly evaluated. BPA should make an attempt in the final EIS to adequately address the impacts resulting from central generation facilities which will be needed if all conservation resource opportunities are not acquired by a restricted program. 6

Recommendation

EWEB proposes that BPA move ahead with acquiring all cost-effective conservation resources available from weatherization. The program EWEB is proposing encompasses the following major features: 7

1) Addresses all of the concerns identified by the EIS.
2) Provides Oregon utilities with a program which is consistent with state mandated program requirements.
3) Matches the requirements for the Federal Residential Conservation Service Program and the EIS adopted for that program.
4) Offers a complete program which does not deny customers access to cost-effective weatherization.
5) Is consistent with EWEB's existing weatherization program.

Under this program, homes would be classified into four types.

Type 1 homes would include residences and apartments where no possible pollutant sources (as identified by BPA) are found to be present. These homes would be eligible for all weatherization measures at the owner's choice. The occupants would also receive information on the possible impacts on indoor air quality resulting from weatherization. This is the present program offered by Bonneville.

Type 2 homes would include residences and apartment where

possible pollutant sources as identified by BPA are found. These possible sources include:

1) Urea-formaldehyde foam insulation
2) Slab floor, basement, or unventilated crawl space
3) Mobile homes

These homes would receive information regarding possible impacts on indoor air quality from weatherization, the opportunity to request monitoring to determine if pollutants exist, and the opportunities to install all weatherization measures financed by BPA. Mitigation by air-to-air heat exchangers or exhaust fans would be provided if monitoring of the home indicates the need to mitigate. A signed consent form would be required to receive reimbursement for house tightening and mitigation, if installed. Under this program, BPA would pay the costs for monitoring and mitigation.

Type 3 homes would include residences and apartments where the possible pollutant sources as identified by BPA are related to occupant lifestyle. These possible sources would include smoking, wood stoves, fireplaces, portable space heaters, chemical cleaners and other household products. Since these possible sources are highly dependent upon the occupants, the customer would be provided with information regarding possible impacts on indoor air quality from weatherization. All weatherization measures would be offered the customer. A signed consent form would be required to receive reimbursement for house tightening.

37

Type 4 homes would include those homes where a permanent unvented combustion appliance is present. These homes would receive information about possible impacts on indoor air quality from weatherization. All conservation measures would be offered along with appropriate ventilation.

EWEB recommends that indoor air quality information used in the weatherization program address all of the concerns relating to house-tightening measures. Information on both structural and occupant pollutant sources would provide the greatest programmatic benefit. Information regarding occupant-dependent pollution sources should address recommended use patterns and maintenance strategies which would minimize any possible risks.

Within EWEB's proposed program, apartments and rental units would require a signed consent form from both the landlord and the renter at the time of weatherization. Information regarding installed weatherization measures and indoor air quality would be made available by the utility to subsequent tenants upon request.

In the case of owner-occupied homes, the utility would provide information regarding a particular residence to any potential buyer. But as with any real estate purchase, the buyer assumes any potential risks. BPA would not assume responsibility for providing monitoring or mitigation to a subsequent buyer of a weatherized residence.

By adopting this categorization approach, BPA can provide a program which addresses the concerns of the EIS, offers consistency with state and federal program requirements, does not deny customers access to a complete program, and guarantees the purchase of a cost-effective resource.

37

EWEB believes that the program which it has proposed in these comments is a most reasonable approach, given the information presented in the draft EIS. If, in its subsequent analysis, Bonneville determines that a more cautious approach is warranted, EWEB strongly suggests that the final EIS clearly justify a more restrictive path by including specific evidence regarding the impacts on indoor air quality resulting from weatherization.

PUGET POWER

November 10, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Subject: Comments on Draft Environmental Impact Statement

Dear Mr. Morrell:

GENERAL COMMENTS

As a result of concerns regarding the impact of house tightening on indoor air quality and public health, BPA has undertaken a huge effort to study the potential risks and to use the knowledge gained to make informed decisions regarding its conservation programs. When BPA began looking into the issue in early 1981, the concerns were based on evidence that indoor pollutants have caused discomfort and minor health ailments in a significant number of people. There was a growing concern among some that even more serious health effects may result from indoor pollution; however, there was no firm evidence, only a few studies that show health problems among miners and industrial workers exposed to pollutant levels that were several orders of magnitude higher than typical indoor levels. For indoor environments the risks are so small that the "noise" in the data drowns out any evidence that may exist. Therefore, it requires the development of a model to simulate the effects, a model that has been severly criticized on technical grounds. We do not intend to get into a technical debate over the model, except to make it clear that there is, in fact, a great deal of controversy over the reliability of a model that extrapolates data to the extent that this one does. The EIS itself points out these weaknesses. What else can you reasonably do when the risks you are trying to measure are immeasurable? Modeling may be the only possible way to get at these risks. In fact, we may never be able to measure them with any reasonable degree of confidence.

The results of Battelle's modeling effort indicate that under worst-case conditions there might be some serious health effects that result from indoor air pollution. While these risks are very small, they can be theoretically derived through the use of the model. Furthermore, when the model is used to estimate the risks due to house tightening, it is shown that even under worst-case conditions the risks are much smaller yet, by an order of magnitude or more.

Puget Sound Power & Light Company Puget Power Building Bellevue, Washington 98009 (206) 454 6363

III-4-1

1 Puget Power does not take issue with the statement that indoor air quality may sometimes be a problem that causes discomfort or possibly even serious diseases. The EIS shows that under worst-case conditions it is a theoretical possibility. We feel that it is a problem that should be addressed; however, the issues must be kept in perspective. This is especially important when dealing with the effects of house tightening on indoor air quality and on the related health effects. It is also important to emphasize that the problems are not due to weatherization per se, but to the original pollutant source.

As we all make decisions that affect conservation programs based on the worst-case risks given in the EIS, it is essential that we keep these risks in perspective. Similar risks, and even much more serious risks, are typically left to individuals to evaluate for themselves and to determine a course of action.

2 Puget Power recommends an informational approach, telling customers that there may in fact be some risks, telling customers what is known about indoor air quality, but putting these risks into perspective. When dealing with risks that are this uncertain, and this small in magnitude, we must not remove or restrict customer options, but we must let our customers decide for themselves what the risk is for them, and what action to take, if any, to reduce that risk.

3 To help put these risks into perspective, Puget Power recommends changes to Appendix J dealing with risk assessment. Risks are typically expressed in terms of annual occurances per 100,000 population. For those who want to compare risks on their own, several sources of data are readily available. For example, almanacs contain such information and are available on newstands. Statistical Abstracts of the United States is available in most public libraries as are other statistical sources (our technical comments on Appendix J are attached). On comparing risks in this fashion, it is obvious that the increased health risks due to house tightening are equivalent to the least of the risks reported in the statistical references mentioned above. All but a very few of the risks reported far exceed the risks due to house tightening.

What is normally done to protect people from these equivalent risks? For example, the risk of drowning may be similar to some of the worst-case conditions examined in the EIS. In reality, the risk of drowning is far greater when only the exposed population is considered. In other words, the risk of drowning is higher for those who go near water, than it is for the general population, upon which the tables are based, and very high for non-swimmers or poor swimmers who enter the water, and for small children left unattended in bathtubs. What is done to reduce the risk of drowning? Typically, a lifeguard may be provided (mainly to reduce the high risk to non-swimmers and poor swimmers), or signs may be placed to caution people

to swim at their own risk. Yet funding will not be held up for a proposed park because of the potential risk of people drowning in lakes or streams that may be within the boundaries of that park. Homes will continue to have bathtubs.

When considering the far more extreme risks of automobile accidents or heart attacks, one would not expect to see funding of parks restricted because of additional deaths that may occur due to auto accidents within the park, or heart attacks due to over-exertion on the trails. All of these are very real possibilities, but we leave it up to individuals to determine risk for themselves and to determine how they will respond to it.

As stated in Appendix J, one study indicates that the public appears willing to accept voluntary risks roughly 1,000 times greater than involuntary exposure risks. If this is true it leads to the conclusion that utilities should not force conservation programs upon their customers. Conversly it can be implied that the public may be offended by BPA's removing the voluntary acceptance of risks. We believe the informed public is very willing to accept the voluntary risk of house tightening.

Furthermore, on page 2.54 of the EIS it is stated that to ban certain pollutant sources could violate human rights. The example given was to refuse tightening for residences where smoking occurs. It is further stated that this type of option would be regarded as interfering with the economic system and the right of public choice. Puget Power agrees, and the example applies to other pollutant sources as well.

4 While cancers and deaths have received the greatest attention in this study, they are not the only issue of importance. We believe that human discomfort is of equal concern. Indoor air quality problems are far more likely to bring about discomfort symptoms than serious effects such as cancer or death. Again, Puget Power wants to emphasize that house tightening is not a problem in itself but the source of the pollutant is the problem.

Typically, any problems that are noticed when a house is tightened are due to improper procedures for moisture ventilation, or perhaps due to the well documented effects from the use of urea formaldehyde foam insulation, which is not approved for use in any of the conservation programs in the Northwest. Normally, people are fully aware of the cause of the discomfort (i.e., cigarette smoke, smoke from a fireplace or wood stove, cooking odors, chemicals, humidity from various sources, etc.) and they know what the solution is -- eliminate the source, or take some common sense action, e.g., open windows, use exhaust fans, etc.

However, there is a possibility that problems may exist undetected. For example, the EIS points out that there might be a problem with radon, a colorless, odorless gas. Again, it should be emphasized that the problem

would exist with or without house tightening. Also, the EIS clearly shows that the increased risk due to house tightening is very small. If a person has reason to believe he has a problem with radon he can relatively inexpensively measure radon levels to determine whether or not a problem really exists. Then, if there is a problem it can be addressed.

Puget Power believes that the responsibility lies with the occupant or building owner, not with the utility or with the Bonneville Power Administration. We should not restrict conservation programs or provide mitigation any more than we should prevent customers from lowering thermostats, or provide sweaters to guard against the risk of catching a cold. Instead we should make information available to customers, outlining what is known about indoor air quality, putting risks into perspective, and suggesting possible actions if a problem is suspected.

Sincerely,

Joel K. Jackman
Conservation Programs

JKJ/blt

Attachments

5

COMMENTS ON APPENDIX J

COMPARISON OF RISKS FROM EXPOSURE TO AIR POLLUTANTS TO VOLUNTARY RISK

Appendix J As It Now Exists:

As stated in the EIS the purpose of Appendix J is to derive approximate equivalencies between exposures to concentrations of radon and BaP and everyday voluntary risks such as smoking, driving a car, etc. The appendix starts off with a list of situations, each of which has a one in a million risk of dying. However, to make this list useful, it is stated that the risks must be adjusted and compared as done in the example. In fact, the list may well be misleading to someone who scans quickly through the appendix, looking for a table of comparative risks, sees them neatly listed, and fails to read further.

When one does read further, it only gets confusing. In the example, where does the radon exposure risk coefficient of 2.1×10^{-3} per pCi/l come from? Is this coefficient real or just exemplary? After thirty minutes or so of digging through earlier chapters we found it on pages F.8 and F.9 mixed in with several other coefficients.

The example was relatively easy to follow, in spite of the typos, but it is not clear what the result means, or how to use it. For example, the time frame used in the example is not clearly explained. The results of the example lead one to conclude that the risk of one pCi/l of radon exposure is equivalent to smoking one fourth cigarette per day for fifty years, or 1.6 cigarettes per day for 70 years. Heavier smoking, longer period, but equal risk. This does not make sense! (By the way, where do 50 and 70 years come from?)

Well, we have waded this far, but now what? What is the significance of one pCi/l? Is that the additional exposure that we are comparing to smoking? No, not exactly. With the help of figure I.1 (excellent road map) we found table I.8, which gives the before and after concentrations of radon. The increased concentration due to house tightening varies from 0.01 to 0.42 pCi/l in unmineralized regions, and 0.06 to 2.14 pCi/l in mineralized regions, depending on various combinations of radon sources and dwelling types. What to use? An average might be appropriate, following the argument at the bottom of page F.9 that population mobility tends to distribute risk. It appears that a reasonable value for before-and-after radon concentrations in unmineralized regions is 0.2 pCi/l, and for mineralized regions 1.0 pCi/l seems reasonable.

Finally the risk comparisons can be applied. When multiplying by the above radon concentrations, it is seen that the comparisons given in Appendix J would directly apply for increased radon exposure in a mineralized region, while they are five times too high for use in unmineralized regions.

In summary, Appendix J presents several numbers that have no relationship to each other without detailed, thoughtful analysis, which has not been done. Furthermore, the results of the brief examples are useless in the form given.

As it stands, Appendix J, perhaps even worse than useless, is misleading.

PROPOSED CHANGES TO APPENDIX J

We propose that risks be expressed in terms which can be compared to common statistical sources readily available to the general public. The most common term we have found is "occurences/100,000 population." Various almanacs and the Statistical Abstracts of the United States (copies attached) publish causes of death. Much of the data is obtained from the U.S. National Center for Health Statistics. Another source is Accident Facts published by the National Safety Council. We found all these references at the local public library.

The attached Table (Table 2.1 Extension) shows the incremental risk of incurring lung cancer as a result of house tightening, expressed in terms of lung cancers per 100,000 "exposed" population. A derivation of the numbers is covered in footnotes. This table is readily compared with common causes of death as published in common sources. We believe this table is useful for giving an overall view of the health impacts of house tightening, and should be included in Table 2.1, "Summary of Environmental Impacts." It clearly points out the small theoretical impact of house tightening compared to the greater baseline risks that existed before tightening, and the relatively immense risks of daily living.

Determining health impacts due to specific combinations of program options, dwelling types, and mineralized vs. unmineralized regions is far more complex and takes a great deal of digging through numbers and tables scattered throught the EIS. We have done some of this for radon as shown in the attached table, a modified version of Table I.9.

This table clearly shows the theoretical range of risk due to radon exposure. It shows that even in the most severe worst-case condition, the risk of incurring cancer is only 2.56 cancers per 100,000 people exposed to these extreme conditions. This is approximately equal to the reported national average risk of drowning (2.6/100,000 total population). It should be noted that the reported risk of drowning would be much higher if based on the actual number of people exposed (e.g., swimmers, boaters, young children in bathtubs, etc.) instead of the whole population.

A similar analysis was attempted for BaP. It was unsuccessful due to the difficulty of digging through discussions and tables in the EIS in order to find the data needed for the analysis. A more complete analysis should be done by someone very familiar with all the assumptions that were made at each step in the computational methodology outlined in figure I.1. It may only be necessary to look at max-min values.

A new appendix on risk comparisons should also include a discussion of how to compare risks, including a discussion of assumptions and interpretation of results. For example, one must carefully consider the basis on which risks were calculated.

To do this one should consider the nature of the occurence. The occurence could be death, a disabling injury, discomfort, illness, etc. It could result from an accident or disease. It could be something over which one has control or does not have control.

One should also consider the population affected or exposed to the risk. As discussed in the above example, many risks are commonly expressed in terms of the entire population (occurences per 100,000 people). Sometimes the population is divided into subsets. Such subsets may be based on age, sex, occupation, location, housing type, mineralized or non-mineralized soil. When making comparisons it is best to compare situations with similar conditions. When comparing risks due to house tightening one should look for analogous voluntary actions where a significant benefit results (financial, comfort, enjoyment), but where an increased health risk is incurred. Some examples might include:

1. Using a smaller car or motorcycle to get improved gas mileage. Passengers in smaller, lighter cars and motorcycles have greater risks of injury in accidents, but there are benefits from reduced fuel costs. Insurance companies have a great deal of data.

2. The increased risk of injury from the use of a power mower instead of a hand mower to make the job of cutting the lawn easier.

3. The risk of cancer from diagnostic X-rays.

4. Certain medications, e.g., contraceptives.

5. Increased risk of lung cancer, emphazema, or other respiratory ailments when smoking or living with a smoker. (According to the first paragraph on page I. 23, living with smokers will cause 2.2 additional cancers per year in the proposed action, or 0.1 per 100,000. What is the baseline rate?)

6. The risk of drowning incurred when owning a swimming pool.

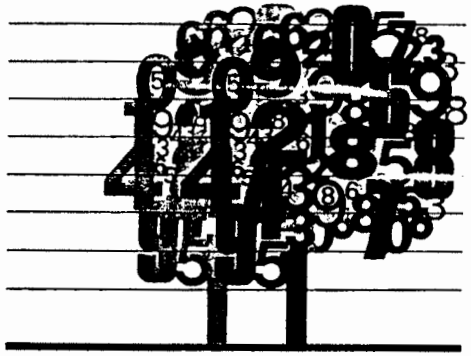
COMMENTS ON APPX. J
PUGET POWER 11/10/83

Statistical Abstract of the United States

National Data Book and Guide to Sources

103d Edition

1982-83



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U.S. Department of Commerce
Malcolm Baldrige, Secretary
Guy W. Fiske, Deputy Secretary
Robert G. Dederick, Under Secretary for Economic Affairs

BUREAU OF THE CENSUS
Bruce Chapman, Director

No. 115. Deaths From Selected Causes for Selected Countries—Age-Adjusted Rates: 1970 to 1979

[Deaths per 100,000 population. For explanation of age-adjustment, see headnote, table 113. The standard population for this table is based on the sum of male and female population of all countries for which the source published causes of death statistics in 1960. Causes of death are classified according to eighth revision of the *International Classification of Diseases*]

SEX AND CAUSE OF DEATH	United States	Canada	France	Germany, Federal Republic	Japan	Sweden	United Kingdom [1]
MALE							
Ischemic heart disease:							
1970	318.7	272.9	68.7	162.8	48.2	224.9	241.3
1975	281.6	253.3	77.6	172.3	44.7	238.5	248.8
1979	[2]261.8	[2]243.3	[2]72.8	[2]176.1	38.8	244.9	243.8
Malignant neoplasms:							
1970	164.9	168.1	175.9	175.7	141.7	129.8	187.4
1975	159.1	156.0	189.0	181.9	140.3	148.3	184.9
1979	[2]163.7	[2]159.1	[2]193.3	[2]181.3	145.6	143.8	185.4
Cerebrovascular diseases:							
1970	75.8	65.8	83.1	109.0	214.8	65.7	82.5
1975	64.0	61.3	84.2	95.4	167.0	57.5	81.7
1979	[2]53.1	[2]54.8	[2]71.4	[2]86.6	128.4	49.6	73.8
Accidents:							
1970	78.0	75.0	82.4	76.5	65.5	46.5	37.6
1975	65.7	74.6	72.0	61.2	45.3	56.9	32.5
1979	[2]64.5	[2]64.2	[2]71.5	[2]64.0	36.7	52.1	31.3
FEMALE							
Ischemic heart disease:							
1970	163.8	132.8	26.8	83.3	28.1	120.4	101.3
1975	140.6	118.1	31.8	74.8	26.9	120.1	105.7
1979	[2]132.8	[2]112.5	[2]29.4	[2]75.4	22.8	112.2	100.9
Malignant neoplasms:							
1970	108.5	109.9	98.0	123.4	91.7	106.9	118.0
1975	105.2	105.6	96.2	118.4	87.0	110.7	119.9
1979	[2]107.5	[2]106.7	[2]93.5	[2]116.8	85.2	107.1	122.0
Cerebrovascular diseases:							
1970	69.4	67.1	65.0	87.2	142.8	51.1	82.4
1975	64.8	61.7	61.0	75.9	118.6	51.9	73.7
1979	[2]48.7	[2]45.8	[2]52.8	[2]68.7	90.5	42.6	67.3
Accidents:							
1970	28.6	29.0	39.1	31.9	20.3	20.1	18.5
1975	23.7	29.0	32.1	27.2	14.7	20.0	15.8
1979	[2]23.8	[2]24.8	[2]32.2	[2]24.5	12.8	17.7	15.1

[1] Covers England and Wales only. [2] 1978 data. [3] 1977 data.

Source: World Health Organization, Geneva, Switzerland, *World Health Statistics*, vol. I, annual.

No. 116. Death Rates From Heart Disease, by Sex, Age, and Selected Type: 1950 to 1979

[Deaths per 100,000 population in specified age groups. Deaths for 1979 classified according to the ninth revision of the *International Classification of Diseases*; for earlier years classified according to the revision in use at the time; see text, p. 57. Beginning 1970, excludes deaths of nonresidents of the United States. See Appendix III]

AGE AT DEATH AND SELECTED TYPE OF HEART DISEASE	Male 1950	Male 1960	Male 1970	Male 1975	Male 1979	Female 1950	Female 1960	Female 1970	Female 1975	Female 1979
Total U.S. rate [1]	424.7	438.5	422.5	386.2	370.4	289.7	300.6	304.5	290.7	287.9
25–44 years	70.2	67.8	57.3	42.4	38.1	36.2	25.2	19.5	13.9	12.4
45–54 years	441.2	420.4	378.4	328.7	280.0	177.8	127.5	109.9	81.3	85.1
55–64 years	1,100.5	1,080.8	987.2	880.2	788.8	807.0	428.4	381.8	300.0	278.2
65 years and over	3,280.3	3,314.7	3,258.0	2,833.0	2,751.7	2,468.3	2,416.8	[illegible]	2,038.7	1,889.5
Persons 45–54 years:										
Ischemic heart	318.8	347.1	338.0	282.3	223.9	78.0	72.4	84.0	70.9	63.1
Rheumatic heart	24.3	19.8	11.4	7.3	3.2	23.8	16.5	10.8	8.1	4.5
Hypertensive heart	48.0	22.9	6.8	8.8	8.3	48.7	21.5	4.0	2.2	5.7
Persons 55–64 years:										
Ischemic heart	792.9	[illegible]	804.8	779.1	608.8	275.0	298.8	289.1	252.9	190.2
Rheumatic heart	35.0	29.0	21.8	18.2	6.7	30.8	28.4	20.8	15.3	8.5
Hypertensive heart	126.2	71.2	11.7	8.1	21.7	118.0	63.9	9.1	8.1	14.8
Persons 65 years and over:										
Ischemic heart	2,041.1	2,388.4	3,022.5	2,884.3	2,144.1	1,334.0	1,801.2	2,071.8	1,841.3	1,485.2
Rheumatic heart	88.3	32.9	32.9	30.5	13.4	52.8	34.8	32.3	31.6	22.1
Hypertensive heart	643.4	268.5	54.8	38.2	87.3	487.8	321.2	60.0	41.2	79.7

[1] Includes persons under 25 years old, not shown separately.

Source: U.S. National Center for Health Statistics, *Vital Statistics of the United States*, annual; and unpublished data.

No. 117. Death Rates From Cancer, by Sex, Age, and Type of Cancer: 1940 to 1979

[Deaths per 100,000 population in the specified age groups. See headnote, table 116]

AGE AT DEATH AND SELECTED TYPE OF CANCER	Male 1940	Male 1950	Male 1960	Male 1970	Male 1975	Male 1979	Female 1940	Female 1950	Female 1960	Female 1970	Female 1975	Female 1979
Total U.S. rate [1]	114.1	142.9	162.6	182.1	192.3	205.6	126.4	136.8	136.4	144.4	152.1	168.1
25–44 years	24.6	31.0	34.2	33.9	28.7	26.2	50.3	49.1	46.8	40.3	33.4	30.2
45–54 years	135.3	156.2	170.8	183.5	187.4	186.6	204.1	184.0	183.0	181.5	176.6	173.4
55–64 years	352.2	413.1	450.9	511.8	512.3	520.7	384.1	368.2	337.7	343.2	367.7	366.5
65 years and over	866.2	968.8	1,086.2	1,221.2	1,301.1	1,364.3	782.3	756.7	700.1	706.3	725.2	750.9
Persons, 45–54 years old:												
Respiratory, intrathoracic	23.3	39.3	54.7	72.1	78.2	79.8	6.2	6.7	10.1	22.2	30.1	33.5
Digestive organs, peritoneum	70.7	59.8	53.2	45.9	44.8	44.6	68.6	47.0	36.8	32.5	29.7	28.4
Breast	.3	.4	.2	.4	.2	.1	47.5	46.9	51.4	52.6	50.4	48.9
Genital organs	6.6	4.6	4.0	3.4	3.3	3.3	68.2	58.0	44.6	34.4	28.9	25.1
Lymphatic and hematopoietic tissues, excl. leukemia	(NA)	8.7	11.6	12.8	11.0	10.8	(NA)	6.7	7.1	8.3	7.4	6.6
Urinary organs	8.1	8.7	8.3	8.0	8.1	8.3	4.5	3.6	3.6	3.5	3.3	3.2
Lip, oral cavity, and pharynx	6.0	6.3	7.8	7.9	8.2	8.4	1.6	1.8	2.8	2.8	3.0	2.8
Leukemia	[2]5.6	6.5	7.2	6.6	5.9	6.0	[2]4.8	5.1	5.3	4.8	4.4	4.9
Persons, 55–64 years old:												
Respiratory, intrathoracic	45.7	94.2	150.2	202.3	214.1	224.4	12.6	15.4	17.0	38.9	58.3	72.3
Digestive organs, peritoneum	195.3	174.8	153.7	139.0	129.5	132.4	149.1	125.1	102.2	86.0	83.5	82.9
Breast	.8	.8	1.0	.6	.8	.5	74.9	68.9	70.8	77.6	79.2	79.8
Genital organs	30.7	26.2	23.5	22.8	23.3	23.2	100.8	87.4	73.0	68.2	53.0	48.4
Lymphatic and hematopoietic tissues, excl. leukemia	(NA)	18.2	23.1	27.1	26.7	24.0	(NA)	11.5	15.7	17.7	17.6	16.5
Urinary organs	23.7	26.9	25.9	26.4	24.8	22.7	11.8	11.2	9.3	8.4	9.0	9.0
Lip, oral cavity, and pharynx	16.1	18.2	16.3	20.1	18.9	18.1	3.0	3.3	3.8	6.2	6.8	6.6
Leukemia	[2]10.6	14.1	16.1	15.4	14.9	14.5	[2]7.5	10.1	10.6	9.0	8.6	9.0
Persons, 65 years and older:												
Respiratory, intrathoracic	80.7	112.5	208.4	336.5	384.2	435.1	17.7	30.9	30.4	40.9	60.0	63.5
Digestive organs, peritoneum	479.8	449.4	412.0	374.0	369.6	375.0	403.6	346.7	301.9	262.0	251.9	259.8
Breast	2.1	2.2	1.4	1.9	1.8	1.5	122.8	112.7	107.9	108.7	113.5	115.8
Genital organs	186.8	186.5	188.4	181.6	186.5	188.1	135.3	119.2	105.1	93.5	88.2	85.5
Lymphatic and hematopoietic tissues, excl. leukemia	(NA)	23.5	39.6	57.7	60.8	60.3	(NA)	16.8	26.5	30.9	42.6	42.7
Urinary organs	57.3	63.3	71.5	80.5	81.4	80.5	32.1	32.0	31.3	30.8	30.0	29.8
Lip, oral cavity, and pharynx	61.7	38.4	31.9	30.9	30.3	28.7	12.3	9.2	8.8	8.1	8.6	10.4
Leukemia	[2]15.6	30.4	41.8	47.9	48.8	50.8	[2]10.6	18.2	25.8	28.4	27.4	29.4

NA Not available. [1] Includes persons under 25 years old, not shown separately. [2] Not classified as cancer in the 5th revision, therefore, not included in totals for cancer.

Source: U.S. National Center for Health Statistics, *Vital Statistics of the United States*, annual; and unpublished data.

No. 118. Death Rates From Accidents and Violence: 1960 to 1979

[Deaths per 100,000 population. Beginning 1970, excludes deaths of nonresidents of the U.S. Deaths for 1979 classified according to the ninth revision of the *International Classification of Diseases*; for earlier years classified according to the revision in use at the time; see text, p. 57. See Appendix III]

SEX, CAUSE OF DEATH, AND AGE	White 1960	White 1970	White 1975	White 1978	White 1979	Black 1960	Black 1970	Black 1975	Black 1978	Black 1979
Male, total [1]	91.3	101.9	96.8	97.7	96.6	137.1	163.2	164.5	147.9	153.4
Motor vehicle accidents	31.5	39.1	32.2	36.2	37.3	33.2	44.3	32.7	32.7	32.0
All other accidents	38.6	38.2	35.5	32.1	31.2	60.6	63.3	58.2	45.7	45.2
Suicide	17.6	18.0	20.1	20.2	20.0	6.4	8.0	10.8	10.8	11.6
Homicide	3.6	6.8	8.1	9.2	10.1	36.7	67.8	66.8	65.7	64.6
15–24 years	105.2	130.7	129.7	138.3	142.2	144.2	234.3	182.9	138.3	157.7
25–44 years	89.5	107.1	103.4	104.5	107.5	205.8	301.1	278.1	241.8	263.9
45–64 years	118.6	121.4	104.0	95.2	93.2	188.4	248.7	214.8	186.7	190.5
65 years and over	223.5	218.8	185.3	173.2	168.8	180.1	220.0	202.9	194.7	202.7
Female, total [1]	36.3	42.4	38.3	38.2	37.2	55.6	61.7	46.8	42.6	42.5
Motor vehicle accidents	11.2	14.8	11.4	13.1	13.0	8.7	13.4	9.3	9.7	8.8
All other accidents	20.4	18.3	16.7	15.4	14.8	36.1	32.5	18.9	17.2	17.0
Suicide	5.3	7.1	7.4	6.8	6.6	1.6	2.8	2.7	2.8	2.8
Homicide	1.4	2.1	2.8	2.8	3.0	10.4	13.3	15.1	13.0	13.8
15–24 years	23.5	34.9	33.1	38.7	36.2	31.8	45.5	42.7	38.1	38.7
25–44 years	24.0	33.8	31.1	30.8	29.9	61.7	60.8	55.1	47.7	47.4
45–64 years	37.7	44.6	39.2	38.7	34.8	54.8	65.8	61.6	46.6	46.0
65 years and over	148.1	122.4	100.7	91.8	86.3	113.9	107.8	86.7	86.4	85.9

[1] Includes persons under 15 years old, not shown separately.

Source: U.S. National Center for Health Statistics, *Vital Statistics of the United States*, annual; and unpublished data.

No. 113. Death Rates, 1960 to 1979, and Deaths, 1970 to 1979, From Selected Causes

[Beginning 1970, excludes deaths of nonresidents of the U.S. Age-adjusted death rates were prepared using the direct method, in which age-specific death rates for a population of interest are applied to a standard population distributed by age. The standard population for this table is the total population of the United States enumerated in 1940. Age adjustment eliminates the differences in observed rates between points in time or among compared population groups that result from age differences in population composition. Deaths for 1979 classified according to ninth revision of *International Classification of Diseases*; for earlier years, classified according to revision in use at that time. See also Appendix III and *Historical Statistics, Colonial Times to 1970*, series B149–166]

CAUSE OF DEATH	Crude death rate per 100,000 population 1960	1970	1975	1978	1979	Age-adjusted death rates per 100,000 population [1] 1970	1975	1979	Deaths (1,000) 1970	1975	1979
All causes	954.7	945.3	888.5	883.4	869.5	714.3	638.3	586.8	1,921.0	1,892.9	1,913.8
Major cardiovascular diseases	515.1	496.0	455.8	442.7	435.4	340.1	291.4	258.3	1,008.0	971.0	958.3
Diseases of heart	369.0	362.0	336.2	334.3	333.1	253.6	220.5	203.5	735.6	716.2	733.2
Percent of total	38.8	38.3	37.8	37.8	38.3	35.5	34.5	34.6	38.3	37.8	38.3
Rheumatic fever and rheumatic heart disease	10.3	7.3	6.1	6.1	3.5	6.3	4.8	2.6	14.9	12.9	7.8
Hypertensive heart disease [2]	37.0	7.4	5.2	4.7	11.2	4.8	3.2	7.0	15.0	11.0	24.6
Ischemic heart disease		328.1	301.7	294.3	250.5	228.1	196.1	152.8	666.7	642.7	551.4
Other diseases of endocardium	321.8	3.3	2.1	1.8	2.9	2.3	1.4	1.8	6.7	4.9	6.5
All other forms of heart disease		15.9	21.2	27.2	64.9	12.0	15.0	39.1	32.3	45.1	142.9
Hypertension [2]	7.1	4.1	3.0	2.5	3.3	2.9	1.9	1.9	8.3	6.3	7.3
Cerebrovascular diseases	108.0	101.9	91.1	80.5	77.0	66.3	54.5	42.5	207.2	194.0	169.5
Atherosclerosis	20.0	15.6	13.6	13.3	13.1	8.4	6.6	5.7	31.7	28.9	28.8
Other	11.0	12.5	12.0	12.2	8.9	8.8	8.0	5.6	25.3	25.6	19.5
Malignancies [3]	149.2	162.8	171.7	181.9	183.3	129.9	130.9	133.2	330.7	365.7	403.4
Percent of total	15.6	17.2	19.3	20.6	21.1	18.2	20.5	22.6	17.2	19.3	21.1
Of digestive organs and peritoneum	50.8	46.6	46.8	48.3	49.9	35.2	33.6	33.8	94.7	99.8	109.1
Of respiratory and intrathoracic organs	22.2	34.2	40.7	45.8	48.9	28.4	32.5	35.8	69.5	86.7	103.2
Of breast	13.4	14.7	15.2	15.9	15.7	12.6	12.5	12.4	29.9	32.4	34.6
Of genital organs	21.6	20.3	20.2	20.7	20.6	15.6	14.6	13.9	41.2	43.0	45.4
Accidents and adverse effects	52.3	56.4	48.4	48.4	47.8	53.7	44.8	42.7	114.6	103.0	105.3
Motor vehicle	21.3	26.9	21.5	24.0	24.3	27.4	21.3	23.7	54.6	45.9	53.5
Falls	10.6	8.3	7.0	6.3	6.0	5.7	4.5	3.7	16.9	14.7	13.2
Drowning	2.9	3.1	3.1	2.7	2.6	3.1	3.1	2.6	6.4	6.6	5.7
All other	17.5	18.1	16.7	15.4	14.9	17.6	15.8	13.7	36.7	35.9	32.8
Chronic obstructive pulmonary diseases and allied conditions [4]	([5])	15.2	12.0	10.0	22.7	11.8	8.5	14.9	30.9	25.5	49.9
Bronchitis, chronic and unspecified	([5])	2.8	2.2	2.0	1.7	2.1	1.6	1.0	5.8	4.7	3.7
Emphysema	([5])	11.2	8.8	7.2	6.2	8.4	6.2	4.1	22.7	18.8	13.8
Asthma	3.0	1.1	.9	.8	1.2	1.0	.6	.9	2.3	2.0	2.9
Other	([5])	([5])	([5])	([5])	13.7	([5])	([5])	8.8	([5])	([5])	30.1
Pneumonia and influenza	[6]37.3	30.9	26.1	26.7	20.5	22.1	16.6	11.4	62.7	55.7	45.0
Pneumonia	[6]32.9	28.0	24.1	24.9	20.2	20.8	15.4	11.2	59.0	51.4	44.4
Influenza	4.4	1.8	2.0	1.8	.3	1.3	1.2	.1	3.7	4.3	.6
Diabetes mellitus	16.7	18.9	16.5	15.5	15.1	14.1	11.6	10.0	38.3	35.2	33.2
Chronic liver disease and cirrhosis	11.3	15.5	14.8	13.8	13.5	14.7	13.8	12.2	31.4	31.6	29.7
Certain conditions originating in the perinatal period	37.4	21.3	12.5	10.1	10.7	(X)	(X)	(X)	43.2	26.8	23.4
Suicide	10.6	11.6	12.7	12.5	12.4	11.8	12.6	11.9	23.5	27.1	27.2
Homicide and legal intervention	4.7	8.3	10.0	9.4	10.2	9.1	10.5	10.4	18.8	21.3	22.6
Nephritis, nephrotic syndrome, and nephrosis	7.6	4.4	3.9	4.1	7.1	3.5	2.8	4.4	8.9	8.1	15.7
Congenital anomalies	12.2	8.3	6.2	5.9	6.1	7.6	6.4	6.3	16.8	13.2	13.5
Septicemia	1.1	1.7	2.8	3.8	3.6	1.4	2.0	2.4	3.5	6.0	8.0
Ulcer of stomach and duodenum	6.3	4.2	3.2	2.5	2.7	3.2	2.2	1.7	8.6	6.7	5.9
Benign neoplasms	2.7	2.4	2.3	2.3	2.7	2.0	1.8	2.0	4.8	4.8	6.3
Hernia of abdominal cavity and intestinal obstruction [7]	5.1	3.6	2.8	2.6	2.4	2.8	1.9	1.4	7.2	6.2	5.3
Other infective and parasitic diseases	2.9	1.8	1.8	2.2	1.8	1.7	1.7	1.8	3.8	4.1	4.1
Anemias	1.8	1.7	1.5	1.5	1.4	1.3	1.1	1.0	3.4	3.2	3.2
Cholelithiasis and other disorders of gallbladder	2.6	2.0	1.4	1.3	1.4	1.3	.9	.8	4.0	3.0	3.1
Infections of kidney	4.3	4.0	2.1	1.4	1.3	2.8	1.3	.7	8.2	4.5	2.9
Nutritional deficiencies	([5])	1.2	1.2	1.3	1.0	.9	.7	.6	2.5	2.9	2.2
Tuberculosis	6.1	2.6	1.6	1.3	.9	2.2	1.2	.7	5.2	3.3	2.0
Meningitis	1.3	.8	.8	.7	.6	.8	.7	.6	1.7	1.6	1.4
Hyperplasia of prostate	2.5	1.1	.6	.4	.4	.8	.3	.2	2.2	1.2	.8
Acute bronchitis and bronchiolitis	([5])	.6	.3	.3	.3	.6	.3	.2	1.3	.7	.6
Viral hepatitis	.6	.4	.3	.2	.3	.4	.3	.3	1.0	.6	.6
Symptoms, signs, and ill-defined conditions	11.4	12.7	14.8	14.4	12.5	10.4	12.3	9.9	25.8	31.6	27.6
All other causes	48.9	55.0	60.3	66.4	51.2	45.2	46.3	36.3	111.9	128.6	112.8

– Represents zero or rounds to zero. X Not applicable.

[1] Based on resident population enumerated as of Apr. 1 for 1960 and 1970, and estimated as of July 1 for other years. [2] With or without renal disease. [3] Includes other types of malignancies not shown separately. [4] Prior to 1978, data are shown for bronchitis, emphysema, and asthma. [5] Included in "all other causes." Comparable data not available separately. [6] Excludes pneumonia of newborn. [7] Without mention of hernia.

Source: U.S. National Center for Health Statistics, *Vital Statistics of the United States*, annual; and unpublished data.

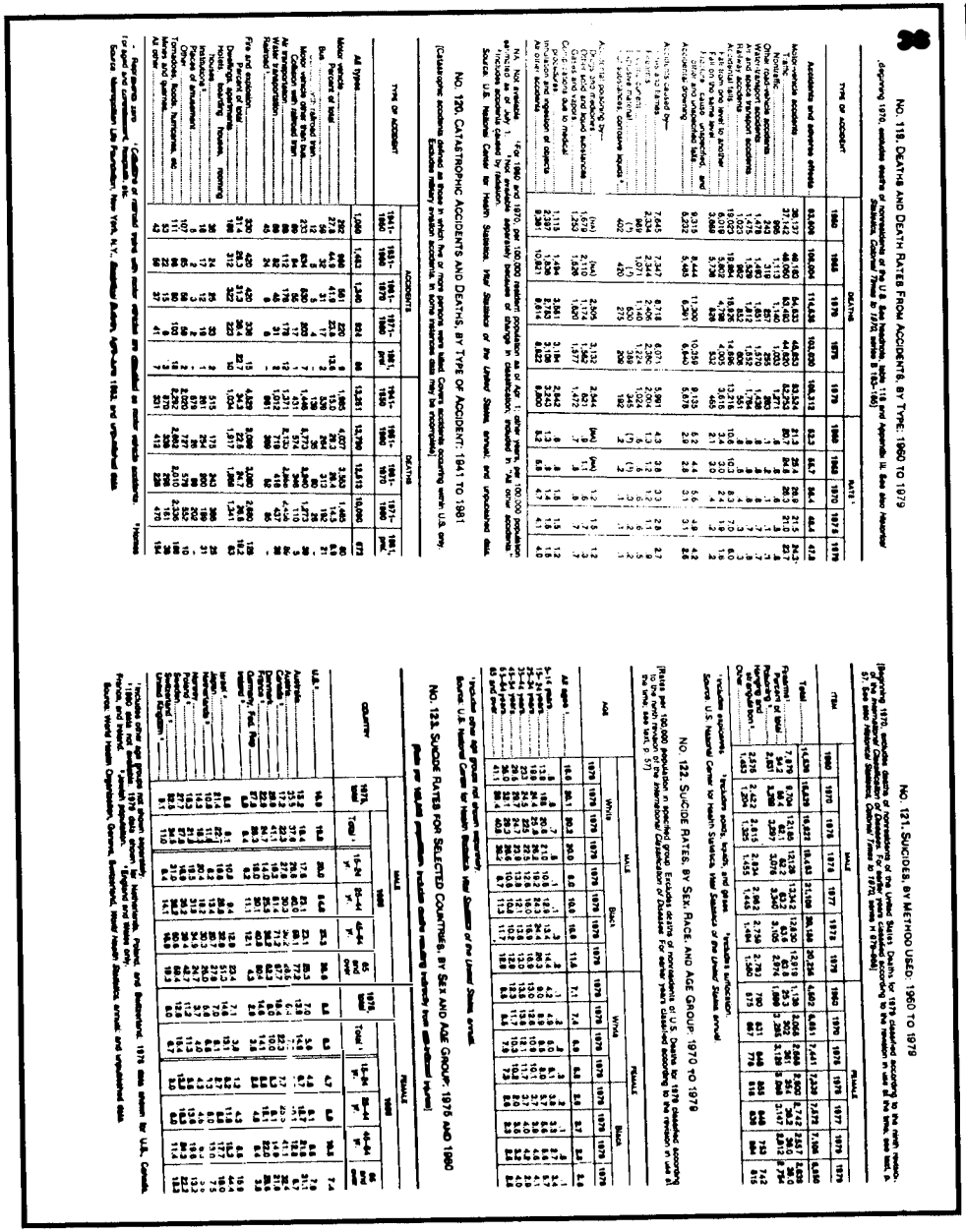
No. 114. Death Rates, by Cause, Sex, and Age—States: 1979

[Deaths per 100,000 estimated midyear population in each area, by place of residence. Excludes nonresidents of U.S. Causes of death classified according to ninth revision of the *International Classification of Diseases*]

STATE, SEX, AND AGE	Diseases of heart	Malignant neoplasms	Cerebrovascular diseases	Accidents	Chronic obstructive pulmonary diseases [1]	Pneumonia, flu	Diabetes mellitus	Chronic liver disease and cirrhosis	Atherosclerosis	Suicide	Conditions originating in the perinatal period
U.S. [2]	333.1	183.3	77.0	47.8	23.7	20.5	15.1	13.6	13.1	12.4	10.7
Male [2]	376.4	205.6	65.8	69.5	33.0	22.2	12.8	18.1	10.7	18.9	12.6
15–24 yr	3.3	7.6	1.0	100.8	.3	.9	.4	.3	–	20.4	(X)
25–44 yr	38.1	26.2	5.6	70.4	1.1	2.9	2.7	10.8	.1	24.4	(X)
45–64 yr	518.0	345.6	52.8	63.2	33.5	16.0	17.9	50.0	3.7	23.8	(X)
65 yr and over	2,751.7	1,364.3	671.8	126.8	277.0	184.0	91.0	55.2	105.9	36.7	(X)
Female [2]	297.9	162.1	87.8	27.3	12.9	18.8	17.2	8.8	18.4	6.1	8.9
15–24 yr	2.1	4.9	.9	27.1	.3	.7	.4	.2	–	4.8	(X)
25–44 yr	12.4	30.2	5.1	17.6	.9	1.6	2.0	4.9	–	6.4	(X)
45–64 yr	178.4	266.7	41.8	22.1	16.2	7.7	16.9	23.5	1.9	10.2	(X)
65 yr and over	1,989.5	759.9	598.4	77.5	71.7	124.1	101.3	23.4	115.5	7.0	(X)
New England	351.4	205.3	72.3	39.8	22.1	25.1	16.6	14.8	14.8	10.1	8.0
Maine	365.3	213.5	78.8	47.7	29.7	20.1	14.3	14.6	17.3	14.3	5.5
New Hampshire	319.4	196.5	73.4	40.4	24.2	22.4	14.8	13.1	17.9	11.3	7.8
Vermont	328.2	181.3	66.9	54.2	27.8	19.3	13.0	10.8	17.0	17.6	7.9
Massachusetts	361.1	207.0	71.9	40.1	19.8	31.1	16.3	14.0	13.2	8.9	7.7
Rhode Island	408.4	228.2	77.1	35.5	25.3	16.0	21.9	15.1	17.1	12.3	9.8
Connecticut	324.4	198.8	70.0	35.5	21.3	20.3	13.8	14.2	14.9	8.6	6.8
Middle Atlantic	398.4	208.5	70.8	35.8	21.4	22.6	19.5	16.9	11.8	8.7	10.1
New York	398.1	208.8	67.0	32.2	20.4	26.9	17.5	20.1	11.1	8.4	10.1
New Jersey	375.9	208.2	67.7	36.8	20.5	18.8	17.3	14.8	8.9	7.6	9.7
Pennsylvania	412.4	215.6	78.6	40.7	23.6	18.5	20.7	13.4	14.2	11.4	10.2
E. No. Central	347.8	181.4	76.0	43.0	21.2	18.2	18.7	12.8	14.3	11.8	11.2
Ohio	352.3	188.5	77.2	42.5	23.4	17.2	17.6	11.8	14.8	12.8	10.1
Indiana	330.7	178.0	90.5	49.2	23.4	17.2	18.3	8.9	10.4	11.1	10.9
Illinois	378.6	191.9	77.1	41.5	18.6	21.0	18.4	14.3	12.9	9.3	13.8
Michigan	319.1	188.0	66.0	42.0	21.1	16.1	15.7	14.9	12.0	12.4	11.2
Wisconsin	342.8	173.6	73.7	42.8	17.9	18.3	15.7	9.4	14.5	12.8	7.8
W. No. Central	344.2	188.3	86.6	48.8	23.9	24.6	14.1	8.6	17.3	11.1	6.6
Minnesota	294.8	188.1	81.4	49.2	18.0	23.9	12.0	7.9	15.0	10.2	8.3
Iowa	370.1	194.2	95.9	47.4	24.3	25.8	15.2	8.1	19.9	11.0	8.9
Missouri	369.4	203.4	92.2	50.1	27.0	24.6	15.3	10.2	15.9	11.8	11.2
North Dakota	316.0	177.2	74.6	47.3	18.8	20.5	12.6	8.3	18.8	11.8	12.8
South Dakota	372.1	189.2	86.7	61.7	26.0	24.6	15.4	10.8	17.9	10.2	8.4
Nebraska	348.6	184.1	92.8	48.7	25.5	25.6	12.8	8.0	21.0	10.1	9.7
Kansas	342.0	178.2	87.6	49.1	26.5	24.8	14.7	8.4	18.5	12.4	8.9
South Atlantic	340.3	190.3	83.8	51.3	23.9	18.3	15.2	14.1	11.8	13.7	13.4
Delaware	345.2	188.9	66.9	40.5	22.3	11.8	20.8	15.1	8.8	11.2	17.0
Maryland	304.1	185.0	56.0	37.5	17.8	14.2	18.3	12.3	8.4	10.8	11.7
District of Columbia	332.2	245.7	70.4	40.4	17.8	28.1	20.3	30.9	23.8	8.2	22.4
Virginia	295.8	168.2	71.6	42.6	19.4	16.7	11.4	10.8	11.0	15.0	12.4
West Virginia	427.6	191.7	83.0	67.7	33.5	20.0	18.5	11.7	13.0	12.9	12.0
North Carolina	309.4	182.3	83.6	54.4	19.4	12.8	14.3	12.7	10.3	12.6	12.1
South Carolina	294.9	184.6	85.8	60.4	18.6	18.7	18.2	10.3	8.7	10.3	14.3
Georgia	304.1	153.6	90.1	59.4	21.7	20.7	13.8	11.3	8.6	13.0	13.5
Florida	420.7	250.4	100.2	53.3	33.8	21.1	18.5	10.3	15.1	17.1	10.5
E. So. Central	329.7	179.6	93.5	64.6	23.0	19.8	14.8	9.8	12.2	13.2	11.8
Kentucky	359.7	185.9	87.9	55.5	25.7	22.4	18.6	10.4	12.8	13.4	9.5
Tennessee	322.8	177.6	96.0	54.5	23.6	20.6	12.6	8.7	14.6	13.7	10.7
Alabama	313.2	178.4	93.4	50.5	22.2	17.3	17.2	8.7	8.8	11.1	12.1
Mississippi	324.0	171.8	87.2	66.8	19.0	18.9	18.3	8.0	11.1	9.7	15.9
W. So. Central	301.4	163.9	81.6	87.2	21.6	19.7	14.2	10.6	13.4	13.4	12.3
Arkansas	363.6	187.8	109.8	84.1	26.3	21.6	14.3	8.6	14.0	11.4	9.7
Louisiana	318.3	170.3	78.1	80.5	18.1	17.3	19.2	9.7	15.8	12.6	16.4
Oklahoma	370.1	188.0	98.0	59.9	25.8	24.9	14.1	12.4	13.8	13.0	8.7
Texas	271.8	151.7	74.8	58.1	20.8	18.8	12.7	10.6	12.3	12.2	12.1
Mountain	232.6	137.7	64.9	84.7	27.2	18.8	11.4	12.3	11.4	17.8	10.9
Montana	282.7	157.6	74.8	78.7	25.1	18.0	11.8	8.1	10.2	15.0	8.7
Idaho	243.2	134.6	63.8	68.5	22.9	18.8	8.4	7.1	13.8	13.7	10.4
Wyoming	231.1	118.2	64.0	77.8	26.1	15.1	10.7	8.1	11.8	19.1	13.1
Colorado	229.7	128.5	61.2	80.2	25.9	22.0	8.8	10.2	13.4	18.0	8.1
New Mexico	171.2	131.7	60.0	83.0	24.7	18.3	12.1	14.5	8.6	19.3	14.5
Arizona	258.3	166.7	67.6	70.8	36.6	18.9	13.2	16.2	10.1	18.7	11.3
Utah	204.1	86.7	45.8	47.8	17.8	18.8	12.8	8.4	8.0	13.0	13.8
Nevada	238.8	180.8	65.1	74.4	32.3	18.2	11.0	26.1	11.5	24.8	8.4
Pacific	273.4	168.0	70.6	48.5	23.4	19.6	10.8	16.8	13.8	18.2	8.8
Washington	275.1	166.0	72.1	51.5	25.2	20.4	12.4	12.0	16.5	14.2	7.5
Oregon	290.3	180.0	79.8	56.3	28.5	23.9	11.3	13.6	17.5	13.8	7.3
California	275.8	170.2	71.4	48.7	23.1	18.4	10.2	16.4	11.9	15.6	8.7
Alaska	83.7	67.6	18.0	78.3	8.7	8.9	4.4	10.3	3.0	11.6	18.7
Hawaii	107.8	120.9	40.3	40.8	15.4	14.8	14.0	8.2	3.8	14.3	8.7

– Represents zero. X Not applicable. [1] Includes allied conditions. [2] Includes persons under 15 years old, not shown separately.

Source: U.S. National Center for Health Statistics, unpublished data.



NO. 118. DEATHS AND DEATH RATES FROM ACCIDENTS, BY TYPE: 1960 TO 1979

NO. 119. DEATHS AND DEATH RATES FROM ACCIDENTS, BY TYPE: 1960 TO 1979

NO. 120. CATASTROPHIC ACCIDENTS AND DEATHS, BY TYPE OF ACCIDENT: 1941 TO 1981

NO. 121. SUICIDES, BY METHOD USED: 1960 TO 1979

NO. 122. SUICIDE RATES, BY SEX, RACE AND AGE GROUP: 1970 TO 1979

NO. 123. SUICIDE RATES FOR SELECTED COUNTRIES, BY SEX AND AGE GROUP: 1975 AND 1980

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11/10/83

ATTACHMENT TO COMMENTS ON APPX. J

HEALTH IMPACTS DUE TO SELECTED COMBINATIONS OF PROGRAM OPTIONS

TABLE I.9. Total Increase in Radon-Induced Lifetime Lung Cancers as a Result of Residential Tightening if All Residences are Tightened, By Residence Type and Source-Term Combination

Combination	Mobile Homes	Single-Family Detached	Single-Family Attached	Apartments	
		Mineralized			
4	0	94.29 (1.57)	10.82 (1.11)	150.12 (2.56)	TOTAL MINERALZ.
5	14.62	15.06	1.27	0	341.95
6	0	23.23 (2.08)	1.40	0	(0.95)
7(a)	7.24	18.44 (0.17)	2.06	3.40	
		Nonmineralized			
4	0	69.56 (0.21)	15.55	180.14 (0.30)	TOTAL NON-MIN.
5	21.81	25.55	4.07	0	376.78
6	0	24.13 (0.40)	3.25	0	(0.15)
7(a)	4.24	22.31	3.47	2.70	

(a) Category 7 includes persons in residences of two types:
A--without UFFI and without unvented combustion appliances
B--with UFFI or with unvented combustion appliances.

NUMBERS IN PARENTHESES REPRESENT ANNUAL CANCERS PER 100,000 PEOPLE IN EACH CATEGORY.

ANNUAL RATE = $\frac{\text{LIFETIME CANCERS}}{85 \text{ YR LIFETIME}} \div \left[\begin{array}{c}\text{EXPOSED}\\ \text{POPULATION}\\ \text{TABLE I.5}\end{array}\right] \times 100{,}000$

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COMMENTS ON APPX J OF EIS PUGET POWER 11/10/83

TABLE 2.1 EXTENSION

TABLE 2.1. Summary of Environmental Impacts

Health Effects of	Baseline	No-action: Present Program	Proposed Action	Proposed Action with Mitigation-By-Exclusion: 1%	2%	3%	4%	5%	6%	7%	Proposed Action with Mitigation-By-Action: 99%	99%	99%
Formaldehyde: Annual Cancers (a) / Incremental (b) / Total (c)	N/A / 4	.05 / 4.05	.25 / 4.30	<.25 / <4.30	<.25 / <4.30	<.25 / <4.30	<.25 / <4.30	<.25 / <4.30	0.17 / 4.22	0.17 / 4.22	0.25 / 4.30	0.17 / 4.22	0.20 / 4.25
Benzo(a)-Pyrene (BaP): Annual Cancers (a) / Incremental (b) / Total (c)	N/A / 57	1 / 58	5 / 63	<5 / <63	5 / 63	<5 / <63	<5 / <63	2 / 60	4 / 62	3 / 61	5 / 63	2 / 60	4 / 62
Radon (Rn): Annual Cancers (a) / Incremental (b) / Total (c)	N/A / 57	.17 / 57.17	4 / 61.17	3 / 60.17	4 / 61.17	.5 / 57.67	3 / 60.17	3 / 60.17	3 / 60.17	2 / 59.17	4 / 61.17	2 / 59.17	2 / 59.17
ANNUAL CANCERS (INCREMENTAL) (b)	N/A	1.22	9.25	<8.25	<9.25	<5.75	<8.25	<5.25	7.17	5.17	9.25	4.17	6.20
ANNUAL CANCERS (TOTAL) (c)	118	119.22	128.47	<127.47	<128.47	<124.97	<127.47	<124.47	126.39	124.39	128.47	123.39	125.42
"EXPOSED" POPULATION (d) (ELIGIBLE FOR PROGRAM)	N/A	858,520	2,415,540	2,352,040	2,334,260	967,740	2,065,020	1,684,020	2,029,460	1,646,920	2,415,540	2,415,540	2,415,540
TOTAL POTENTIALLY AFFECTED (e)	3,275,163	←											3,275,163
INCREMENTAL CANCER RISK PER 100,000 "EXPOSED" POPUL.	N/A	0.14	0.38	<0.35	<0.40	<0.59	<0.40	<0.31	0.35	0.31	0.38	0.17	0.26
TOTAL CANCER RISK PER 100,000 PEOPLE POTENTIALLY AFFECTED	3.60	3.64	3.92	<3.89	<3.92	<3.82	<3.89	<3.80	3.86	3.80	3.92	3.77	3.83

FOOTNOTES:

(a) ANNUAL CANCERS FROM TABLE 2.1.

(b) INCREMENTAL CANCERS = PRESENT PROGRAM COMPARED WITH BASELINE ; PROPOSED ACTION & PROPOSED ACTION WITH MITIG. COMPARED WITH PRES. PROG.

(c) TOTAL CANCERS = BASELINE CANCERS + CANCERS DUE TO PRESENT PROGRAM + CANCERS DUE TO PROPOSED ACTION OR PROP. ACT. WITH MITIG.

(d) "EXPOSED POPULATION = NUMBER OF RESIDENCES ELIGIBLE FOR EACH OPTION (TABLE 2.1) MULTIPLIED BY 2.54 PERSONS PER RESID. (Pg I.4)

(e) TOTAL POTENTIALLY AFFECTED FROM TABLE I.2

"<" MEANS "LESS THAN"

Comments on Draft EIS **38**
Puget Power
11/10/83
Attachment 2

COMMENTS ON APPENDIX K

PREDICTION OF ELECTRICAL LOAD REDUCTION

6 Parts of the analysis performed in Appendix K were extremely difficult to follow. Many assumptions were made and numbers used without explanation. The sample calculation starting on page K.6 is an example. We tried to determine how the average savings was calculated for residences receiving all tightening measures. We could not follow the analysis. There was not enough work shown. We tried to derive the numbers on our own and found a substantial difference. For Zone 1 (5,000 DEG-DAYS), the EIS shows 1,621 Kwh for Single-Family Detached residences (pg. K.7). The attached rough analysis done by Puget Power shows 3,781 Kwh. Why the difference? Are the energy savings under-estimated in the EIS? See comments on Economics under Miscellaneous Comments.

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ENERGY ANALYSIS FOR
COMMENTS ON APPX. K
PUGET POWER 11/10/83

PUGET POWER

SHEET ____ OF ____
DESCRIPTION ____ BY ____ DATE ____
____ CK'D BY ____ DATE ____

Savings in infiltration M.L.

Energy Savings

ZONE 1, 5000 DEG DAYS

$C_\Delta = .6$

From Pg K.6 $25.9 \times 10^6 \times .60 = 15.5 \times 10^6$ BTU

① 1 AC/HR

$\frac{15.5 \times 10^6 \text{ BTU}}{3413 \text{ BTU/Kwh}} \times 0.176$ (SING. FAM, DET) $= 801.4$ kwh

Compare to Pg K.7 1621 kwh

This is about 1/2

Pg K.7 must include Transmission Heat Loss.

Estimate Transmission M.L.

From Table K.4, SQ FT of glass =

$4.304 \times 8 + 4.917 \times 25 + 1.849 \times 45 =$

$34.43 + 122.93 + 83.21 = 240.56$ ϕ

$\Delta U = U_{\text{single}} - U_{\text{double}} = 1.1 - .6 = 0.5$

ANN'L ENGY (BTU) $= U \times A \times D\text{-}D \times 24 \times C_\Delta$

$= 0.5 \times 240.56 \times 5000 \times 24 \times .6$

$= 8.66 \times 10^6$ BTU

ANN'L ENGY (kwh) $= 2,537$ kwh

790.90.4.78

PUGET POWER

DOORS (assume 2 × 3 × 7 ; $\Delta\alpha$ = 1.1 − .6 = .5)

BTU SAVES = $\frac{.5 \times 42^{\#} \times 5000 \times 24 \times .6}{3413}$

= 443 kwh

SHEET ____ OF ____

DESCRIPTION ____ BY ____ DATE ____

CK'D BY ____ DATE ____

Savings (INFILTRATION) = 801 kwh

Savings (Transmission windows) = 2,537

Savings (Transmission Doors) = 443

TOTAL ENERGY SAVINGS 3,781 kwh

compare to PK-7

1,621 kwh

Ø90 4-78

COMMENTS ON APP'X K OF EIS PUGET POWER 11/10/83

ADDITIONAL COMMENTS ON ENERGY SAVINGS

JKJ 11/10/83

1. THE DIFFERENCE BETWEEN THE PRESENT PROGRAM AND THE PROPOSED ACTION IS 74.4 MW.

2. THE PRESENT PROGRAM IS THE SAME AS THE PROPOSED ACTION WITH MITIGATIONS 1 THRU 6.

3. THE ENERGY REDUCTION, OR ENERGY PENALTY, ASSOCIATED WITH EACH MITIGATION IS THE DIFFERENCE BETWEEN THE PROPOSED ACTION AND THE PROPOSED ACTION WITH THAT MITIGATION.

4. SINCE THE EIS TREATS EACH MITIGATION INDEPENTLY, IT FOLLOWS THAT THE SUM OF THE ENERGY PENALTIES FOR EACH MITIGATION SHOULD EQUAL THE DIFFERENCE BETWEEN THE PROPOSED ACTION AND THE PRESENT PROGRAM, OR 74.4MW.

5. HOWEVER, IT DOES NOT:

$$\sum_{i=1}^{6} 74.4 - \text{SAVINGS}_i = 94.8 \text{ MW} \quad (\text{SHOULD} = 74.4 \text{ MW})$$

7 6. THIS MEANS THAT THERE IS A PROBLEM SOMEWHERE IN THE CALCULATION OF ENERGY SAVINGS FOR THE PROPOSED ACTION AND/OR ONE OR MORE OF THE MITIGATIONS.

7. IT IS A POSSIBILITY THAT ENERGY SAVINGS FOR THE MITIGATIONS MAY HAVE BEEN UNDERESTIMATED.

Comments on Draft EIS 30
Puget Power
11/10/83
Attachment 3

MISCELLANEOUS COMMENTS

1. ECONOMICS

We tried to calculate the weatherization program cost in terms of $/MW and $/Kwh for the first year energy savings. We found some questionable results that we cannot understand. (See the attached copy of Table 2.1 with write-in changes.) While the program costs under the Present Program are approximately 33¢/Kwh for the first year savings, the incremental costs for the Proposed Action and the Proposed Action with Mitigations exceeds $1.00/Kwh and in one case exceeds $2.00/Kwh. We have found no explanation for this tremendous increase in incremental costs. 8

If the numbers are unrealistically high, it leads one to the conclusion that either the program costs have been over-estimated or the energy savings have been under-estimated, or both. Our comments on Appendix K indicate that energy savings may be under-estimated.

2. RISK OF LUNG CANCER FROM RADON

On page 3.19 the "normal" risk of lung cancer, approximately 4%, is added to the 2.6% risk of incurring cancer from exposure to radon to yield a total risk of 6.7%. Since radon exposure is part of this "normal risk", such a calculation is inappropriate unless the average risk from radon exposure is an insignificant part of the "normal" 4%. Is that the case? 9

3. WATER QUALITY

On page 4.49 the Proposed Action would result in reduced releases of heat and water pollutants of 3.5 to 4.9 quadrillion Btu and 2.0 thousand tons, respectively. 4.9 quads represents a 4.9% decrease in heat while 2.0 thousand tons represents a 0.1% decrease in effluents. (See also Sec. 4.8) Why is there such a difference? Would it be logical for the percent reduction for these two to be closer? If so, perhaps it indicates an error somewhere. 10

4. MITIGATION OPTIONS

In Section 2, specifically 2.17 on page 2.53, several mitigations are discussed which have not been included in this EIS. In fact, the only mitigation-by-action that has been included is the use of air-to-air heat exchangers. We believe that several other mitigation options are viable and should be permitted in addition to the use of air-to-air heat exchangers. It is inappropriate for BPA to consider only air-to-air heat exchangers as mitigations, especially since the L.B.L. research shows that they do not perform as well as expected, and they are not cost-effective compared to ventilation by other means. 11

5. POSITIVE HEALTH IMPACTS

While great pains have been taken to calculate negative health impacts of weatherization, nothing is done to show the positive health benefits of the weatherization program. It is possible that there may be some positive health impacts due to weatherization. The $26 million of additional disposable income, and the reduction in water pollution could both have an effect. The effect may be small, but 12

then again, so are the negative health impacts. Perhaps they cancel each other. A quick and dirty, order-of-magnitude analysis might be appropriate to determine whether the concept is worth considering in more detail. However, we are not recommending an extensive analysis. 12

6. CONFUSING USE OF THE WORD "TYPICAL"

The word "typical" is used to describe a worst-case residence which includes all of the pollutant sources of concern. (See pg. xi, last paragraph) It is also used to describe the "most likely" impacts of weatherization as determined by your calculation methodology. The implication is that the "typical" impact occurs in the "typical" residence. It is very confusing for someone not intimately familiar with the EIS. 13

7. ADDITIONAL USEFUL INFORMATION

To make it easier to follow various analyses, it would be helpful to display some of the numbers used later. This could be done by improving some of the tables. 14

For example, Table 1.8 shows the "before" and "after" concentrations of radon, but fails to show the "difference", which would have been helpful if used in conjunction with Appx. J and other places.

Another example is Table K.7. The total effectiveness of all three tightening measures is used on the following page. It would have been helpful to have these totals listed in a fourth column of Table K.7 so that it would be more obvious where the numbers came from.

There are undoubtedly many more examples.

8. MISLEADING TERMINOLOGY

Table 1.5 shows a GRAND TOTAL of the number of persons in each housing type. This appears to be a meaningless number since many have been double counted. It could also be misleading. 15

9. MISSING FOOTNOTE

On page A.13, radon standards for Sweden refer to footnote "c." There is no footnote "c." 16

MISC COMMENTS ON FIS
ECONOMICS
PUGET POWER
11/10/83

TABLE 2.1. (contd) WITH PROGRAM COSTS ($/MW, $/kwh) ADDED
SEE MISC. COMMENTS, 1. ECONOMICS.

Eligible Residences	No-Action Baseline	No-Action Present Program	Proposed Action	Proposed Action with Mitigations-By-Exclusion 1*	2*	3*	4*	5*	6*	7*	Proposed Action with Mitigation-By-Action 1**	2**	3**	Proposed Action Other Options***	Delayed Action
Energy — TOTAL SAVINGS →	1.3 million Average load of 17500 MW in 1981-1982	338 thousand 191 Savings of (191) annual MW	951 thousand 265.4 Savings of 74.4 annual MW in addition to existing program (range: 61.6 to 114)	926 thousand 263.0 Savings of 72.0 annual MW in addition to existing program (range: 59.7 to 110.3)	919 thousand 262.7 Savings of 71.7 annual MW in addition to existing program (range: 59.4 to 109.9)	381 thousand 218.2 Savings of 27.2 annual MW in addition to existing program (range: 21.9 to 45.5)	813 thousand 254.1 Savings of 63.1 annual MW in addition to existing program (range: 52.4 to 96.1)	663 thousand 239.3 Savings of 48.3 annual MW in addition to existing program (range: 40.9 to 73.1)	799 thousand 260.3 Savings of 69.3 annual MW in addition to existing program (range: 57.6 to 104.9)	648 thousand 243.7 Savings of 32.7 annual MW in addition to existing program (range: 42.7 to 82.7)	951 thousand 265.3 Savings of 74.3 annual MW in addition to existing program	951 thousand 259.6 Savings of 68.6 annual MW in addition to existing program	951 thousand 263.9 Savings of 72.9 annual MW in addition to existing program	951 thousand Same as Proposed Action	Unknown Depends on action chosen
Cost, $(b) — TOTAL COST →	0	550 million(a)	793.6 million over No-Action (range: 678.6 to 983.1) 1,343.6	769.5 million over No-Action (range: 657.9 to 953.4) 1,319.5	766.1 million over No-Action (range: 655.0 to 949.1) 1,316.1	531.1 million over No-Action (range: 453.7 to 658.9) 1,081.1	879.6 million over No-Action (range: 751.3 to 842.4) 1,229.6	552.6 million over No-Action (range: 455.8 to 660.9) 1,082.6	740.7 million over No-Action (range: 633.7 to 918.1) 1,290.7	534.6 million over No-Action (range: 455.0 to 659.7) 1,084.6	819.9 million over No-Action 1,369.9	952.6 million over No-Action 1,502.6	857.0 million over No-Action 1,407.0	Same as Proposed Action	793.6 million above No-Action (or less depending on actions chosen) plus cost of research
Socio-economics	Price-induced conservation to save about 740 MW by 1995	About 80% of cost paid by BPA	12,222 installer years required above No-Action	11,851 installer years required above No-Action	11,797 installer years required above No-Action	8,178 installer years required above No-Action	10,465 installer years required above No-Action	8,202 installer years required above No-Action	11,406 installer years required above No-Action	8,232 installer years required above No-Action	Increase installer years over Proposed Action	Increase installer years over Proposed Action	Increase installer years over Proposed Action	Same as Proposed Action	Depends on action chosen
Land Use	98.5 thousand acres permanently lost	4,582 acres not lost	1,785 acres not lost above No-Action	Slightly less than Proposed Action	Same as Measure #1	652 acres not lost above No-Action	1,313 acres not lost above No-Action	1,199 acres not lost above No-Action	1,663 acres not lost above No-Action	1,267 acres not lost above No-Action	Less than Proposed Action	Less than Proposed Action	Less than Proposed Action	Same as Proposed Action	Depends on action chosen
Water Quality	469 million acre-feet of water withdrawn, 24.8 million tons of effluent and 410 quadrillion Btu not released	2.4 thousand acre-feet of water not withdrawn, 5.1 thousand tons of effluent and 12.5 quadrillion Btu of heat not released	0.94 thousand acre-feet of water not withdrawn, 2.0 thousand tons of effluents and 4.9 quadrillion Btu not released above No-Action	Slightly less than Proposed Action	Same as Measure #1	0.34 thousand acre-feet of water not withdrawn, 0.7 thousand tons of effluent and 1.8 quadrillion Btu not released above No-Action	0.80 thousand acre-feet of water not withdrawn, 1.7 thousand tons of effluents and 4.2 quadrillion Btu not released above No-Action	0.61 thousand acres-feet of water not withdrawn, 1.3 thousand tons of effluents and 3.2 quadrillion Btu not released above No-Action	0.88 thousand acre-feet of water not withdrawn, 1.9 thousand tons of effluents and 4.6 quadrillion Btu not released above No-action	0.67 thousand acre-feet of water not withdrawn, 1.4 thousand tons of effluents and 3.5 quadrillion Btu not released above No-Action	Less than Proposed Action	Less than Proposed Action	Less than Proposed Action	Same as Proposed Action	Depends on action chosen

(a) BPA 1981e
(b) Total cost. Part will be covered by BPA.
*1 = excluding residences with urea-formaldehyde foam insulation
2 = excluding residences with unvented combustion appliances
3 = excluding residences built slab-on-grade, with basements, or with unventilated crawl space
4 = excluding residences served by well water
5 = excluding residences with wood stoves
6 = excluding mobile homes
7 = excluding apartments
**1 = provide air-to-air heat exchanger to residences with measured formaldehyde levels exceeding 480 micrograms per cubic meter ($\mu g/m^3$), or 0.4 parts per million (ppm)
2 = provide air-to-air heat exchanger to residences with wood stoves
3 = provide air-to-air heat exchanger to residences with measured radon levels above 3 picocuries per liter (pCi/L)
***1 = provide booklet on detrimental effects of operating a wood stove and smoking in a tightened house

$/MW (MILLIONS)	INCREMENTAL	2.9	10.7	10.7	10.7	19.5	10.7	11.0	10.7	10.1	11.0	13.9	11.8	
	AVERAGE	2.9	5.1	5.0	5.0	5.0	4.8	4.5	5.0	4.5	5.2	5.8	5.3	
$/Kwh	INCREMENTAL	$.329	1.218	1.221	1.220	2.229	1.230	1.260	1.221	1.159	1.260	1.586	1.342	
	AVERAGE	$.329	0.579	0.573	0.572	0.566	0.553	0.517	0.566	0.508	0.589	0.661	0.609	

NOTE: Kwh = MW x 8760 HR/YR x 1000 Kwh/Mwh

11-8-83

Sirs: Anthony R. Morrell

I have recently completed building my own home, in which I have instituted many energy conserving factors. I have over insulated the walls and ceiling, have movable window insulation covers, South facing windows, and weather stripping & caulk everywhere. My 800 sq. foot rambler is zone heated with electricity & costs about $50/month. I am a strong supporter of the BPA's weatherization program. I believe this is the most effective way of conserving the North West's power and hopefully eliminating the need for nuclear power plants. Your weatherization program I feel should be extended to all types of construction, including mobile homes. The use of heat exchangers should be instituted to handle indoor pollutants.

There is one factor I find very upsetting, and that is the increased use of Wood Stoves. Undoubtedly the Wood Stove is many peoples answer to the increasing electricity costs they are faced with. When I wake up on a cold, clear morning and find the sky hazy with Wood Stove smoke, I can only think, why in the hell does BPA keep increasing their costs? Is it because

1

1 people are conserving electricity, therefore decreasing the utility companies revenue? If so, it seems like a very cyclic effect.

It seems unjustified to have anti-pollution laws for automobiles and industry when any one can install a Wood Stove and Smoke up the atmosphere. It is for this reason, I would never install a Wood Stove in my home. But I fear so many people see their electricity bills increasing that they feel this is the only cheap way out.

2 I would like to see mandatory weatherization programs instituted for all homes, no matter how they are heated. The Utility Co. could deal directly with the Customer and Subsidize the costs. Air to air heat exchangers should be made available at reduced costs for homeowners, to handle indoor pollutants. If home owners could only see a viable alternative to Wood Stoves, I feel it would be a great service to our environment.

Thank you

Jonathan K. McCormick

18609 -40th ave W

Lynnwood, WA 98036

COMMUNITY DEVELOPMENT DEPARTMENT
P.O. Box 1083, Corvallis, OR 97339-1083

Planning	(503) 757-6908
Housing and Redevelopment	757-6981
Building	757-6929

November 9, 1983

Anthony R. Morrell
Environmental Manager
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

Reference: SJ, Draft EIS for Expanded Weatherization Program

Dear Mr. Morrell:

The Corvallis Energy Task Force is an advisory committee consisting of five members appointed by the Mayor and City Council of Corvallis to provide advice to the City on energy conservation issues. Our membership includes two contractors, a representative of the local electrical utility and others who will be affected by the decision on whether the BPA residential weatherization program should be expanded.

George Starr, State and Local Government Area Coordinator for BPA, provided a report to the Task Force on the indoor air quality issues. We appreciated his presentation. We have carefully reviewed and discussed residential weatherization and air quality issues. Our discussion is summarized in the minutes of the meeting of October 11. These minutes are attached and hereby made a part of our testimony. We hope that you will find the minutes useful as an expression of the policy implications of the draft EIS on the health impacts of home weatherization.

On November 1, the Task Force approved the following recommendations concerning the draft EIS on the expanded residential weatherization program:

1 1. BPA should adopt the no-action alternative but must take necessary steps to expeditiously resolve air quality issues for homes that are currently excluded from weatherization.

2 2. To effectively deal with potential health impacts, BPA should establish indoor air quality standards. Based on the draft environmental impact statement, we believe that sources of formaldehyde and radon are the most likely pollutants for near-term modification of the exclusions related to infiltration-reducing measures.

3 3. BPA should implement a separate weatherization program for homes currently excluded from house tightening measures, possibly emphasizing delivery of services through non-utility organizations such as independent contractors employing house-doctor techniques. House doctoring programs may offer the most practicable means for cost-effective weatherization, consumer education and assistance in monitoring and mitigation of sources of indoor air quality problems. In addition, BPA should encourage the use of available low-cost monitoring devices to guide air tightenting treatments.

Thank you for your consideration.

Sincerely,

David J. Davis
Chairman
Corvallis Energy Task Force

DD/JC/las
Attachment

Corvallis Energy Task Force

October 11, 1983

Members Present	Staff Present	Others Present
David Davis	Jeff Christensen	George Starr
Ray Chesbrough		
Grace Phinney		
Raheem Hadee		
Rod Terry		

The meeting was called to order by Chairman Davis at 4:10 p.m. The minutes of the September 20, 1983, meeting were approved as mailed.

Raheem Hadee reported that he was notified yesterday that the prospects that PP & L will sign the Conservation Contract with BPA are much improved. He indicated that it was his impression that BPA had made substantial changes in the contract offer that was bringing the company closer to signing. The decision on whether or not to sign will be made by October 31.

Environmental Effects of Home Weatherization

George Starr, BPA State and Local Government Coordinator, presented a slide show summarizing the recently-issued draft environmental impact statement (EIS) on health impacts of home weatherization. BPA noted that concerns have been raised that some energy conservation measures in certain homes might have adverse health empacts. In an Issue Backgrounder, BPA described the nature of the health impacts as follows:

> "Reducing a home's air exchange rate by sealing air leaks also has the unfortunate side effect of increasing the concentration of various air pollutants found indoors. Installing home-tightening measures does not cause indoor air pollution. It can aggravate existing problems. Some of the indoor pollutants are irritating to the respiratory system and some are capable of causing cancer."

Prior to the start of BPA's residential weatherization program in November 1981, the agency issued an environmental statement permitting BPA involvement in the full range of cost-effective conservation measures for approximately 30% of electrically-heated home in the region. The balance, about 70% of the 1½ million electrically-heated homes in the region, were declared not eligible for certain kinds of energy conservation measures (termed "tightening measures") because one or more of the following characterizes the house with particular associated pollutants as follows:

Home Characteristic	Principal Pollutants
1. Homes built slab on grade	Radon
2. Homes with basements	Radon
3. Homes without fully ventilated crawl spaces	Radon
4. Homes supplied with private well water	Radon
5. Homes containing wood stoves	Combustion pollutants (e.g., sulphur-oxide, carbon monoxide, respirable suspended particulates, formaldehyde, and benzo-(a)-pyrene)
6. Homes having unvented combustion appliances	Combustion pollutants
7. Homes with ureaformaldehyde foam insulation	Formaldehyde
8. Mobiles homes	Formaldehyde

Homes with any of the preceding characteristics are still eligible to receive weatherization measures which do not reduce air exchange rates, including ceiling, floor, and water pipe insulation, unfinished wall insulation, dehumidifiers, and clock thermostats. Home-tightening measures, for which homes with potentially significant pollutant sources are not eligible at present, include storm windows and doors, caulking, weatherstripping, and electrical switch and outlet gaskets.

BPA is holding public hearings on three alternatives: 1) expansion of the residential weatherization program to provide additional energy-saving measures to more homes; 2) no action; and 3) delay action for 3-5 years to allow time for research to provide more definitive answers on the extent of indoor air quality problems and means of mitigating potential impacts. The deadline for comments on the EIS is November 14.

The EIS was prepared by Battelle, a consulting firm, in consultation with BPA. Although the authors claim that the study is the most detailed and comprehensive evaluation of health risks associated with indoor air quality problems in residences, Starr referred to the estimates of incidence of cancers and other health problems resulting from house tightening as "nebulous". He also re-emphasized the point that conservation is in effect a source of new electrical power resources and that, to the extent that conservation replaces large thermal power plants, it also reduces environmental impacts associated with such facilities.

Starr noted that the EIS (and BPA) does not recommend any one of the three alternatives. He did indicate that perhaps the agency should implement the alternative of expanding the residential weatherization program with a stipulation that the implementing utility or other program sponsor advise the participating client that tightening of the house could cause health impacts. He compared this approach to the requirements of the tobacco industry that they must carry a health hazard label approved by the Surgeon General on their products.

Starr also suggested that the Task Force or the City should comment on the EIS. Several Task Force members expressed concern that the EIS appears to lack sufficient scientific evidence to allow an informed response and doubts about the ability of the Task Force to contribute information on the issue. Starr responded that because the evidence in the EIS is somewhat nebulous, the decision about expanding the residential weatherization program would probably be based primarily on political pressure and considerations. For this reason, he felt that the opinion of the Task Force, the City and other state and local governments would be influential.

He also pointed out that there are inconsistencies at present between the BPA weatherization program and Oregon state law which does include enabling legislation that requires utilities to provide financing for tightening measures.

Ray Chesbrough asked Starr if BPA was concerned about lawsuits over these issues. Starr said, no, that the agency was concerned with complying with NEPA. Chesbrough stated that he disagreed with Bonneville's current weatherization program. He said it appeared to him that BPA has used the issue of indoor air quality as a way of stymieing the region's conservation efforts.

In response to a question by Chesbrough, Starr indicated that the current EIS process does not address health hazards associated with indoor air quality problems in commercial buildings.

Grace Phinney noted that in addition to exclusions under the current program for homes with slab on grade, mobile homes, etc., that the EIS identifies a new potential 'mitigation-by-action" that, if approved, would limit financial assistance to owners of apartments. She pointed out that according to the EIS, the elimination of apartments from financing for house tightening measures would reduce about half of the lung cancers from benzo-(a)-pyrene and radon that would otherwise occur from indoor air pollution. She asked why apartments have such potentially high concentrations of pollution. The consensus of the Task Force was that the causes of air pollution within apartments can usually be traced to "cheap carpets" and other materials used in furnishing of the apartment. Chesbrough stated that he was concerned about the possibility that apartments could be excluded from house tightening measures in that about 40% of all residences in Corvallis are apartments.

Rod Terry expressed his concern that the EIS report appears to be seriously lacking hard data regarding environmental problems. David Davis asked what sort of comments were being received so far on the EIS from technical experts. Starr said that the draft EIS was being widely distributed including internationally, but that not enough time had elapsed during the period for comments on the EIS to answer the chairman's question.

4 Christensen provided several of his own observations on the EIS without stating a preference for any of the alternatives. He suggested there was a possibility of health risks and that BPA needs to continue to fund air quality research irrespective of which alternative is chosen. He suggested that BPA needs to do something that it has apparently not done before; specifically, the agency should provide testing of air changes and pollution levels either as a routine part of the energy audit or with a large enough sample to provide statistically useful information.

Christensen also raised questions as to the accuracy of a statement in the draft EIS that conservation measures other than tightening measures account for two thirds of the cost-effective energy conservation savings. He noted, for example, that a study at Princeton University has concluded that actual energy savings from measures such as ceiling insulation are generally 30-70% of the estimated savings. He suggested that in the average residence about one third of potential savings could be attributed to measures such as ceiling insulation, about one third to house tightening measures, and one third to the occupant's behavioral characteristics.

5 Christensen also indicated that in reviewing the EIS he noted that one of the possible mitigation-by-actions which was not addressed in the EIS was the possibility of providing financial assistance for tightening houses to a certain standard expressed in air-changes per hour.

Christensen mentioned that he had recently attended a demonstration in Eugene of a process called "house-doctoring". This involves the temporary installation of a blower door to pressurize and/or depressurize the house and a smokestick which is used to identify actual sources of infiltration and to verify the effectiveness of remedial steps for controlling air infiltration. He said that one of the reasons ceiling insulation often does not perform well, is because a house without tightening measures may contain major leaks that result in "bypassing" of the insulation in much the same manner as a chimney. He said he was concerned about cost-effectiveness of ceiling insulation in such a situation because the installed measures are not performing effectively. Also, if a decision is made at a later date to add the tightening measures, the resulting two-phased weatherization would likely be more expensive when compared to doing all of the measures at one time.

Rod Terry stated that he agreed with staff that cost-effectiveness is a major consideration which does not appear to be adequately addressed in the EIS. He also reiterated that he did not agree that the environmental problems constitute major barriers to what should be done to conserve energy. He indicated there are a variety of existing and emerging new products - air-to-air heat exchangers and pollution monitoring equipment - that will find their way into the marketplace.

Terry and David Davis said they were inclined to recommend that BPA proceed with expanding the residential program with the stipulation that the agency require that the customers be notified of potential problems in the manner described by Starr for cigarette sales.

Christensen indicated that he had some concern about such a recommendation. He said that, in his opinion, a house and sources of pollution within the house are more complex than cigarettes. He said that it is not possible for a resident to know how many equivalent cigarettes he or she may be inhaling in a household without monitoring equipment.

Grace Phinney said that she agreed that labeling is not an adequate response to these potential health problems. She said that we know very little about the synergistic effects of various pollutants. She said that some of her friends had experienced health problems with indoor air pollution, for example, in mobile homes.

Raheem Hadee stated that he did not feel that there were any health problems. He said that he doubted that it would be possible to tighten a house enough through these measures to ever create a problem.

Christensen asked the Committee if they wanted to consider whether or not to prepare a response to BPA at the next meeting. He noted there was apparently some differences of opinion on the Task Force regarding whether a problem exists. He reiterated that most of the members and George Starr had indicated that the reported environmental data was nebulous about health effects and he asked whether the Task Force members felt they had the expertise or inclination to comment on the EIS.

The consensus of the Task Force was that staff should prepare some ideas that might be included in testimony and that a decision about whether to comment should be made at the next meeting.

A copy of the BPA Issue Backgrounder, which provides a summary of the draft is attached and made a part of the minutes.

Weatherization Policies

Christensen reported on the status of the draft community weatherization policies. He stated that he had a chance to briefly discuss with the Legal Assistant for the City where such policies might be included (i.e., Comprehensive Plan or other source) were this to be adopted by City Council. A report from the City Attorney was not available for discussion. He also indicated that some additional research on item 2(e) is being done. He distributed copies of documents from the Oregon Department of Energy and from the Regional Power Council Plan that indicate that a better performance standard might well be a single standard for all types of residences expressed in kWh/sq. ft. (or equivalent energy) possible at around 10 to 15 kWh/sq. ft./yr.

He suggested that approval of the policies in concept would be useful to staff in preparing a draft final document on weatherization.

David Davis raised the question of whether the certification under item 2(e) might mean two different things depending upon which provision the applicant utilized. He noted that one of the means of obtaining certification was a performance standard; the other two were based on an energy audit and implementation of the recommendations. He asked if certification would be given to a structure if the owner implemented audit recommendations but the energy use still exceeded the performance criteria.

Christensen indicated that this was a possibility. He stated that in either instance, the goal was simply to recognize a structure that was relatively energy-efficient. He pointed out that a certification program would work only if the established criteria for certification are tough but not impossible to meet. He said the program would have little or no effect on the rental marketplace if only 5% of all housing units could meet the test or, conversely, if 95% could meet the est.

Rod Terry said that he supported all of the policy recommendations. In addition, he asked if there might be merit in some sort of consumer reporting requirements for disclosing to a prospective renter the actual energy used. He agreed that this information might be misleading to the prospective renter in some cased in that the previous occupants may have been exceptionally low or high in regards to personal use of energy. Staff agreed to inquire about the legal obstacles, if any, to such disclosure.

After considerable discussion, the Task Force endorsed the policy recommendation in concept. Staff noted that when the Task Force next reviews the weatherization element, these policies will be accompanied by a summary of information from the community weatherization staff report, weatherization survey, and other

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information that will be presented in the form of "findings" to accompany the recommended policies.

There being no further business, the meeting was adjourned at 6:20 p.m. The next meeting will be November 1, 1983, at 7:00 p.m. in the City/County Meeting Room in the Law Enforcement Building.

III-57

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TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSEE 37902

NOV 10 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
Post Office Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

The Tennessee Valley Authority (TVA) has completed its review of Bonneville Power Administration's proposed expanded residential weatherization program. Our comments are enclosed and listed under General and Detailed headings.

We hope TVA's comments will be helpful as you move ahead toward preparation of the final statement. If you have questions regarding TVA's comments, please contact John R. Thurman at FTS 856-6656.

Sincerely,

Alvan Bruch

Alvan Bruch, Ph.D.
Acting Director of
Environmental Quality

Enclosures

TVA COMMENTS - BONNEVILLE POWER ADMINISTRATION'S PROPOSED EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM

General Comments

Indoor Air Quality (IAQ) Research--Research on IAQ to reduce the uncertainty in predicting pollutant concentrations and health effects is proposed under the delayed action alternative. We believe that such research (to characterize pollutants, quantify the effects of weatherization, and evaluate mitigation measures for new and existing homes) would also be extremely important in evaluating both the No Action and the Proposed Action alternatives. For example, the health effects estimates indicate the uncertainties in assumptions regarding radon source terms, indoor radon concentrations, and air turnover rates in residences. The magnitude of these uncertainties demonstrates the importance of obtaining field data on indoor pollutant levels. Therefore, regardless of the alternative action BPA now selects based upon current scientific information, we encourage BPA to undertake this research.

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Detailed Comments

2 Page iii, first full paragraph--Carbon monoxide (CO) is not a ". . . natural end-product of combustion." It is an end-product of incomplete combustion. Incomplete combustion is also the source of the ". . . complex chemicals known as polycyclic organic matter." Benzo-[a]-pyrene (BaP) is not a major constituent of this group in terms of quantity. It is normally named because it is better known and has been quantified better.

3 Page iii, second paragraph--The manner in which carbon dioxide (CO_2) displaces oxygen (0_2) should be clarified. The context of the next-to-last statement implies that CO_2 displaces 0_2 in the blood. Such a statement is more accurate for CO tban CO_2, which displaces 0_2 in air when it is present in high quantities. Also, the last sentence of the second paragraph is inaccurate and contradicts the text on page 3.14 and in Appendix E. A statement in the tbird paragraph of page 3.3 is consistent with this last sentence but is also inaccurate.

4 Page xi, Effects of the Proposed Action, Air Quality, second sentence--This statement cannot be true for all pollutants. Reactive and nonreactive pollutants as well as indoor and outdoor source pollutants will have widely varying effects.

5 Page xi, last paragraph--Because of the importance of the caveats at the end of the paragraph, they should be highlighted in some fashion.

6 Page xiv, first paragraph--Figure 3 is missing.

7 Page xvii, second paragraph--A reference should be included for the determination that 480 ug/m^3 is an acceptable level of formaldehyde.

8 Page xvii and xviii--The sentence that begins on the bottom of page xvii and continues to the next page is inaccurate. The end of the sentence at the top of page xviii should be changed to ". . . relationship has been quantified."

9 Page 2.9, fifth paragraph--A reference is needed for estimated concentrations for formaldehyde, BaP, and radon.

10 Page 2.12, Air Quality, second paragraph, second sentence--Does the estimated 74.4 annual megawatts (MW) of electrical energy represent additional energy actually needed or is it energy which would not be saved if the Proposed Action is not undertaken? (See page 2.20, second paragraph, and page 2.23.) Should this value be 75.4 MW? (See Appendix K, page K.9, Table K.9.)

11 Page 2.14, table 2.4--Radon-222 emissions from coal plants could be included for better comparison.

12 Page 2.17, fourth paragraph--For time-average concentrations the averaging time should be shown.

13 Page 2.20, Outdoor Air Quality, second paragraph--Total suspended particulates (TSP) emissions resulting from glass manufacture are projected to

13 increase by 0.45 percent over current annual average emissions. What are the current annual average TSP emissions and how was the increase determined? (This appears to be inconsistent with the assumption, page 4.6, sixth paragraph, that the glass would be manufactured outside of the region.) Also, how were the estimated TSP emissions (3.9 tons) from aluminum manufacture and product transportation determined?

14 Pages 2.36-2.38, Mitigation-by-Exclusion No. 6--(Exclude Mobile Home)--The preparation of the final statement should address the Department of Housing and Urban Development's (HUD) proposal to revise its "Manufactured Home Construction and Safety Standards" (according to the Federal Register, Volume 48, No. 195, Tuesday, August 16, 1983). A formaldehyde standard is being proposed to regulate indoor air quality. Specifically, the standard would regulate formaldehyde emissions from plywood and particle board materials.

We believe that HUD's objective in implementing a minimum standard is to regulate the level of formaldehyde within the home environment. HUD has determined that an indoor ambient air formaldehyde level of 0.4 part per million (PPM) provides reasonable protection to manufactured home occupants. The proposed standard would require that formaldehyde emissions not exceed 0.2 PPM for plywood and 0.3 PPM for particle board as measured by the Air Chamber Test Method.

Also, it should be noted that certification of formaldehyde-containing wood products is in progress. As of November 1, the Hardwood Plywood Association, which developed the Air Chamber Test Method, should be certifying hardwood plywood according to the HUD standard. The American Plywood Association has tested structural softwood plywood and particle board according to the HUD

standard and has found that almost all manufacturers can comply. This industry, which predominately uses phenol formaldehyde instead of urea formaldehyde, has solved the emission problem primarily by switching adhesives.

15 Section 3.0, Description of the Affected Environment--Averaging times for concentrations are critical. This section is a good example of how critical they are. For example, page 3.13, first paragraph, references average outdoor concentrations for the six-city study and immediately compares these with indoor levels for different smoker distributions. Without averaging times, these concentrations cannot be compared. A similar statement is true for nitrogen oxides (NO_x) concentrations, e.g., on pages 3.14 and 3.15, the nitrogen dioxide (NO_2) standard is referenced without stating that its value is an annual average.

16 Page 3.2, Table 3.1--This needs a reference.

17 Page 3.8, Outdoor Air Quality--We suggest that an explanation be given on how the typical pollutant concentrations were obtained and that a reference be included. Also, it would be helpful if the averaging times were included. The BaP value is erroneous and conflicts with Table 2.3, page 2.13.

18 Page 3.10, Table 3.5--Consistent units for pollutant concentrations should be give. Also, the National Research Council reference should be completed.

19 Page 3.10, Public Health--Treatment of health effects justification is inconsistent. For example, this page references Appendix F for the principle of linear extrapolation (apparently applied to all three cancer-causing pollutants), but the referenced appendix is for radon only. If the predictive model for radon risk assessment was used for BaP and formaldehyde, it is not clear why Appendices D and E were included in the DEIS.

20 Page 3.13, first paragraph, first sentence--The reason for the change from respirable suspended particulates (RSP) to TSP is unclear. TSP is not normally measured indoors where smoker emissions occur.

21 Page 3.16, second paragraph--The source for the CO_2 concentrations should be identified.

22 Section 4.0, Environmental Consequences--The methodology used for the ranges and typical residence effects is overly simplistic. More precise information could be obtained by convoluting frequency distributions (i.e., homes with various sources, air exchange rates, etc.) to give better frequency distributions and uncertainties for specified concentration levels. Health effects could then be estimated with less uncertainty. Also, we believe the definition of the typical home is overly severe in number and types of sources. This is evidenced by the very high estimated concentrations that are presented in Table 4.3 (page 4.8).

23 Page 4.4, eighth paragraph--The stated assumption is that cigarette smoking is not considered to be a combustion source. However, on page 4.8, lines 2-3 and 6-9, cigarette smoking is specifically included as a combustion source of BaP. This discrepancy should be resolved.

24 Page 4.6, sixth and seventh paragraphs--The reference for the stated particulate emission rates (2 lbs/ton for glass manufacture and 0.2 lbs/ton for aluminum manufacture) should be given.

25 Page 4.7, last paragraph--The second sentence states that BaP ". . . exists as a vapor as well as condensed on particles at room temperature." BaP should be primarily on particles even at room temperature because of the high particle concentrations which will also be associated with sources of BaP.

26 Page 4.11, first paragraph--The estimated 87.5 MW of energy saved from the proposed action does not agree with the 75.4 MW energy savings given in Table K.9 on page K.9 of Appendix K, nor with the 74.4 MW stated on page 2.12 and 2.20. How was this value obtained? How were the power plant pollutant emissions determined?

27 Page 4.12, Table 4.6, measure 7--Either the given percentage (18) or footnote (c) is incorrect.

28 Page 4.13, third paragraph--Units for the second BaP value (4.9) should be nanograms (ng) rather than ug.

29 Page 4.17, first paragraph, last sentence--The efficiency of the particle collection systems must be 99.7 percent, not 99 percent, to reduce an emission rate of 2 lbs/ton to 0.006 lb/ton.

30 Page 4.17, second paragraph--This appears to be inconsistent with the text on page 2.20, third paragraph, which states that a maximum of 16,000 tons of glass would be manufactured. It also appears to be inconsistent with the assumption on page 4.6, sixth paragraph, that the glass will be manufactured outside of the region.

31 Page 4.17, third paragraph--This should include a reference to page 4.6, seventh paragraph, where the particulate emission rate of 0.2 lbs/ton is given, or it should be included here.

32 Page 4.21, fifth garagraph, second sentence--If these BaP levels are more reasonable, the document should explain why they are not used. The concen- trations to which they are being compared should be discussed.

33 Pages 4.24 and 4.25, Tables 4.13 and 4.15--The percent change in concen- trations from the No Action to the Proposed Action are the same for RSP and NO_2. This can't be true since NO_2 is reactive. The percent change for NO_2 should be less.

34 Page A.3, last paragraph--The emission rate for BaP should be 1.7×10^{-4} mg/ cigarette rather than 1.7×10^{4} mg/cigarette.

35 Page A.3, last sentence--There are many situations for which ambient BaP is not negligible. Field studies in the BPA region (e.g., Medford, Oregon, and Missoula, Montana) have shown elevated BaP levels. These findings should also be reflected for the BaP entries in Table 2.3,

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page 2.13. In addition, the DEIS's reference (Moschandreas and Zabranski, 1981) shows penetration of 80 to 90 percent of the ambient BaP during periods of no woodstove burn. This error is repeated throughout the DEIS.

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Page A.5, last paragraph--The equation for average daily concentration (CAVG) does not allow for ambient contributions even though some of the pollutants modeled are listed as group 2 pollutants (i.e., from indoors and outdoors). The examples used to demonstrate this equation could be presented in a different manner as indicated by the following two comments.

36

Page A.6, Example 1--In the second line of text, the house volume should be 400 m^3. The value for t_1 comes from Table A.5 and is 8 h. The resulting CAVG is 0.919 ug/m^3.

Page A.6, Example 2--In the ninth line, "77.5 916)" should be "77.5 (16)." In the next line, the correct reference is Table A.2. For all three volumes, a reference to Table A.3 should be included. In the last line, CAVG (low) = 0.052 mg/m^3, the use of significant digits is not consistent.

37

Page A.5, last sentence--". . . source term emission rage . . . ." should be ". . . source term emission rate . . . ."

38

Pages A.7 through A.10--All of the information in these tables is not referenced.

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39

Page A.8, Table A.5--Footnotes (a) and (b) are missing.

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Page A.10--The denominator of equation (A.2) is incorrect. It should read "V * I" instead of "V + I."

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Page A.10, last paragraph--In the second line, the correct reference is Table A.10.

42

Page A.12, third line after equation (A.5)--Table A.13 (not Table A.12) contains typical water use values.

43

Page A.12, last paragraph-- In the sample computation the equation for the mass of concrete should be: "Mass of concrete = 17.4 * (2.3 x 10^3) = 4 x 10^4 kg."

44

Page A.13, Table A.12--In the text on page A.14, this table is referenced after Table A.13, and therefore, should follow Table A.13, not precede it.

45

Page A.14, third line--This line should read: "= 1.2 * (4 x 10^4) . . . ."

46

Page A.14--In the calculation of the radon-222 well water term using the equation (A.5), the basis should be given for using a value of r = 0.6 for the fraction of radon-222 released from well water.

47

Page A.14, seventh line--Using values given for the estimates At 1 ACH and At 0.8 ACH, values of 0.90 and 1.12, respectively, are obtained.

48 Page A.15, first paragraph, third line--Should this be ". . . on a mass per unit area per unit . . .?"

49 Page A.15, Formula--The units on inputs and outputs need to be defined. It should be explained why the wall and ceiling emission rate is divided by V*I, while the building and furnishing emission rates are divided by I only.

50 Page A.16, last paragraph, fourth line--This line should be "C_s, smoking, 0.52, 5.0, 47 (Table A.15)."

51 Page A.17, first paragraph after Table A.15--In the third line of the computations At 1 ACH, the value "247.0/1.0" should be "47.0/1.0."

52 Page A.17, last line--The correct reference is Figure 4.1.

53 Page B.1, first paragraph--Appendix F does not contain the stated information.

54 Page B.2 through B.19--In Tables B.1 through B.16, the heading of the last column is confusing and should be clarified. Aa written, it could be interpreted either as the minimum and maximum contribution in percent to the indoor concentration or as the percent contribution to the minimum and maximum concentrations.

55 Appendix C, Outdoor Air Quality--This appendix is too general to be of much value. It is not clear how seasonality of outdoor concentrations relates to indoor air quality. Only one assumed ambient environment was used. How was

55 information from Appendix C used? No mention is made of BaP which has an approximate national 24-hour average of 0.4 ng/m^3 in cities that do not have coke ovens.

56 Page C.1, fifth paragraph, seventh line--The correct reference is Table C.1. The National Ambient Air Quality Standards (NAAQS) include lead but it is not listed here. A statement should be made that lead has an ambient standard but is not included because it is not a concern in the weatherization program, if that is the case. NAAQS were not "set forth" in the 1970 Clean Air Act. A requirement for standards was mandated in the act, but standards were not promulgated until 1971.

57 Page C.4, second paragraph--In the fifth line, should this be "18% of the observed days . . ."? In the sixth line, is "(a26)" correct or should it be "(25%)"? In the last sentence, should "58 and 35" be "58% and 35%"?

58 Page C.5, third paragraph, last line--Should this be "15%"?

59 Appendix E, Benzo-[a]-Pyrene Concentration and Health Effect Risks--The discussion presented in this appendix does not provide the basis for the assumptions used in the impact aasessment. Testing of Pike and Henderson's model with occupational populations exposed to BaP is no more accurate than the U.S. Environmental Protection Agency (EPA) risk assessment procedure for benzene soluble organic (BSO) because the occupational environment contains many other pollutants acting synergistically witb BaP. The basis for Table E.2 should be included in tbe DEIS along with the reference to Pike and Henderson.

60 Page F.1, paragraph 2, line 11--We question the statement that "the unattachment fraction values found in the workplace and in the environment are reasonably constant and not sufficiently different to cause a large disparity in the radiological dose assessment of environmental and occupational exposures to radon daughters." Dust levels and air exchange rates are expected to be more variable in homes than in workplaces, such as uranium mines, where these parameters are controlled by ventilation. The report of the Committee on the Biological Effects of Ionizing Radiation (BEIR III) states on page 316 that "In other atmospheres, however, such as homes or buildings, the degree of disequilibrium may be substantial. Another variable factor affecting the health significance of a given WL [working level] is the fraction of free daughter ions unattached to dust particles--not a major problem in mines, but potentially important in relatively clean spaces, such as homes." Thus, the above statement

60 from the DEIS tends to oversimplify the assessment of health effects from exposure to radon daughters in residences.

61 Page F.4, second paragraph, last sentence--Should this be "(>95%)"?

62 Page F.5, first paragraph, fourth line--Should this be "73%"?

63 Page F.7, paragraph 3, line 7, and page I.2, paragraph 5, line 4--It is not clear why an exposure period of 85 years is used for radon risk estimates. EPA has used a value of 70.7 years for the purposes of estimating risks from lifetime exposure to radon-222 and its daughters.

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64 Page F.10, fifth line--Should this be "75%"?

65 Appendix H, Health Effects of Oxides of Nitrogen--Data contained in this appendix are dated (e.g., EPA 1971); more recent air quality data for NO_x are available (see Appendix C references). Moreover, averaging times are not included with the concentrations. In the second paragraph, an erroneous reference to Shy (1973) is apparently given because no 1973 reference is included for Shy. We believe Shy's work based on his Chattanooga study is questionable and would recommend other references such as Speizer, Ferris, and Hackney.

66 Page I.2, last paragraph--The caveats contained herein need to be highlighted in some fashion. This paragraph may be one of the most important in the DEIS because readers tend to remember numbers rather than caveats.

67 Page I.7, Table I.5, and page I.12, Table I.11--In the column headings, the second "Single Family" should be deleted.

68 Page I.14--The first two paragraphs are duplicated from the bottom of page I.13.

69 Page I.19, first paragraph, first line--The correct references are Tables I.16 and I.17.

70 Page I.21, first paragraph, last line--The correct reference is Table I.19 (from Table I.3).

71 Page I.23, first paragraph, last sentence--This should read: "The difference in additional lifetime cancers from the Proposed Action (329.6-175.5 = 154.1) would be entirely due to tobacco smoke in residences."

72 Appendix J, Comparison of Risks from Exposure to Air Pollutants to Voluntary Risk--Comparative risk values may be of general interest but can lead to inaccurate evaluations because of different bases of derivation. In addition, many risks are voluntary while the ones derived in this DEIS are generally involuntary. Insofar as possible, all health risk numbers should be normalized (as in the second paragraph on page J.2) and expressed as the number of expected deaths per 100,000 population per year. The reasoning for use of cigarette equivalents should be included.

73 Page K.1, second paragraph, seventh and eighth lines--Heating zones 2 and 3 should be included.

74 Page K.5, unnumbered table--No numbers are included for apartments, and no reason is given as to why they were omitted.

75 Page K.6, second equation--The last term should be "0.24 $\frac{\text{Btu}}{\text{lb.}}$."

76 Page K.11, fourth paragraph--The first two sentences should be made into one: "According to the air quality analysis (see Chapter 4), only residences in mineralized regions . . . ."

77 Page K.11, fourth paragraph, second sentence--This sentence is confusing because the values given are actually the fractions of residences that do not meet the exclusion criteria and do not need air-to-air exchangers. It should be reworded.

78 Page K.15, Formaldehyde--The first paragraph, last sentence, states that (with urea-formaldehyde foam insulation (UFFI) present) apartments and single-family detached (SFD) residences could require air-to-air exchangers. The next paragraph states that no apartments have UFFI so only single-family attached residences will need exchangers. It should be explained why the change was made from detached to attached and why SFD residences are not included in the calculations of additional exchangers required. Table I.3 indicates that SFD residences do have UFFI and they should be included.

SIERRA CLUB

NORTHWEST REGIONAL CONSERVATION COMMITTEE

November 14, 1983

Comments on Bonneville Power Administration's draft environmental impact statement, The Expanded Residential Weatherization Program

The Sierra Club commends the Bonneville Power Administration for its leadership role in addressing the problem of indoor air quality. The research developed by BPA will be useful in helping to protect the health of millions of people across the nation. We admire BPA's efforts to fill the vacuum left by other government agencies in this policy arena.

We recommend the following measures be taken in conjunction with the residential weatherization program:

- Implement monitoring and mitigation option #3.

Because of the lack of predictability of radon levels, we propose that all homes weatherized in BPA's program be monitored for radon.

1 We think monitoring and mitigation for radon should apply retroactively to homes already weatherized in the pilot and regionwide programs. This itoring program should begin at once. The early conservers should not be provided with less protection from radon exposure than later participants will enjoy.

2 We are concerned that the level of radon at which BPA is proposing to take corrective action may be too high. Little information is presented in the draft EIS as to why BPA choose a radon level of three picocuries per liter as an action level. The final EIS should discuss the rationale for choosing this standard.

The ASHRAE definition of acceptable indoor air quality (page 3.7) is not applicable to radon. There is no known safe level of exposure to radon. Also, there is no quantitative means to measure "dissatisfaction" with an imperceptible pollutant such as radon.

We are also concerned because the Environmental Protection Agency's radon standard for buildings built on or near uranium mill tailings was never intended to apply to other bulidings. The draft EIS acknowledges this fact but does not offer any compelling reasons why that standard should apply to homes weatherized in BPA's program.

Further, the radon criteria level of three picocuries per liter is higher than the estimated average radon level for homes in the Northwest (2.5 picocuries per liter).

- Implement monitoring and mitigation option #1.

3 We propose that high risk homes (mobile homes and homes with urea for-

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SIERRA CLUB

NORTHWEST REGIONAL CONSERVATION COMMITTEE

maldehyde foam insulation) be monitored for formaldehyde. A sample of homes without these characteristics should also be monitored to determine if formaldehyde levels exceed BPA's criteria standard.

3 We think it is probably unnecessary to extend retroactive monitoring and mitigation for formaldehyde to homes already weatherized in BPA's program. We assume that neither mobile homes nor homes with UF foam insulation have been weatherized through BPA's efforts.

We are concerned about BPA's selection of .4 parts per million (formaldehyde) as the level which triggers mitigation. We would like an explanation of the rationale for choosing this standard.

4 We are particularly concerned because so many other entities have choosen a lower standard of .1ppm. The final EIS should quantify the number of people expected to develop a formaldehyde allergy at exposure to .4ppm. If this is impossible, the NEPA requirement to estimate a "worst case" analysis will apply.

If we accepted BPA's figures on the cost of monitoring and mitigation, we would be more reluctant to recommend options #1 and #3. BPA's estimate indicates it would cost approximately $1 million or more per life expected

5 to be saved by mitigation.

We assume that costs will be reduced considerably by quantity purchasing of monitors and air-to-air heat exchangers. We would like to see such an estimate in the final EIS. This $1 million cost could also be reduced by venting water wells at the source rather than installing air-to-air heat exchangers.

The cost of mitigation, per kWh of energy acquired, would be less expensive if greater energy savings were achieved in each weatherization job. The final EIS should calculate a cost per kWh figure based on the

6 Northwest Power Planning Council's directive to install all structurally feasible and regionally cost effective conservation measures.

- We urge BPA to implement the Council's directive regarding comprehensive weatherization jobs.

The indoor air quality problems related to wood as a fuel source are relatively new to the Northwest. Fuel switching to wood is becoming more and more commonplace for cost reasons.

State and local governments are increasingly concerned with both the problems of fire and pollution hazards associated with wood stoves. Consequently, we assume that standards for wood stoves will be established throughout the region (i.e. the new wood stove legislation passed in Oregon).

MEMBER CHAPTERS: Cascade, Oregon, Northern Rockies, Western Canada

SIERRA CLUB NORTHWEST REGIONAL CONSERVATION COMMITTEE

We think that it is preferrable to reduce emissions at the source rather than provide compensatory ventilation to dillute pollutants.

- We recommend that the regional model conservation standards address both health and safety factors related to wood heating.

- We recommend that information regarding the health and safety impacts of wood stoves be made avaliable to all participants in BPA's weatherization program.

7

We think that both tobacco smoking and the use of portable gas space heaters are matters of personal choice. The Northwest ratepayers should not bear the cost of mitigating these hazards.

- We recommend that information on the hazards of tobacco smoking and use of unvented gas space heaters be made avaliable to all program participants.

- Rather than exclude homes with unvented gas stoves and ovens from full participation in BPA's program, we recommend that range hood ventilators be installed to reduce the level of combustion pollutants.

Recommended additions to the analysis contained in the draft EIS

The health impacts of the "no action" and "delayed action" alternatives could be as great or greater than the impacts related to the proposed action (without mitigation). Price-induced conservation will motivate many people to weatherstrip and caulk their windows and doors regardless of pollutant sources.

8

- The final EIS should project health and energy impacts (under the "no action" and "delayed action" alternatives) from people weatherizing their own homes without BPA's assistance.

We are concerned that do-it-yourself weatherization efforts may permanently impair the cost effectiveness of comprehensive weatherization. The cost effectiveness of BPA's weatherization program is related to how comprehensive the program is and how quickly it is implemented

The individual weatherization efforts spurred by the "no action" and "delayed action" alternatives will be piece-meal and unpredictable in timing. The penetration rate, timing, and ultimately, cost effectiveness of BPA's weatherization program will be affected by these individual efforts.

9

- The final EIS show display the potential energy savings that will be permanently lost if the "no action" or "delayed action" alternatives are implemented.

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SIERRA CLUB NORTHWEST REGIONAL CONSERVATION COMMITTEE

10

- The health impacts of generating resources which may be needed if the proposed action is not adopted should include estimates of deaths from construction and operation of transmission facilities. Historical records can provide this data.

11

- We would like to see more epidemiological data on the health effects of radon.

Sweden, for example, has high radon levels. Is there an increased incidence of lung cancer in Sweden that can be correlated with the elevated level of radon?

- The analysis of health effects related to radon should quantify expected number of cases of emphysema.

- The health effects of gamma radiation from radon, such as birth defects should be quantified. (See Environmental Assessment: Proposed BPA Regionwide Weatherization Program, April 30, 1981, page 7.)

12

- We would like to see table 2.1 augmented with some additional figures. 1) The final EIS should include a calculation of environmental costs and benefits based upon the methodology developed by the Northwest Power Council. 2) Energy savings should be projected using both BPA's and the Council's heat loss methodology. 3) The cost figures should include a mill per kWh estimate. 4) We would also like to see an estimate of the cost of mitigation (by action) related to the number of lives expected to be saved by such actions.

Sincerely,

Ralph Maughan

Ralph Maughan, Chair
NW Regional Conservation Committee, Sierra Club
PO Box 1173
Pocatello, Idaho 83204
(208) 233-9553

RM/lf

MEMBER CHAPTERS: Cascade, Oregon, Northern Rockies, Western Canada

2555 Van Buren
Eugene OR 97405
Nov 2, 1983
503-485-6265

RE: WEATHERIZATION PROGRAM...AIR TIGHTENING MEASURES

Peter Johnson
BPA
P O Box 3621
Portland OR 97208

Dear Mr. Johnson,

I was unable to attend the public hearing on the Expanded Residential Weatherization Program in Eugene. I am writing to express my views on this subject.

I have lived for over a year in a EWEB certified energy efficient house in the River Road area of Eugene. I moved because I had to change neighborhoods for family reasons. The EWEB energy efficient house is extremely tight. It is constructed with plastic air seals throughout. It had a dehumidifier as standard equipment.

Very often the air quality inside was much better than the outside air quality. In the neighborhood there were many wood burning stoves and fireplaces. During frequent periods of air stagnation the outside air quality was very poor. The inside air quality was always excellent.

1 I strongly urge that you pay for air tightening measures for all homes in this area. If someone in a tight house needs fresh air and the air outside is better than the inside air, the home residents can always open a window.

We need more weatherization and conservation measures so that people will burn less wood and this will help to keep the outside air cleaner.

2 In your Environmental Impact Statement you do not consider the effect of large numbers of people switching from electric or gas heat to wood heat. Wood heat is the cause of most of the air pollution in Eugene and Portland. And this wood heat pollution will continue to grow worse as electric and gas rates rise. Also conservation measures will help to reduce wood heat pollution because a well weatherized house will need to burn much less wood than a old drafty unweatherized house.

PLEASE.....weatherize all the homes in the and provide as much money to help people weatherize as possible. And help to provide storm windows, weatherstripping, caulking etc. If the air is better outside than inside, we can always open the window. But if the air outside is polluted by wood smoke what can we do?

Sincerely,
Joe Weiner

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DEPARTMENT OF HEALTH & HUMAN SERVICES — Public Health Service

Centers for Disease Control
Atlanta GA 30333
(404) 452-4257
November 10, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

We have reviewed the Draft Environmental Impact Statement (EIS) for Bonneville Power Administration's (BPA) proposed Expanded Residential Weatherization Program. We are responding on behalf of the Centers for Disease Control and are offering the following comments for your consideration in preparing the final document.

We understand that under this expanded program (Proposed Action), all presently excluded residences would be eligible to receive air-infiltration reduction measures. It is the purpose of this EIS to evaluate this "Proposed Action", a "No Action" Alternative (no expansion of BPA's present weatherization program), and a "Delayed Action" Alternative (3 to 5 year delay in expanding BPA's "Present Program" to allow for additional health research). We note that a preferred alternative will not be identified until after public review and comment on the Draft EIS.

While the overall goal of the Proposed Action is to provide a complete weatherization program for all eligible homes so that participation in the program and the resulting energy savings are maximized, one purpose is to protect public health and welfare while carrying out the program (p. 1.2). However, it appears that this Proposed Action may have a significant negative impact on the cumulative health risks associated with the BPA Residential Weatherization Program.

Based on the EIS, we have public health concerns about the expected increase in indoor air pollution. The Proposed Action alternative is expected to result in the highest risk of adverse health effects of the three alternatives discussed above. Increased cases of cancer could result from higher concentrations of benzo-(a)-pyrene (BaP), radon, and formaldehyde due to the predicted reduction in the air exchange rate from the proposed weatherization measures. As a result, increased concentrations of respirable suspended particulate matter, nitrogen oxides, carbon monoxide, and carbon dioxide may cause sensitive individuals to experience eye and nose irritation, breathing difficulties, headaches, dizziness, and possibly nausea.

From examination of the estimated concentrations of NO_2 and CO_2 associated with the Proposed Action alternative, it appears that certain air quality standards which are protective of human health will be exceeded in indoor air. Since sensitive individuals can experience breathing problems and possibly respiratory illness at these expected concentrations, steps must be taken not to increase the risk to public health by implementing weatherization measures without the inclusion

of adequate safeguards. In view of the "Baseline" health effects and the "Present Program's" health effects for each of the indoor air pollutants, the significance of the added health risks from the Proposed Action and the mitigation alternatives needs to be carefully assessed and related to acceptable levels, standards, and/or public health goals.

1 In the comparative evaluation of the alternatives (Table 2.1), we believe that the cancer risk rate in terms of annual cancers per specific population size should be clarified. The acceptable level of cancer risk is an important issue that needs to be addressed in the Final EIS. What is the maximum level of cancer risk that would be considered acceptable without mitigation by the BPA decision-making authorities?

2 For the Proposed Action, the most significant health effects appear to be the result of elevated BaP and radon levels. Since the mitigation alternatives are shown to significantly reduce the cancer risk rates and potential health effects associated with the indoor contaminants, we would recommend that the Proposed Action alternative not be selected without including mitigation.

If the Present Program is to be expanded, mitigation should be incorporated into the expanded program to minimize potential health effects. Consideration should be given to the use of more than one mitigation-by-exclusion or mitigation-by-action alternative to minimize any significant increase in the cancer risk rate above BPA's Present Program. While the potential outdoor air quality benefits to be gained from the emission source reductions have been discussed, the positive health effects to be gained from the reduced outdoor air pollution emissions

3 should be compared with the negative health effects associated with the Proposed Action's degradation of indoor air quality. This comparison should also discuss the difference in the extent of exposure and the voluntaristic ability of the exposed populations to prevent and control any potentially harmful exposure.

Risk estimates presented in the DEIS for lung cancer secondary to radon daughter exposure appear to be in line with currently accepted radiation protection guidelines. Recognition is given to the fact that large uncertainties exist in these estimates.

Certain of the proposed actions with mitigations will require that potential participants be advised of the risk that may result to them from weatherization of their particular home. Although it may not be within the scope of this DEIS, precisely how this will be done, so that people can make informed decisions on weatherization, has important public health and legal implications - particularly if weatherized homes are subsequently sold or if radon risk estimates change significantly in the future.

4 In conclusion, since the No Action Alternative has been demonstrated to have the least impact upon public health, we would support selection of this alternative. We appreciate the opportunity to review the Draft EIS. Please send us

three copies of the Final EIS when it becomes available. Should you have any questions about our comments, please call Mr. Robert L. Kay, Jr., or me at FTS 236-4161 or 236-4257, respectively.

Sincerely yours,

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Center for Environmental Health

III-69

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RETYPED FROM ORIGINAL LETTER

Eugene, Oregon
November 11, 1983

Bonneville Power Administration
Anthony R. Morrell

This letter is in response to your proposed Expanded Residential Weatherization Environmental Impact Statement (EIS).

My home was build in 1966 to the codes at that time. It has single pane glass in all windows. My home was analyzed in late 1982 per BPA standards, but did not qualify for storm windows or whatever was and is necessary for tightening, because I live rural and have my own water well, and one-fourth of main floor is concrete slab. The reason for not qualifying was radon gas per BPA.

My family and myself respect your concern for our health, but I cannot prove your statements in the EIS nor can I disprove them.

1 My neighbors and friends feel the same way, therefore I propose that we get on with full weatherization.

I feel so strongly about this that I will volunteer my home as a pilot for full weatherization with continued monitoring.

I am a member of Lane Electric Cooperative here in Lane County, Eugene, Oregon.

2 An example would be a home that meets all standards-was weatherized, but later added a wood stove or other things might cause more health problems. I believe this example shows the potential problems that might arise due to the individual home owners search for comfort. No law or government agency could control the individual.

Again I am concerned enough that I am reminding you about volunteering my home as a pilot for this region.

Sincerely,

/s/ Lewis C. Jones
85641 Pine Grove Rd.
Eugene, Oregon 97405

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DAVID BUSCHER, M.D.
Clinical Ecology
Preventive Medicine

13210 S.E. 240TH
KENT, WA. 98031

(206) 631-8920

November 4, 1983

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

I am a physician who specializes in clinical ecology and have a strong interest in the environment and how it is affecting the health of our population.

I would like to add that indoor pollution is certainly much more of a problem than outdoor pollution for the most part. For several years I have been aware of the growing sensitivity of numerous patients to pollutants within their homes.

The work place also is a considerable source of problems for many people, especially those working in new offices that have been constructed "tight," to prevent heat loss. Many of these office buildings are poorly ventilated and the air is simply recycled.

As you are aware, in many homes the "tightening" has allowed the pollutants to accumulate in a more concentrated fashion. Many patients do not know that they are being made ill by their home or working environment. The pollutant levels are usually quite minimal, but chronic exposure on a long-term, daily basis can gradually weaken a person's immune system resulting in numerous problems.

These symptoms commonly will manifest simply as eye, nasal, throat, and lung irritation, but other times they will manifest as more generalized symptoms such as depression, irritability, repeated infections, as well as many other symptoms too numerous to mention.

I feel that the "tightening" is one of the major causes of this problem with increased levels of indoor pollution. The other problem which is probably more important is the building materials that are used within the home and office environments. Many of these materials are quite toxic such as glues, resins, and, of course, particle board which contains formaldehyde.

Some grades of plywood also contain formaldehyde. Synthetic carpeting is a petrochemical base and the foam undermat generally contains formaldehyde.

There are also many other potentially hazardous materials used within our homes and offices.

Oil and gas heating systems can be a source of very serious problems especially if the furnaces are not functioning at optimum eficiency. The combustion products produced can be a source of problems for sensitive individuals.

1 I know the energy crisis is very real. I feel electric heat is probably the safest form of heating to be used within our living and working environments. I also feel that tightening the homes and offices is generally a good idea, but this can be over-done. They should not be made 100% airtight. I also strongly feel that this problem of indoor air pollution will be significantly reduced if we use more non-toxic building materials in the future. Of course, I have not brought up the problems of wood stoves, space heaters, tobacco smoking, etc., which are a very serious hazard for susceptible individuals.

Thank you for allowing the public to comment on this extremely serious problem.

Sincerely,

David Buscher

David Buscher, M.D.

DB/pm

HH-71

VICTOR ATIYEH
Governor

Department of Environmental Quality

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 PHONE: (503) 229-5696

November 14, 1983

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, OR 97208

Re: BPA Expanded Residential
Weatherization Program

Dear Mr. Morrell:

The Oregon Department of Environmental Quality is extremely interested in BPA's Expanded Residential Weatherization Program. We are relying heavily on increased residential weatherization to reduce severe ambient air quality problems, created by residential wood heating, by reducing heating loads and consequently wood use. Local governments in Portland, Eugene, and Medford have adopted weatherization ordinances which are incorporated in our federally approved Clean Air Act Implementation Plan. These plans are designed to clean up air quality problems to the point that health and welfare air quality standards are met and airshed space is available for growth and development. Success of weatherization is heavily dependent on

1 financial incentive programs such as those of BPA. We therefore strongly support the proposed action alternative.

2 We are very sensitive to indoor air quality problems and we recognize concerns about tightening of homes with wood heating appliances. We believe an air to air heat exchanger mitigating measure is a potential solution although there may well be significant objection to this mitigating measure because of its cost. We believe that another acceptable

3 approach would be to limit your expanded residential weatherization program for wood heating homes to double pane windows and patio doors without requiring air to air heat exchangers. This should result in achieving the majority of potential energy savings without materially "tightening" the house as it is our impression that double glazing can be added to homes without changing the air leakage rates.

Anthony R. Morrell
November 14, 1983
Page 2

Again, we strongly urge BPA to take a positive action now on the expanded residential weatherization program as we believe that overall, there will be a positive benefit to the health of Oregonians due to clean up of major air quality problems caused by wood heating. We also believe there will be a positive economic benefit due to the airshed room made available for growth and development by helping to solve one of our toughest air quality problems.

Sincerely,

for Michael J. Downs
Acting Director

JFK:ahe

AZ446

cc: Department of Energy

VIKING INDUSTRIES, INC. P. O. BOX 20518 PORTLAND, OREGON 97220 • PHONE (503) 667-6030

November 10, 1983

Mr. Anthony R. Morrell
1002 N.E. Holladay Street
Portland, OR 97232

RE: The Expanded Residential Weatherization Program
Draft Environmental Impact Statement

Dear Mr. Morrell:

With regard to the above, we wish to have the following comments included in your review of the draft E.I.S.:

1 Viking Industries admires Bonneville's continued contributions to the improvement of our environment and the Northwest's energy needs. After reviewing the E.I.S. and the summary document, we recommend the one clear path for the B.P.A. to take; action No. 2, the Proposed Action. Provide tightening measures to all eligible electrically heated residences. We would also suggest including a statement to all recipients of weatherization benefits, indicating that some potential health risks could develop. Also, the relationship of those potential risks should be delineated in real world comparisons, rather than just statistics, i.e. the risk of developing cancer from Radon could be compariable to the risk of cancer from drinking diet pop for "x" number of years.

2

3 After studying the data presented in the E.I.S., it is almost impossible to justify the continued reduced levels of your present weatherization program. There is not enough clear data to assure that any estimated side effect would occur. Even when trying to group information, as to the range of effects, you can not correlate this into the lifespan of an individual. Therefore, any weatherization, short of the Proposed Action, would be a disservice to the individual and the region.

4 Although further research into the environmental trade-offs of any weatherization program is important, Bonneville is not the best agency for continuing such studies. There are agencies more appropriate for this task, especially since the issues raised by the B.P.A. are neither regional nor specific to electric heat. Perhaps it is time to let this responsibility pass and return to the business at hand; preparing the Northwest for the next decade.

Sincerely,

James Franklin

Viking Industries, Inc.
James Franklin
Engineering Department

JF/ldt

M-73

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Lawrence Berkeley Laboratory
1 Cyclotron Road Berkeley, California 94720
(415) 486-4000 • FTS 451-4000

November 11, 1983

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

Enclosed are comments on the EIS.

I appreciate the opportunity to comment on this important and difficult statement.

Sincerely,

John R. Girman
Staff Scientist
Building Ventilation and
Indoor Air Quality

enc.

COMMENT ON THE DRAFT ENVIRONMENT IMPACT STATEMENT (BPA)

BY JOHN R. GIRMAN

INDOOR AIR QUALITY GROUP

LAWRENCE BERKELEY LABORATORY

The following comments are made with a realization of the difficulty that occurs in writing an EIS on such a broad issue with so much uncertainty in the basic information. It is recognized that in many cases, such difficulties cannot be resolved at this time on a sound scientific basis. Nevertheless, many comments are presented on these difficulties for completeness and to insure consideration of all aspects of an important issue.

This first section of the critique will deal with general comments on BPA's Draft Environment Impact Statement (DEIS) on the Expanded Residential Weatherization Program. Subsequent sections will offer more specific comment.

ORGANIZATION

1 The organizational order of the DEIS tends to obscure and confuse rather than provide information clearly. Comment will be made on each chapter in order starting with Chapter 2.0. The title of Chapter 2.0, "Comparison of Alternatives" (as titled on the red overleaf, "Alternatives Including the Proposal Action") is completely misleading. It is really an extended summary as is indicated by the titles of the first tables in the chapter, and follows the Summary too closely. This chapter presents inade-

2 quate summaries of the pollutants and their health effects. The range of calculated pollutant concentrations are presented without information

regarding the assumptions and parameters used to calculate these concentrations. Thus, the reader is left without any basis or context to assess the validity of the health effects presented in this chapter. If this chapter were the last chapter (following what is now Chapter 4.0), it would be appropriate and logical; in its present position it serves as a second and unnecessary summary.

Chapter 3.0, "Description of the Affected Environment" (or as titled on the red overleaf, "Affected Environment") is logically the introductory chapter and should follow Chapter 1.0, "Purpose and Need for Action", as it provides descriptive information needed to define the problem and the parameters affecting it.

A short, new chapter outlining the "Alternate Courses of Action" should be added after "Affected Environment". Much of this material would come from the chapter presently titled "Comparison of Alternatives".

Finally, the chapter titled "Environmental Consequences" should conclude with much of the material it now contains. However, the Summary Tables and Figures from what is now chapter 2.0 should be incorporated at the end of the chapter.

HEALTH EFFECTS

3 In general, the DEIS tends to underemphasize health effects other than death by cancer. While limited data exist for the health risk of certain pollutants with respect to cancer, facilitating a numerical risk assessment for these pollutants, certainly concern for public health goes beyond the absence of body counts; some awareness must exist that high levels of non-carcinogenic pollutants have deleterious effects on public health. For example, despite a reasonably comprehensive appendix on the health studies of NO_2, no discussion or recognition of the role NO_2 may play in decreasing resistance to respiratory illness can be found in the main body of the report. Decreased resistance to respiratory illness would result in increased medical expenses and increased absenteeism. The omission of any discussion of non-fatal health effects occurs despite calculated concentrations of NO_2 that are 2 to 300 times higher than the EPA outdoor standard. Some recognition should be given to the health effects that encouraged EPA to establish the standard for the health of the general population. Similar arguments can be made for the need to assess the non-carcinogenic health effects of HCHO, CO and CO_2 within the context of the weatherization program.

4 In general, the appendices on health effects are well written and reasonably comprehensive, yet the main body of the report fails to incorporate this information or its implications. For example, in Appendix E it is stated that, "the entire carcinogenicity of cigarettes cannot be attributed to BaP,..". Yet that is exactly what is done in the main body of the report. All of the carcinogenic effects of RSP excluding BaP are ignored repeatedly. Cigarette smoke particulates are a component of RSP and contain many other PAH besides BaP (some of which are also

carcinogens). Thus, the health effects of increases of RSP are incorrectly trivialized to, "Non-smokers may experience eye and nose irritation and reduced breathing capacity", as is found in Tables 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, and 2.11.

Similarly all of the results of health studies on NO_2 are reduced to "Sensitive Individuals may have trouble breathing". For CO, health effects as listed in the main body of the report are that, "Senaitive individuals may become exhausted more quickly". This ignores the basis for the EPA outdoor standard: health effects of individuals with angina pectoris.

In summary, the DEIS is inconsistent in its treatment and assesament of health effects. The main body of the report ignorea or fails to incorporate fully the results of health effects atudiea listed in the appendices.

RISK ASSESSMENT

5 The number of cigarettes smoked per day is not an appropriate or recognized unit of risk. If used once in the report as an indicator, by comparison, of the level of risk, few would find fault. But the attempt to elevate this method of estimating risk by its use in Appendix J and Chapter 2.0, is without an accepted scientific basis and ignores common practice without offering a defense of its use.

In using the number of cigarettes smoked per day as a unit of risk, the report is comparing risks from indoor air pollutants of which the general public has little knowledge or basis for understanding, with a risk (from cigarette smoking) of which, again, the general public (and in fact, much of the scientific community) has little understanding. Restating the above, the report is comparing a risk only vaguely defined with another risk only vaguely defined in the public mind. Few members of the general public could give the excess risk for a lifetime, pack-a-day cigarette smoker.

6 Another factor ignored by the report's comparison of risks to cigarette smoking is reviewed by Repace and Lowery (1982): the health effects of cigarette smoking appear to be nonlinear to a strong degree. As an example of this, if a person having no exposure to cigarette smoke has a pulmonary function of 100%, a 40-cigarette a day smoker has a pulmonary function of only 50%. People exposed to sidestream smoke at work or who smoke 1 to 10 cigarettes a day have a pulmonary function of, not 98.8 to 87.5% as would be the case if the health effects were linear, but 75%. Thus, the report has used a standard for which there are strong indications of nonlinearity.

7 The comparison of risks in Appendix J is actually a normalization of the estimated risks, which is not appropriate. It would be useful to replace this appendix with one which draws the parallels between air pollutant-related risks and others indicating how differences lead to alternative perspectives for regulatory control.

A much better approach to defining risk and what may be acceptable risk has been given recently by Albert (1983). He states that the FDA has used 10^{-6} as a level of acceptable lifetime excess risk for the general population. The EPA has used 10^{-5} to 10^{-7} in setting standards for water. In contrast to this, OSHA standards correspond to risks of about 10^{-2}. Albert suggests that OSHA standards should be lowered to 10^{-3} to more closely correspond to the risks in the workplace not associated with chemical contaminants. He also suggests that because of the more diverse population exposed, levels for the general population should be lower by a factor of ten. Because of multiple carcinogen exposure, lowering of levels by another factor of ten is also suggested, giving a final risk of 10^{-5} for the general population.

The approach outlined above stands in stark contrast to the method used by the DEIS. However, it is recognized that risks in the vicinity of 10^{-3} or 10^{-4} are typical for many chronic exposures to which large numbers of people are exposed, so that applying a substantially lower general criterion (such as 10^{-5}) would be very difficult and expensive to implement.

Repace and Lowery, "Tobacco Smoke, Ventilation and Indoor Air Quality", ASHRAE Transactions, 88, (1983).

Albert, "Discussion", JAPCA, 33 836 (1983).

STANDARDS and GUIDELINES

8 Table 2.3 which summarizes ranges of pollutants concentrations under the No-Action Alternatives also lists various standards. This list of standards is far from complete. While listing OSHA standards for HCHO, RSP, NO_2 (incorrectly listed as NO_x), and CO, the OSHA standard for CO_2 is inexplicably absent. In the case of state standards, the California short term standard for NO_2 is omitted. The ASHRAE Guidelines should also be listed as an additional column in Table 2.3. Curiously, the list of ASHRAE Guidelines in Table 3.3 is truncated and many of the pollutants addressed in the DEIS are omitted. In Table 3.5, HCHO standards are incorrect. In this table, ceiling levels from OSHA are lower than the 8-h averages, also from OSHA.)

9 Scant attention is given to difficulties in applying workplace standards to the exposures of the general population. The difficulty is inadequately treated on page i. Occupational study groups do not just "generally include healthy, adult males" but are made up almost exclusively of this group. While the Summary correctly concludes that "the general population includes the very old, the very young, and the chronically ill" (and the pregnant), the report fails to recognize that exposure times to residential pollution can be and often are much longer than that which occur in occupational settings. Thus, residents exposed to pollution levels low relative to occupational pollution levels, may still receive a larger dose at home by virtue of longer exposure times.

A second factor affecting the validity of applying workplace standards to the general public's exposures, deals with compensation. Workers take greater risks, in part, because they are compensated to do so. The public

is not. The Risk Assessment section of this critique gives some perspective on what may be appropriate levels of risk for the general public and the workplace.

10 The DEIS errors in differentiating between occupational study groups who "are also exposed to other pollutants common to their work environment" and the general population. As the DEIS amply illustrates, the general population is also exposed to other pollutants (other than a single pollutant specified by a standard), e.g., the effects of no less than three potential carcinogens are considered in the DEIS.

RADON

11 • A brief look at the material relevant to radon yields the conclusion that, although appendix F on lung cancer risk from radon daughters constitutes a substantive review of this question, the discussion of radon levels, risks, and standards elsewhere in the DEIS is not sound, reflecting in many details an ephemeral appreciation of the question of radon and more general considerations.

As examples:

12 • the tables indicate "mineralized" to mean "nonbasaltic", in which case the latter work ought to be used. Not doing so leads, in appendix A, to the oddity of using Bruno's general estimates for radon flux from mineralized vs. mon-mineralized to apply to the DEIS definition of mineralized, which may be entirely unappropriate. In any case, the DEIS usage is imprecise, where there is no need to be.

13 • the discussion of radon levels and risks is affected, as are treatment of other pollutants, by the misuse of the words such as "average", "typical", and "expected", e.g., on page 2.20, first paragraph, "average" and "typical" are used interchangeably. In each of these cases, the word nominal would be more appropriate, since the calculations are based on nominal (not typical) situations.

14 • the main text does not make proper use of significant figures, e.g., on page 2.14, considering uncertainties, it is ridiculous to say the estimated number is between 56 and 57 lung cancers. Other examples abound but proper understanding and use of numerical results is essential to clarity.

15 • the main text does not reflect a proper understanding of individual, average, aggregate risk. On page 2.14 the individual risk is supposedly stated, when in fact this is the average individual risk. Risk to the individual could be much larger, or somewhat smaller, than stated.

16 • the DEIS is often misleading as to behavior or cause and effect: page iii states that alpha radiation irritates the lung tissue (perhaps only an unnoticed typographic substitution for "irradiates", the proper word); page 3.3 states that daughters can enter the lung after attaching to particulates, ignoring the well-known fact that they can also enter unattached and that the latter daughters contribute substantially to the lung dose; page A-5 indicates that radon from soil can enter by diffusion through a concrete slab, ignoring the fact that pressure-driven flow through imperfections is thought to be more important.

17 • the discussion of standards is generally weak, and this certainly applies to the case of radon: page 2.44 states that 0.015 WL equals the ASHRAE limit, which is actually 0.01 WL, as stated in Table 3.3. Moreover, the discussion (p. 3.7 ...) gives no appreciation of the fact that ASHRAE did not "establish" these guidelines, but simply draw them in various and different ways from other contexts. The 0.01 WL value is the lower limit of a range recommended for remedial action in Grand Junction, Colorado. As another possible value, the National Commission on Radiation Protection and Measurements is expected to chose 0.05 WL as a limit. (The comment - e.g., Table 3.3 - that 0.01 Wl is approximately 1 or 2 pCi/l is incorrect in that it can never be 1 pCi/l; on the otherhand, it does correspond, in some circumstances,

to 3 pCi/l.

The prevalence of errors or misleading statements throughout the text make it difficult to discern how sound the document is as a whole. The items listed below are indicative of the problem.

SPECIFIC COMMENTS

18 • On page xvii, air-to-air heat exchangers are listed as being 75% efficient. This should be referenced; some studies have found lower efficiencies.

19 • References throughout the main body of the DEIS are generally lacking even when controversial statements are presented as fact. In the appendices, bibliographies are incorrectly listed as references.

20 • The word "sensitive" is used throughout the report without definition; it is also not defined in the glossary. In the context of the DEIS and any report addressing health affects, "sensitive" should have a specific medical definition. Some members of the medical community have suggested that "sensitive" in this context should indicate a specific, biologically defined response such as an immunological response of increased production of antibodies. (An allergenic response would imply increased production of histamines.) The use of "sensitive" as a vague, undefined response to some factor is totally inappropriate in the DEIS.

If the word "sensitive" is not formally defined, then it becomes defined by its use in a sentence. But this becomes circular; a sentence such as found in page 4.23 "...only sensitive individuals should notice eye and nose irritation", becomes: only sensitive individuals, that is, only individuals experiencing eye and nose irritation should notice eye and nose irritation. The word sensitive loses all meaning.

On the other hand, "sensitive" should not be used to define a population in the absence of a specific biological response. A statement that sensitive individuals experience eye irritation at low formaldehyde concentrations ignores the fact that everyone experiences eye irritation at some concentration. This suggest a continuum of response, not the existence of a definable and distinct sensitive population.

21 • BaP is only 3 to 5% by mass of the PAH in cigarette smoke. Many PAH are also carcinogens. While some controversy exists as to the appropriateness of focusing on BaP as the indicator carcinogen of PAH, the DEIS goes further and considers that BaP is not an indicator of the carcinogenic PAH but the sole carcinogen of RSP. This is an incorrect treatment.

22 • The word "typical" is misused throughout the DEIS. Tables 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 4.9, 4.10, and 4.11 list "typical" pollutant concentrations that bear little resemblance to what has been observed in the admittedly few surveys conducted to date. As an example, "typical" HCHO concentrations for single-family detached houses listed on the No-Action Alternatives (Table 4.2) are at the 68th percentile of the complaint houses with UFFI (Table D.3); mobile home concentrations (Table 4.2) are at the 85th percentile of randomly sampled mobile homes in Wisconsin (Table D.4). Use of the word "typical" as has been done in the DEIS will be lifted and used by others to show that indoor pollutants are far higher than is suggested by current scientific literature. A more appropriate word should be substituted.

23 • The statement that the largest source of HCHO is UFFI is conjectural in the absence of a reference. Many scientists in the field of indoor air quality believe that wood products with UF resins are the largest source of HCHO.

24 • Little understanding of the behavior of pollutants indoors is evident in the DEIS. NO and NO_2 are summed. The justification for this, as found on page A.4, is that NO reacts quickly to form NO_2. This is not true! There is little or no evidence that this process is important indoors. It is an important process outdoors because ozone reacts quickly to convert NO to NO_2. However, there is little ozone indoors, in part, because the light flux indoors is too low to photolyze NO_2 to any significant degree. Additional proof is found in Traynor et al, Environment International, 8, 447, 1982 and Traynor et al, Lawrence Berkeley Laboratory Report LBL-15130, 1983. In these studies NO was found to decay at essentially the same rate as CO and CO_2, two non-reactive gases. Thus, ventilation was the primary removal process for NO and no evidence of reaction to NO_2 was found. In contrast to the behavior of NO, NO_2 decayed at a rate faster than could be explained by ventilation alone. Summing NO and NO_2 results in overpredication of NO_2 concentrations by factors of 2 to 3.

Another process important outdoors but trivial indoors is the reaction of CO to CO_2. While these processes (important only outdoors) are discussed in the DEIS as removal processes, the much more important processes involving the decay of NO_2 and HCHO are ignored.

25 • The DEIS states on page 2.15 that no acceptable technique exist for estimating the removal process of particulate plate-out, but then goes on to state that calculated concentrations of RSP are ten times too high because plate-out has been ignored. This implies that plate-out processes occur at ten times the ventilation rate. Techniques do exist for determining particulate plate-out and have been used at our laboratory to measure plate-out rates much lower than suggested by the DEIS, in fact, much lower than typical ventilation rates.

26 • The values listed on page 3.8 for outdoor NO_2 and perhaps CO are true for areas in or near an urban plume, but are too high for rural areas of the Pacific Northwest.

27 • The statement on page 3.15 regarding short-term, localized, high level concentrations of NO_2 producing irritation but low level, long-term concentrations producing no significant health effects is in conflict with current thought among scientists researching indoor air quality: low-level, long-term concentrations of NO_2 are believed to be more important in indoor air. At a minimum, the source for the speculative statement in the DEIS should be referenced.

28 • Data on emissions from kerosene space heaters are not in conflict (page 4.21). On the contrary, agreement among results from different researchers is good. The uncertainly lies in predicting resulting concentrations because of uncertainties in NO_2 reactivities, ventilation patterns and usage patterns. If data regarding emissions are in conflict, they should be referenced in the DEIS.

29 • The assumptions necessary to calculate source terms used in the appendices are not listed. These include the number of cigarettes smoked

per hour, what combination of stove burner and oven was assumed, and the respiration rate of people. Two extreme cases are described: a case based upon high emissions, low ventilation and low residential volume; and a case based upon low emissions, high ventilation and large residential volume. The probabilities of these cases occurring are not estimated, leaving the reader to guess that they may occur 10%, 1%, 0.1, or 0.01% of the time.

30 • The equation for the Upper Value of Risk on page D.5 implies that at a formaldehyde concentration of 7.69 $\mu g/m^3$, everyone develops cancer. This can not be correct.

31 • The statement on page 4.10 that "the greatest contribution to the typical concentration is the concrete (plus the soil under the concrete) ..." is misleading. It should read "The greatest contributor to the `typical' concentration is the soil (plus to a minor extent the concrete)..".

32 • The entire document carries a sense of numerical precision that is unwarranted and, perhaps unintended. For example, listing a concentration as 5398 $\mu g/m^3$ when the possible range is 500 to 31,000 $\mu g/m^3$ is meaningless. It calls into question the numerical basis for the conclusions reached.

33 • Many problems exist in modeling typical concentrations. The RSP concentrations listed are unreasonable; many others are referred to above.

34 • NASA limits for CO_2 should not be used for a general population.

35 • Wall insulation may reduce air leakage. House doctoring clearly does. To equate the 15% reduction seen the Princeton study (a conservative, worst-csse estimate) for house-doctoring with a rough 15% estimate for wall insulation is inappropriate.

Some of the comments written above may seem harsher than intended. If this is true, I apologize for the harshness but hope the comments help BPA produce an scientifically sound document on an important issue. At the aame time, as stated previously the comments were not made without a sense of the difficulty that occurs in writing an EIS on such a broad issue with so much uncertainty in the basic information. While discussions providing both comment and advice were held with David Grimsrud and Tony Nero of the Building Ventilation and Indoor Air Quality Group at Lawrence Berkeley Laboratory, the comments were written principally by the authors listed. It is recognized that the comments written above are only indications of specific problems with the DEIS and do not necessarily outline best solutions or approaches to improvements. I wish you success in incorporating comments from all sources and improving the EIS. Should clarification of my comments be necessary, please contact me at Lawrence Berkeley Laboratory.

JOHN SPELLMAN
Governor

KAREN RAHM
Director

STATE OF WASHINGTON
PLANNING & COMMUNITY AFFAIRS AGENCY
Ninth & Columbia Building, MS/GH51 • Olympia, Washington 98504 • (206) 753-2200

November 14, 1983

Mr. Anthony Morrell
BPA Environmental Manager's Office
1002 NE Holladay Strect
Portland, Oregon 97232

Dear Mr. Morrell:

The Planning and Community Affairs Agency (PCAA) offers the following comments in response to the Bonneville Power Administration's request for public input on the Draft Environmental Impact Statement (DEIS) pertaining to the Expanded Residential Weatherization Program.

PCAA administers the BPA Low-Income Weatherization Program for the state of Washington. It also administers the low-income weatherization programs funded through the Department of Health and Human Services (HHS) and the Department of Energy (DOE).

1 After reviewing the DEIS, its methodology, assumptions, and findings, PCAA recommends that BPA adopt the Proposed Action, "Provide tightening measures to all eligible, electrically heated residences," as the Preferred Alternative and to implement the alternative as soon as possible.

We believe the DEIS supports a decision to provide house tightening measures to all eligible residences under the premise that such measures do not appear to pose a significant health threat to the occupants. The decision is also supported in that, even in the worst case scenario under which the effects were estimated, the effect of the house tightening measures would be no greater than smoking less than one and as little as 1/10 of a cigarette a day. The DEIS further states that the current building codes result in a more airtight structur than could be achieved through weatherization, thus demonstrating the minimal impact of the measures.

We believe that the DEIS indicates that no measurable health hazard would be created and the savings of 74.4 annual MW of electricity warrants
1 the initiation of the Proposed Action. If mitigating jobs are indicated, they can be implemented on a case by case basis.

Thank you for the opportunity to comment on this important matter.

Sincerely,

Karen Rahm
Director

KR:td

PACIFIC POWER & LIGHT COMPANY
920 S.W. SIXTH AVENUE • PORTLAND, OREGON 97204 • (503) 243-1122

November 14, 1983

Anthony R. Morrell
Bonneville Power Administration
Environmental Manager's Office
1002 N.E. Holladay Street
Portland, Oregon 97232

Re: Response to BPA Request For Comment on Draft EIS

Dear Mr. Morrell:

Implementation of the Pacific Northwest Electric Power Planning and Conservation Act of 1980, directed by the Northwest Power Planning Council, requires that conservation be treated as a priority resource for the region. By purchasing this conservation resource, BPA can help ensure the availability and cost stability of electricity in the region.

BPA has delayed certain, "house-tightening," features of the conservation effort while an environmental impact statement has been prepared to evaluate Indoor Air Quality and associated potential health impacts. The effect of these delays has created a public perception that weatherization somehow causes indoor air pollution. It is important for BPA and the general public to understand that weatherization is not the source of indoor air pollutants. The source of any pollutants existed within the home prior to weatherization.

1

The Draft EIS offers three courses of action to BPA. The first, "no action," cannot be considered an alternative, nor can the third, "delayed action." The only feasible alternative offered by the EIS is the option to offer all conservation, including house-tightening.

2

PP&L is aware of the uncertainties sourrounding the indoor air quality questions arising as a result of weatherization activity. We do not recommend that any conservation measures be excluded, but that indoor air quality concerns be addressed as they are identified. Sufficient data should be maintained to allow the retrofitting of affected dwellings at such time as any long term hazard is identified.

Very truly yours,

Mike Hartley

MIKE HARTLEY
Product Specialist
CONSERVATION SERVICES

MH:lck

TELECOPIER 243-4774 • TWX 910-464-1594

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UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

Draft Environmental Impact Statement
Expanded Residential Weatherization
Program

WRITTEN COMMENTS OF THE AMERICAN GAS ASSOCIATION

The American Gas Association (A.G.A.) is a national trade association composed of natural gas distribution and transmission companies. Together, our nearly 300 companies serve over 160 million consumers in all 50 states. The majority of these consumers are residential customers who utilize the efficiency and economy of gas for household uses such as heating and cooking. We are therefore concerned that the DEIS for BPA's expanded residential weatherization program present an accurate assessment of the effect of gas stoves on indoor air quality.

Our review of the DEIS reveals that it is seriously flawed and biased toward continuing to exclude homes with gas stoves from BPA's weatherization program. By lumping gas stoves into the category of "unvented combustion appliances" the DEIS links gas stoves with appliances such as kerosene heaters. Cooking appliances are used intermittantly and for much shorter time periods than heaters. The DEIS clearly shows that the emissions from kerosene heaters dwarf the emissions from gas stoves. Yet by tying the two together in the analysis, the DEIS treats gas stoves and kerosene heaters equally in the final decision to continue to exclude from the weatherization program, homes with unvented combustion appliances. We would be dismayed if BPA excluded residences with gas stoves from its program because of the risks associated with emissions from kerosene heaters. Gas

1

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stoves should be analyzed independently of kerosene heaters and other appliances that are not used for cooking. 1

Were the analysis performed properly, it would show that gas stoves do not represent a significant risk to the health of the residents of weatherized homes. Attached is a copy of our analysis which discusses the flaws in the DEIS and assesses the effect of gas stove emissions under proper assumptions. The major findings of this analysis are:

1. The DEIS ignores the findings of the two largest studies on gas stove emissions and instead relies totally on a single, more limited, study. Copies of the first two studies are enclosed. 2

2. The DEIS does not adequately explain its methodology and assumptions so that readers can review it properly. Where assumptions can be deduced, they are often inconsistant and/or inappropriate. 3

a. The DEIS assumes as worst case emission levels the misuse of a gas stove as a space heater.

b. The DEIS assesses the effect of weatherizing homes that have air exchange rates low enough to suggest that they are already weatherized.

c. The DEIS omits the description of how average, high, and low pollutant emission rates are calculated in Appendix A. Attempts to duplicate

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BPA's calculations using reasonable assumptions produce answers that are clearly impossible.

3. When assessing the effect of nitrogen dioxide emissions, the DEIS assumes that nitrogen oxide rapidly converts to nitrogen dioxide indoors. This is contrary to the findings of every published study of indoor NO_x behavior.

4. The DEIS places major emphasis on two studies on the health effects of nitrogen dioxide exposure which have been discredited by scientific peer review. 4

5. As a result of cumulative errors, the pollutant concentrations predicted by the DEIS model are as much as 50 times higher than concentrations actually found in homes, as measured during indoor air quality studies.

When the analysis is performed using the most recent emission rate data and appropriate assumptions, we find that no pollutants are produced by gas stoves at levels that present a health risk.

Therefore we encourage BPA to incorporate the information contained in our analysis into the final Environmental Impact Statement for the Expanded Weatherization Program. The EIS should also disaggregate gas stoves from other combustion appliances, such as kerosene heaters, which are used for completely different purposes and therefore have different emission rates. In view of the magnitude of the corrections necessary, it would be prudent for BPA to revise the DEIS 5

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5 and submit it for public review once again before issuing the final EIS.

Respectfully submitted,

THE AMERICAN GAS ASSOCIATION

By _____
George H. Lawrence, President

S. Lorraine Cross
Counsel
Legislative and Regulatory Affairs

John P. Erickson
Manager
Engineering Services Programs

Any concerns regarding these comments should be addressed to:

John P. Erickson
Manager
Engineering Services Programs
THE AMERICAN GAS ASSOCIATION
1515 Wilson Boulevard
Arlington, VA 22209
703/841-8453

11/9/83

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ANALYSIS OF THE BONNEVILLE POWER ADMINISTRATION

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE

EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM

The Bonneville Power Administration's (BPA) Draft Environmental Impact Statement (DEIS) for BPA's expanded residential weatherization program compares the effects of expanding its weatherization program with the effects of continuing to exclude some residences. The effects of these alternatives on indoor air quality is the major portion of the analysis.

BPA currently will not weatherize residences containing unvented combustion appliances, including gas stoves and kerosene space heaters. This eliminates 919,000 residences from the weatherization program. According to BPA's analysis, weatherizing these homes would have the following positive effects:

Annual Energy Savings of 2.7 MW Resulting in the Following Benefits

- o Annual Pollutant Emissions Avoided
  - Particulates - 1.2 tons
  - Sulfur Dioxide - 25.1 tons
  - Oxides of Nitrogen - 25.1 tons
  - Radium - .1mC$_i$
- o 0.9 Avoided injuries per year in coal mining and transportation
- o 0.02 Avoided public fatalities/year due to coal transportation
- o Slightly less land use and water consumption

Additional 425 installer-years employment created for weatherization installers.

These benefits are balanced against the risks of increased levels of indoor pollutants caused by the reduced infiltration of

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outside air into residences after they have been weatherized. The increases resulting from weatherization are estimated in the DEIS through mathematical modelling and data on pollutant emission rates, infiltration rates, and home volumes. However, BPA has seriously overstated the role of gas stoves in indoor air quality by using faulty and inaccurate assumptions in its analysis.

The fact that the analysis is flawed is apparent from Tables 4.2 and 4.3 of the DEIS. These tables list estimated pollutant concentrations found in residences that have not been weatherized, including minimum, maximum, and typical concentrations estimated using the method described in Appendix A. When these modelled pollutant levels are compared to levels that have actually been observed and measured in residences, it becomes obvious that the Appendix A methodology is seriously flawed. For example, the typical values for nitrogen oxides (NO_x) listed in Table 4.3 range from 2375 to 5398 ug/m^3. These concentrations are 40 to 50 times higher than average NO_x concentrations actually measured in residences during epidemiology studies. The maximum NO_x levels estimated in the DEIS are also unbelievably high; up to 31,589 ug/m^3 in Table 4.3 versus an upper value of 1,000 ug/m_3 reported by the National Academy of Sciences[1].

The methodology and assumptions in Appendix A of the DEIS must be evaluated to determine the cause of the inaccuracy of the model.

Table A.1 - Pollutant Source Strengths

Table A.1 of the DEIS lists the emission rates from pollutant sources, including gas stoves, for nine pollutants. The table references the National Research Council report (NRC)[1], as the source of the formaldehyde emission rate from gas stoves. The NRC report

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references a personal conversation with Greg Traynor of Lawrence Berkeley Laboratories (LBL) as the source of its information.

It is improper for BPA to cite the NRC report as its reference. This places the credibility of the National Academy of Sciences behind an emission rate which had not yet been published nor subjected to peer review for study design, statistical analysis, and conclusions.

Another LBL study[2] is the source of all other gas stove emission factors shown in Table A.1. BPA should not place complete reliance on this single study and ignore several other studies which included a much larger sample of gas ranges.

In the 1970's, the American Gas Association Laboratories performed emission measurements on 18 models of gas stoves using the ANSI direct measurement method[3]. Seventy-two rangetop tests were conducted. The results were as follows (converted to ug/kJ):

AGAL Results - 18 Gas Stoves

	Oven	Rangetop
NO	24.1	21.0
NO_2	6.0	8.6
CO	17.1	23.3

Recently, a detailed study of gas stove emissions has been performed at the Institute of Gas Technology (IGT) and the Illinois Institute of Technology Research Institute (IITRI). This study is unique in that it is the only study which has used both the ANSI direct measurement method and the chamber/mass balance methods of emission measurement. Although the final report has not yet been completed, data on gas stove emissions have been analyzed and published[4].

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IGT/IITRI tested three models of gas stoves and conducted 110 tests of rangetop burners and 29 tests of oven burners using the ANSI method.

The results of the direct measurement tests were as follows (converted to ug/kJ):

IGT/IITRI Results Three Gas Stoves

	Oven	Rangetop
NO	21.9	16.9
NO_2	10.7	9.9
CO	23.2	48.1

The results of 72 chamber tests were as follows (converted to ug/kJ):

	Oven	Rangetop
NO	Not Tested	18.5
NO_2	Not Tested	10.4
CO	Not Tested	124

Particularly for NO and NO_2, the chamber tests support the results of the direct measurement method.

The AGAL and IGT/IITRI results are compared with the LBL results below.

Gas Oven Emission Rate (ug/kJ)

	AGAL	IGT/IITRI	LBL
Method	ANSI	ANSI	Chamber
# Stoves	18	3	1
# Tests	27	29	2-6
NO	24.1	21.9	6.61
NO_2	6.0	10.7	10.14
CO	17.1	23.2	226

Gas Rangetop Emission Rate (ug/kJ)

	AGAL	IGT/IITRI		LBL
Method	ANSI	ANSI	Chamber	Chamber
# Stoves	28	3	3	1
# Tests	72	110	72	5-6
NO	21.0	16.9	18.5	9.7
NO_2	8.6	9.9	10.4	14.8
CO	23.7	48.1	124	200

IGT and IITRI also tested gas rangetop burner formaldehyde emissions. Eleven test runs were conducted using three different stoves. In five of these eleven tests, the air shutters on the burner were deliberately maladjusted to cause "worst case" pollutant emission rates. The results of these tests are compared to the results of LBL's tests.

Formaldehyde Emission Rate (ug/kJ)

	#Ranges	#Tests	ugHCHO/kJ
LBL	1	2	1.7
IGT/IITRI	3	11	0.477

IGT and IITRI did not test the oven burners.

For the pollutants of health concern (formaldehyde, NO_2, and CO), LBL's data are higher than both the AGAL and IGT/IITRI emission rates. AGAL and IITRI/IGT conducted tests on larger samples of stoves and performed significantly more test runs. Therefore, these tests are more representative of the diversity of stoves in use. This analysis relies on the IITRI/IGT data for all modeling calculations.

For oven burner formaldehyde emissions, this analysis relies on the

ratio of 2.73:1.7 reported by LBL for oven burners and rangetop burners, respectively, and the IGT/IITRI measured rangetop formaldehyde emission rate of 0.447 ug/kJ to estimate that ovens produce (0.477 x 2.73/1.7=)0.766 ug formaldehyde/kJ.

Air Infiltration Rates for Typical Residences

Table A.2 of the DEIS lists ranges of air infiltration rates for four types of residences: single-family detached, single-family attached, mobile homes and apartments. The lowest air infiltration rate is used in estimating the "worst case" or maximum pollutant concentrations. The low infiltration rates for each type of residence from Table A.2 are:

Residence Type	Air Changes Per Hour
Single-family detached	0.5
Single-family attached	0.348
Mobile homes	0.3
Apartments	0.297

These are very low infiltration rates! Undoubtedly, residences with these characteristics are already fitted with storm doors and windows, weather stripping, and gaskets. It is doubtful that much further weatherizing could or should be attempted on these homes. In an EIS for a weatherization program, BPA should not consider homes that are already weatherized. BPA's proposed action would not have an impact on these homes.

Therefore, BPA should use the average air infiltration rates from Table A.2 to estimate the "worst case" pollutant levels for the

purpose of this EIS.

Tables A.4 to A.9 -Typical Source Term Rates

BPA gives no explanation of how the values for the source term rates, M (units = mass/hour) in Tables A.4 to A.9 were derived from Table A.1 source terms (also in units of mass/hour). The source terms listed in Tables A.4 to A.9 for gas stoves are in every case different from those listed in Table A.1. For example, the table A.1 source terms for gas stove formaldehyde emissions are 25 mg/h for ovens and 15 mg/h for rangetop burners. The source term for average gas stove formaldehyde emissions in Table A.5 is 37.6 mg/h (the units are not specified for the table, but 37.6 mg/h is the only reasonable interpretation. BPA should supply units to each Table to avoid errors in interpretation) and does not distinguish between oven and rangetop burners.

Perhaps the most logical explanation is that BPA recognizes that the gas stove is used intermittently, at less than full rated heat input, and with various combinations of oven and rangetop burners operating. BPA must have made several assumptions when estimating the source terms in Tables A.4-A.9 from the Table A.1. source terms. BPA would have had to assume quantities for:

1. The heat input rate (kJ/h) to the oven during average, high, and low use

2. The heat input rate (kJ/h) to the rangetop burners during average, high, and low use.

In addition, the source terms in Table A.1 would have to be converted back into units of mass per kJ by dividing the values listed by the heat input rate used in LBL's tests (8400 kJ/h for the oven and 9200 kJ/h for each rangetop burner).

With these assumptions, the overall pollutant source term rate, M, in mass/hour, can be estimated for gas stoves under average, high, and low usage conditions. The source term rates for the stove would equal the sum of the source term rates for the oven and the rangetop burners. For pollutant i, these source term rates would be equal to:

$$M_{Ri} = S_{Ri}Q_R \quad (1)$$

$$M_{Oi} = S_{Oi}Q_O \quad (2)$$

where: M_i = burner source term rate (mass/hour) for pollutant i under a specific usage scenario (high low, or average).

S_i = Emission rate of pollutant i (mass/kJ)

Q = Average heat input rate to burner (kJ/hour) under high, low, and average use scenarios

Subscripts R and O represent rangetop burner and oven, respectively. Q_R and Q_O are not subscripted with i since average use is independent of the pollutant being considered.

The stove source term rate listed in Tables A.4-A.9 should equal:

$$M_i = M_{Ri} + M_{Oi} = S_{Ri}Q_R + S_{Oi}Q_O \quad (3)$$

BPA has not stated the assumptions it used in deriving Tables A.4 to A.9. However, assumptions can be deduced from equation (3), the source term rates for average usage from any two of Tables A.4-A.9, and the mean oven and rangetop burner emission rates. Using two equations to solve for the two unknowns, Q_R and Q_O, the values for Q_R and Q_O assumed by BPA as representing average rangetop and oven hourly heat input rates can be found.

For carbon monoxide, equation (3) equals

$M = 440\ mg/h = (Q_O)(0.226\ mg/kJ) + (Q_R)(0.2 mg/kJ)$

where 0.226 and 0.2 are mean emission rates from ovens and ranges, respectively, as reported by Girman et al.[2] 440 is the average source term rate for CO from Table A.4.

For carbon dioxide, equation (3) equals

$M = 910\ g/h = (Q_O)(0.0427) + (Q_R)(0.04532)$

where 0.0427 and 0.04532 are CO_2 emission rates from ovens and rangetops, respectively, as reported in Girman et al.

910 is the average source term rate for CO_2 from Table A.9.

Solving for Q_O and Q_R gives

$Q_O = -95628$ kJ/h for the oven burners

and $Q_R = 110260$ kJ/h for the range top burners

This is equivalent to 12 rangetop burners operating simultaneously and a negative heat input to the oven.

Based on this analysis, several explanations are feasible.

1. BPA uses a different average heat input rate to ovens and rangetop burners when calculating average source term rates for each of the various pollutants listed in Tables A.4-A.9.

   This is illogical. Average usage is independent of pollutant type.

2. BPA is not using the source terms reported in Girman et al[2]. This is contrary to Table A.1.

3. BPA is using some other method than equation (3) above to estimate the average source term rates for Tables A.4-A.9. BPA should list its assumptions so that a proper review is possible.

There is adequate research information available to calculate M for gas stoves for each of the pollutants listed in Tables A.4-A.9

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without requiring unsupported assumptions about gas stove usage. A 1973 study at A.G.A. Laboratories measured the gas consumption of eight different gas ranges during the actual preparation of a typical week's meals for a family of four[5]. It was found that average daily consumption of a stove for cooking was 22512 Btu, 9770 Btu for the oven burner and 12742 for the top burners. These results are from actual research and should be more accurate than best guess assumptions by BPA or its contractors.

The proper values for Tables A.4, A.5, and A.6 for gas stove emissions can be estimated from the following information:

Q_O = 9770 Btu/day

Q_R = 12742 Btu/day

Emission Rates for Gas Stoves[4]

Pollutant	Rangetop (ug/kJ)	Oven (ug/kJ)
Carbon Monoxide	48.1	23.2
Formaldehyde	0.477	0.766
Nitrogen Dioxide	9.9	10.7

Average Daily Emissions from Gas Stoves

Carbon Monoxide: (12742 Btu/day)(48.1 ug/kJ)(1.055 Btu/kJ) + (9770)(23.2)(1.055)

= 886 mg/day

Formaldehyde = 14 mg/day

Nitrogen dioxide = 243 mg/day

The estimated value of 14 mg/day source term rate for formaldehyde from gas stove usage is only 37% of the value of 37.6 mg/day used in

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BPA's risk assessment. On this basis alone, BPA's risk assessment would overstate the risk posed by gas stoves by almost a factor of 3.

Estimated Daily Average Pollutant Concentrations

Since these represent average daily emissions from gas stoves, they can be used in the equation on page A.5 in place of the numerator in order to estimate average daily CO and HCHO concentrations contributed by gas stoves. This equation as written is not applicable to nitrogen dioxide or other reactive pollutants because it does not take into account the reduction in pollutant concentration due to reactive decay. In the case of nitrogen dioxide, decay coefficients equivalent to air exchange rates of over 1 ach have been reported as typical.[6,7]. For NO_2, removal by decay may be a more important removal mechanism than removal by air exchange. A modification of the equation to accommodate decay will be suggested later.

Table A.5

The high use scenario source term rate of 41.2 mg/h is extremely high. Although BPA does not state its assumptions, assuming that this is entirely due to rangetop burners operating at maximum heat input (9200 kJ/h), dividing by the Table A.1 source term of 15 mg/h one finds that this is equivalent to 2.7 rangetop burners operating at full heat input. BPA's duration of use at this rate, six hours per day, represents a heat release of over 150,000 kJ/day or over six times the average daily cooking load!

Obviously, BPA's high stove use scenario assumes the misuse of the cooking appliance as a source of supplemental heating. It is inappropriate to consider this type of behavior in the DEIS for several

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reasons:

1. There is no reason to believe that this behavior is pervasive in the Northwest.
2. Persons using gas stoves for heating either (a) have undersized space heating equipment, or (b) wish to reduce than their overall heating costs by using the gas stove as a heater to reduce electrical consumption by their space heating system.

   In either case, weatherizing these homes would reduce rather than increase indoor pollutant levels. It would provide an alternate, non-polluting means to reduce the heating load on the electric space heating equipment.
3. It distorts subsequent calculations of the range of pollutant contribution by use of gas stoves. Since BPA uses minimum air infiltration rates and minimum home volumes to calculate the upper limit of pollutant concentrations caused by a source, in some cases 150,000 kJ/day is more than 100% of the space heating required by the residence being modeled.

Instead, BPA should use as its high use scenario for gas stoves the highest cooking load realistically possible. In the study conducted at A.G.A. Laboratories[5], the maximum gas consumption per day for cooking was 23,380 Btu/day. Assuming that a high use might be 50% more than this, the maximum cooking use per day would consume approximately 35,000 Btu per day. Assuming that this is divided 43% to the oven burners and 57% to the rangetop burners as was the case for average use, the high use scenario source term rate for formaldehyde is:

(35,000 x 1.055 x .57 x .477) + (35,000 x 1.055 x .43 x .766)

= 22.2 mg/day

compared to 247.2 mg/day according to Table A.5. On this basis alone, BPA's risk assessment would overstate the risk posed by gas stoves by a factor of eleven.

The low use scenario in Table A.5 is also presented without support. This scenario is equivalent to one rangetop burner operated at less than 1/3 of full heat input for only ten minutes per day. This is indeed a low use of the stove. However, since the final decision whether to exclude or include homes containing gas stoves will undoubtedly depend only on average and "worst case" pollutant levels, the low use scenario is less important and will not be discussed further.

Contribution of Gas Stoves to Formaldehyde Levels

Table A.15 lists calculated values for the concentration of formaldehyde in the four types of residences resulting from gas stove usage. Variations in building size, formaldehyde emission rates, and air exchange rates were used to estimate the extreme, both minimum and maximum, as well as average concentrations. The calculations used the average, high, and low source terms from table A.5 and the average, high, and low infiltration rates from Table A.2. These have already been reviewed and changes recommended. The following calculations rely on the corrected values for emission rates and infiltration rates.

Using the high and average emission rates calculated earlier and the average infiltration rate for each type of residence, new values for Table A.15 are calculated using the equation on Page A.5 of the DEIS.

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Average and Maximum Formaldehyde Levels Due to Gas Stove Use

	ach(h^{-1})	Volume(m^3)		HCHO Level (ug/m^3)*	
Residence	Average	Avg.	Min.	Average	Max.
SFD	0.8	350	180	2.2	6.4
SFA	0.556	340	180	3.2	9.2
Mob.	0.81	200	180	3.7	6.3
Apt.	0.475	250	180	5.0	10.8

*HCHO level = Mt/24IV = Average daily concentration (from page A.5)

The average gas stove contribution to indoor formaldehyde concentrations are less than half those estimated in Table A.15. The maximum stove contributions are lower than those calculated by BPA by almost a factor of 20.

Table B.1 of the DEIS lists the percentage of formaldehyde concentrations due to various formaldehyde sources in the four types of residences as a range, minimum and maximum. Once again, no explanation is given as to how the values were calculated. However, Table A.15 was undoubtedly the source of the data for estimating the levels caused by gas stove emissions. Gas stoves are listed as contributing up to a maximum of 11 percent of the indoor formaldehyde level. However, if the new values for Table A.15 calculated above are substituted, the maximum values would be approximately 95% lower.

By this analysis, gas stoves at worst emit less than one percent of the formaldehyde released in residences. Therefore, gas stove formaldehyde emissions are not a significant risk to the occupants. BPA should not exclude residences with unvented gas stoves from its weatherization program based on concern about formaldehyde emissions.

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Carbon Monoxide

Applying the same assumptions of average and minimum residence volume and average infiltration rates, the following values are calculated for the contribution of the gas stove to residential carbon monoxide (CO) levels.

M (average) = 886 mg/day

M (high) = 1,377 mg/day

Average and minimum CO concentrations in the four types of residences are calculated using the equation on page A.5 of the DEIS.

		Volume (m^3)		Avg. CO Conc. (ug/m^3)	
Residence Type	ach(h^{-1})	Avg.	Min.	Avg.	Max.
SFD	0.8	350	180	132	398
SFA	0.556	340	180	195	573
Mob.	0.81	200	180	228	394
Apt.	0.475	250	180	311	671

When compared to the USEPA National Ambient Air Quality Standard of 10,000 ug/m^3 (8 hr. average) and the NIOSH recommended standard of 40,000 ug/m^3 (10 hr. time weighted average), it is apparent that CO from gas stoves is not a significant risk. BPA should not exclude homes with gas stoves from its weatherization program based on concern over carbon monoxide emissions.

Nitrogen Dioxide

BPA performs its calculations for nitrogen oxides rather than nitrogen dioxide (NO_2) only, even though the other major oxide of nitrogen, nitrogen oxide (NO) poses no risk of adverse effects at the levels found in residences. BPA does this on the undocumented assumption, stated on pages 3.6, 4.25, and A.4, that "NO quickly

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oxidizes to NO_2." Obviously, BPA does not differentiate between the behavior of NO_x in the outdoor environment and its behavior in the indoor environment. At least four major studies of indoor air quality have found that NO does not oxidize into NO_2 in the indoor environment (6,7,8,9). No major study has found otherwise. BPA should consider NO_2 alone in its analysis.

Applying the same assumptions and methods previously applied for formaldehyde and carbon monoxide, the following values are calculated for the contribution of gas stove use to residential nitrogen dioxide NO_2 levels.

M(average) = 942 mg/day

M(high) = 1465 mg/day

Nitrogen dioxide is a highly reactive gas and therefore the simplified indoor air quality equation on page A.5 of the DEIS

$$CAVG = Mt/24IV$$

would overestimate the average concentration. However, in the mass balance equation for indoor air calculations

$$dC = PaC_o dt + S/V\, dt - (a+k)\, Cdt$$

a, the air exchange rate and k, the reactivity constant, are both in units of hours $^{-1}$ and act in a similar manner(10). Therefore, BPA's simplified indoor air quality equation can be modified for use in estimating indoor levels of reactive gases by addition of the term k, in hours $^{-1}$, to the denominator. This equation is now

$$CAVG = Mt/24(I+k)V$$

The reaction constant for NO_2 of 1.39h^{-1} reported by GEOMET(6) will be used in calculating NO_2 concentrations. Higher and lower reaction constants have been reported and it appears to be a function of the reaction surfaces available and therefore specific to each

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residence(2).

Average and maximum NO_2 concentrations in the four types of residences are calculated using the modified equation as:

Residence Type		Volume (m^3)		Avg. NO2 Conc.(ug/m_3)	
	ach(h^{-1})	Avg.	Min.	Avg.	Max.
SFD	0.8	350	180	51	155
SGA	0.556	340	180	59	174
Mob.	0.81	200	180	89	154
Apt.	0.475	250	180	84	182

In reality, these concentrations are "worst case" averages. As BPA points out at the top of page 2.10 of the DEIS, estimates using the above equation assume that "emission rates and air exchange (continue) at the same level for long periods of time". BPA makes this statement in reference to the fact that unvented space heaters would only be used during cold weather and therefore the emission rate would be lower (zero) during warm weather. However, the air exchange rate would also change with the season. The infiltration rates listed in Table A.2 of the DEIS are applicable only when all windows and doors are kept closed. Since these would be opened during warm weather, the average air exchange rate for a 1-year period would be much higher. Therefore, the NO_2 concentrations (and all other concentrations calculated using Table A.2 air exchange rates) are very conservative.

Health Effects of Nitrogen Dioxide

Appendix H of the DEIS reviews studies of the health effects caused by exposure to nitrogen dioxide. The community epidemiology studies by Shy, et al and Pearlman et al are cited by BPA as indicating that low levels of nitrogen dioxide, 113 ug/m^3 or greater, can cause

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adverse health effects. It is on this basis that BPA concludes that its proposed action to include residences with unvented combustion appliances would cause breathing problems in sensitive individuals. BPA also lists in Table H.2, but does not discuss, several other epidemiologic studies which report health effects from nitrogen dioxide exposure. Several studies of controlled human exposures are listed in Table H.1 which indicate no adverse effects at nitrogen dioxide exposures up to 2820 ug/m^3, or over 15 times to worst case NO_2 concentrations caused gas stoves as calculated above.

BPA should be aware that the Chattanooga studies of Shy et al and Pearlman et al have been subjected to severe criticism from the scientific community. These studies utilized the Jacob-Hocheiser method to measure ambient NO_2 levels. This method has been found to be inaccurate and suggests that NO_2 exposures in Chattanooga were much higher than reported. In addition, the studies did not consider the confounding effect of exposure to other pollutants. Sulfur dioxide exposures were also high in Chattanooga and may have accounted for the health effects reported. As a result of these and other problems, the U.S. Environmental Protection Agency has dismissed the Chattanooga studies as useless in assessing the health effects of nitrogen dioxide.(10)

All of the studies listed in Table H.2 appear to suffer from many of the defects found in the Chattanooga Studies. The notes to Table H.2 indicate excessive exposure to pollutants such as sulfur dioxide and hydrogen sulfide, often at concentrations higher than than of nitrogen dioxide. BPA should not give consideration to any of the studies listed in Table H.2.

According to the studies referenced in Tables H.1 and H.6, the

lowest levels of NO_2 at which sensitive subjects (asthmatics) experience any measurable effects are higher than the maximum level of NO_2 caused by gas ranges. This conclusion is corroberated by a study comparing the health of persons using gas stoves with persons using electric stoves by Dr. Martin Keller(11). This study found no difference between the health of two study groups in spite of higher NO_2 levels in the gas stove homes.

Based on this analysis, BPA should not exclude homes with gas ranges from its weatherization program based on concern over nitrogen dioxide emissions.

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Constituent Source Emission Rate Characterization of Three Gas-Fired Domestic Ranges

James T. Cole
Thomas S. Zawacki
Robert A. Macriss
Institute of Gas Technology
Chicago, Illinois 60616

and

Dimitrios J. Moschandreas
IIT Research Institute
Chicago, Illinois 60616

A B S T R A C T

Indoor air quality has come under scrutiny, in recent years, as a result of the need to reduce the rate of air infiltration of residential dwellings and, therefore, of the homeowner's space heating and air conditioning energy budget. Indoor air quality is influenced by outdoor air quality, the building structure and materials, consumer products, appliances, weather, occupant activities, etc. Among the various sources, unvented gas appliances are contributors of nitric oxide (NO), nitrogen dioxide (NO_2), carbon monoxide (CO), and of other air constituents. Source emission data from 18 gas ranges were published in 1974 showing an average NO/NO_2 emission factor ratio of about 0.33. More recent work has shown the NO_2/NO ratio to vary in the range of 0.4 to 2.0 and this disparity has been attributed to the differences in the experimental procedure used in each case. This paper presents new emission factor data for NO, NO_2, CO and of other trace constituents (TSP, VOC, PAH) from three modern gas ranges and provides a mechanism that helps explain the relatively high NO_2/NO ratios. The paper also presents average emission factor data for TSP and formaldehyde and shows that the difference in VOC and PAH emission rates (between the background and with range burners operating) is within the in strument precision limit.

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Constituent Source Emission Rate Characterization of Three Gas-Fired Domestic Ranges

Introduction

The quality of indoor air is influenced by outdoor air quality, the building structure and materials, consumer products, appliances, occupant activities, etc. Among the various sources, unvented gas appliances are contributors of nitric oxide (NO), nitrogen dioxide (NO_2), carbon monoxide (CO), and of other air constituents.

As part of a major program, funded by the Gas Research Institute (GRI), dealing with the detailed characterization of the indoor environment, the Institute of Gas Technology (IGT) is conducting a study, on a subcontract to IIT Research Institute (IITRI), to quantify emissions from several unvented gas appliances, under laboratory controlled conditions.

One objective of this program is to determine the emission rates of principal constituents in the flue products of several unvented gas appliances, under carefully prescribed and controlled laboratory conditions, and to measure the effect of various factors on these emissions.s. This paper presents the results of source emission characterization of three domestic gas ranges.

Test Protocol and Procedures

A detail experimental protocol was developed for the study covering, among others, the method of appliance testing, the type of instrumentation to be used, statistical test design, and methodology for data analysis.

Test Chamber

The experiments were carried out in a controlled environment test facility shown in Figure 1 and described below. In this room, the rate of infiltration of fresh outside air can be controlled at an appropriate level, at least sufficient to maintain normal oxygen content in the air of the chamber to avoid build up of CO_2 and of other flue products in the room. Structurally the test room comprises an air-tight plyboard cubicle (8 x 8 x 8 ft) in which various unvented gas appliances can be placed for testing under controlled environmental conditions.

The entire cubicle is situated within a large laboratory space with independently conditioned air. To simulate wind induced infiltration, one test room wall (the windward wall) is enclosed by a fan compartment (8 x 8 x 3 ft) that can be pressurized by one or more squirrel-cage blowers to simulate wind pressures corresponding to wind velocities from 0 to 35 mph. The flow coefficient of the windward wall and of one other wall (the leeward wall) can be varied by varying the number of 1-inch-diameter holes opened in them. Infiltration air (including combustion air) supplied to the test room is drawn only from the conditioned air of the large laboratory space. Air from the room, however, may exfiltrate both to the laboratory space through the leeward wall and to the outdoors through a chimney vent system.

The internal volume of the test chamber is relatively small (512 CF) and, therefore, the air change rate was maintained at about 20 acph to guarantee the maintenance of acceptable air temperature and humidity levels. The velocity at which the air moves through the chamber is less than 4 feet per minute. The test room is instrumented appropriately for measurements of temperature, pressure, air flow rate and gas flow rate to the range. To simulate the required range of wind conditions for the study, two squirrel-cage blowers with free-air capacities of 815 and 465 CF/min are used.

Appliances

The appliances used in this program were selected based on communications with several burner manufacturers and GAMA (Gas Appliance Manufacturer's Association). The ranges are made by three different major appliance manufacturers. The first range was equipped with a self-cleaning oven and non-standing pilot lights. The second range was equipped with a continuous clean oven and non-standing gas pilot lights. The third range was equipped with a conventional oven and standing gas pilot lights. All three ranges were new models, currently in the market. The communications with the burner manufacturers and GAMA indicated that nearly all of the range top burners being produced currently are of a similar stamped aluminum burner-cap construction. The three ranges tested in this program were equipped with such burners.

Instrumentation

Where possible, all instrumentation and testing methods used in the experiments were of the U.S. Environmental Protection Agency (EPA). Where these methods are not specified, procedures used by A.G.A. Laboratories or other suitable investigators were used. For carbon monoxide monitoring, a Horiba Model APMA-300E/3000SE ambient carbon monoxide monitoring system was used. The instrument operates with nondispersive infrared spectroscopy with cross flow modulation and dual detector measurement method.

The instrument used to measure the concentration of nitrogen oxides in the ambient air was a Model 12A TECO Chemiluminescent NO-NO_x Gas Analyzer. The instrument operates on the principle of the chemiluminescent reactions of nitric oxide (NO) and ozone, which produce a light emission when electronically excited nitrogen dioxide (NO_2) molecules revert to their ground state.

For carbon dioxide monitoring, a Beckman Model 864-22 analyzer was used. This instrument operates with a non-dispersive infrared detection method. For measurement of total hydrocarbons, a Beckman Model 400 Hydrocarbon Analyzer was used. This instrument utilizes the flame ionization method of detection.

The outputs of all instruments were fed into a computer based data acquisition system. The system features a TecMar Lab Master analog to digital converter and an International Business Machines personal computer. The computer stored the data and was used for retrieval and processing.

Concentrations of Total Suspended Particulate (TSP) emissions and particle size distribution were studied using an Active Scanning Aerosol Spectrometer (ASAS) Model ASAS-300-PMI. TSP was collected on 47 mm nucleopore filters, 0.1 µm pore size. Polynuclear Aromatic Hydrocarbons (PAH) were collected on Chromosorb 102 cartridge with 10 ml hexane:benzene (9:1, v/v). The

samples were treated to obtain residue weight and tic PAH fraction using an automated high performance liquid chromatograph by reverse-phase coupled column liquid chromatography.

Air samples for Volatile Organic Compounds (VOC) were collected by drawing 12 L of air through a 1.5 x 10 cm glass tube containing about 1.5 µg of TENAX GC. The samples were analyzed using a Finnigan Mat 311A GC-MS coupled with a Finnigan MAT spectrosystem SS-200. A modified pararosaniline calorimetric method was used to determine formaldehyde range emissions.

Sampling System

For each test, with each appliance and burner, three gas sampling probes were positioned in the test chamber with one probe located in the air inlet into the test chamber, another in the exhaust air outlet from the test chamber, and a third placed as close as possible to the appliance flue outlet. The positioning of the chamber inlet and outlet probes remained fixed throughout the experiments, while the appliance outlet sampling probe was positioned as discussed later on.

For range-top burners, the probe positioning procedure employed (previously used in a study[1] by A.G.A.L.) consists of using a single sampling point probe in the flue passage predetermined by a careful traverse of the flue outlet area prior to sampling. This probe is placed at the outlet of a quartz collector, also utilized in the current study of range-top burner emissions. In several tests, we observed that the representative sampling point changed during the transient period of the burner operation and, therefore, we attached a short tubular extension to the quartz collector outlet to aid in sample mixing.

All of the data reported here have been obtained by sampling the appliance flue outlet. During the course of the experiments, however, air contaminant concentrations were monitored at both the flue outlet and the test chamber outlet. The test chamber outlet data are not as precise as those obtained from the flue outlet measurements but have been used as a check to verify that the flue sampling probe was properly positioned.

A particulate filter, constructed of teflon, was connected to the sample inlet of the chemiluminescent analyzer, the hydrocarbon analyzer and the carbon dioxide analyzer, as per manufacturer's operating instructions. The carbon monoxide analyzer has a filtration system integral to the unit. With the exception of a condensate water trap (glass) and of several fittings (stainless steel), the sample was primarily in contact with 1/4 inch teflon tubing.

Before experiments were carried out, a gas mixture containing known amounts of nitric oxide and nitrogen dioxide was used to establish that the sampling train did not affect the sample. This gas mixture was fed directly into the chemiluminescent analyzer, with only a short length of tubing, and concentration readings were recorded. The gas mixture was then injected into the sampling train sampling lines and concentration readings were again recorded. A range-top burner was activated for a sufficient time to collect water in the condensate trap and the gas mixture tests were repeated. Within the accuracy of the chemiluminescent analyzer's capability, no differences in the gas concentration were observed.

Test Gases

The range emission experiments were made with either a rich or lean test natural gas. The analysis for these test gases is as follows:

Component	Test Gas Analysis, Mole % Rich	Lean
Nitrogen	2.24	2.36
Helium	0.09	0.10
Carbon Dioxide	0.54	0.61
Methane	89.96	94.57
Ethane	7.16	2.35
Argon	0.01	0.01

The gross heating value is 1022 Btu/SCF for the rich gas and 983 for the lean gas (saturated at 60°F).

Experimental Procedure

As previously noted, all gas appliances tested as part of this program have been new models, currently in the market. To eliminate extraneous emissions from the combustion or residual materials, oils or lacquers on or near burner elements or heat transfer surfaces, each burner in each appliance was conditioned through firing for approximately 6 hours, before the actual testing sequence could begin.

During this break-in period, the appliance was checked for proper operation according to the manufacturers instructions. For experiments to begin, the appliance was placed in the chamber, adjusted so as to be level, connected to the gas and electric lines and the probes were installed. If a thermal load was required, it was positioned at this time. After any particular burner had been tested, it was retested only after a suitable time period had elapsed to allow cool down to near room temperature.

Range top burners were operated with a water load in a cooking pot as described in ANSI Z21.1-1974.[3] The cooking pot has a top which is sealed except for a 3/4 inch pipe which extends from the center to allow steam to escape. The pot was covered by a quartz collector dome. This dome was positioned on spacers which were located on the range top surface.

The sample probes were positioned in the chamber and the chamber door was sealed. The data acquisition system was activated and the initial gas meter reading recorded. After baseline data had been stored, the burner was ignited using switches located outside the chamber. The chamber has a window so that observations could be made during the course of the experiment. After the burner was shut down, the data storage continued for about 5 more minutes. The chamber was then opened and prepared for another run.

Experimental Results

All 12 range top burners of the three gas ranges were operated at two primary aeration settings, namely properly adjusted blue flame and yellow-tipping flame. These aeration settings are made by adjusting the air shutter

on the burner assembly. This burner assembly is a removable part of the range and consists of the burner cap, a gas carrying tube, the orifice hood, and the air shutter. The burner assembly is mounted by placing the tube inlet over the orifice on the gas manifold, and positioning the mounting bracket to the holes on the burner support. All of the range top burner assemblies tested had a loose fitting connection between the gas manifold orifice and the burner assembly. This practice provides that, even with the primary air shutter completely closed, there is still some primary air available for combustion.

Primary aeration measurements were made by inserting a hypodermic needle sampling probe into a burner port and drawing a sample for oxygen analysis. The average primary aeration for all three ranges was 41% of the stoichiometric requirement. With the air shutters closed, the primary aeration dropped to 33% of the stoichiometric requirement. Again, we observed little difference among the three ranges.

Blue-Flame Burner Tests

A total of 58 runs were completed with gas Range No. 1 while 25 and 33 runs were made with gas Ranges Nos. 2 and 3, respectively. The tests have covered all four top burners of each range, with each burner adjusted to produce the normal blue-flame (as per ANSI standard). For about 60% of the actual total runs with each range, we have supplied the lean gas to each burner and, for the other 40%, the rich gas composition. Each burner, with each flue-gas composition, has been reset and tested repeatedly (from 2 to 14 tests), with the overall average number of tests for each burner being about 10.

The emission factor data, for each burner during each test, were time-averaged over the last 18 minutes of each run. Emission factors (as equivalent pounds per million Btu input to the burner) for NO, NO_2, NO_x (expressed as NO_2) and CO and air-free-basis concentrations (in ppm) for NO, NO_2, and CO, for each test and range top burner, have been obtained and are shown in Tables I to III.

Emission factors of NO and NO_2 from any burner of any range were found to be similar, with maximum variance being less than 10% to 15% of an absolute mean concentration level. On the other hand, CO levels between burners of the same gas range or other range burners were found to vary by as much as a multiple of 5, based on absolute levels. It should be noted here, however, that even the range (No. 1) with the highest average CO concentration was in compliance of the relevent ANSI standard.[3] The results indicate that CO emissions are more sensitive to burner design than are NO or NO_2 emission levels.

Yellow-Tip Flame Burner Tests

The concentration of constituents emitted from the combustion of natural gas in appliances can be affected by the setting of the burner air shutter which controls the amount of primary aeration. A total of 30 additional tests have been made, for comparison, with the air shutter in the worst possible position (completely closed), the extreme condition which could be encountered in the field.

The results of these tests are shown in Table IV. These data show that the CO emissions can be increased significantly over the blue-flame levels (by a factor of 2 to 4). Only small differences were observed in the NO and NO_2 emission data between properly adjusted (blue-flame) and worst condition (yellow-tip flame) in the current tests.

Finally, Table V presents overall emission factor data comparison for each range and burner setting together with similar literature data for 18 ranges. For the three ranges tested, although some individual burners exhibited high CO emissions with the yellow-tipping flame setting, all of these ranges would pass the ANSI[3] requirement.

Ambient Levels of Hydrocarbons and of NO/NO_2 Ratio

During the course of the screening experiments, and while one of the range top burners was operating, fuel gas escaped from beneath the burner seat at a seam in the assembly. At the incident gas leak rate, the emission factor ratio of NO to NO_2 was observed to drop sharply. An experiment was devised to more closely examine the effect. After sealing the seam, the range-top burner was turned on again and was operated normally to obtain baseline emission factors. Gas was then injected into the air supply to the test chamber. Finally, the gas injection was stopped and the test was continued until the chamber hydrocarbon level returned to near baseline levels. At the start of the hydrocarbon injection, the NO/NO_2 ratio (as NO_2) was 3 to 1. When the hydrocarbon concentration in the chamber reached 300 ppm, the ratio dropped to 1. Finally, the effect on the ratio was reversed, as the hydrocarbon level was being continuously depleted and approached the 3 to 1 initial level, near baseline hydrocarbon levels of the chamber.

Trace Constituents from Range-Top Burners

With the range-top burners we performed 10 additional tests and measured TSP emissions. The average emission rate for particulates of mean aerodynamic diameter between 0.24 and 0.54 μm (with 84% less than 1.0 μm) is 2284 μg/hr which corresponds to 0.25 μg/kJ of gas input. The calculated emission rate, using stoichiometric calculations and assuming 9000 Btu/hr gas consumption rate, compares favorably with the Girman range[4] of 0.24 - 0.62 μg/kJ (with a mean of 0.41 μg/kJ), obtained by gravimetric analysis of 3 samples.

The mean formaldehyde emission rate measured in 11 additional tests with the three gas ranges is 0.477 μg/kJ, less than the 1.7 (0.9 - 2.5) μg/kJ mean emission rate reported by Girman[4] and his associates from 2 runs. On the other hand, the difference in VOC and PAH concentrations between the background and with range burners operating was found to be within the instrument precision of the emitted concentrations. Therefore, we conclude that VOC and PAH emissions from unvented ranges are minimal.

Range-Oven Burner Results

For range-oven burners, an integrating multipoint sampling probe was used, similar to a procedure reported[2] earlier. The probe was constructed of stainless steel tubing with a series of holes drilled along its length. This probe was then affixed to the rectangular appliance flue outlet to produce an

integrated sample for measurements. The ovens were operated in several different modes, simulating bake, broil or self-cleaning operations. Each bake or broil test run lasted for about 30 minutes while each self-cleaning cycle lasted about 3 hours.

A total of 29 test runs were completed with the oven burners of the three ranges. Of these, 12 runs were made with the two oven burners of Range No. 1 in three different modes (bake, broil and self cleaning). For the latter operation, both burners are involved to reach the maximum temperature (900°F) utilized in the programmed self-cleaning cycle. Eight additional runs were made with single burner of Range No. 2 and another 9 runs with the single burner of Range No. 3. For about one-half of the oven burner tests, lean gas was supplied to the burners and rich gas composition to the other one-half of the tests.

The emission factor data, for each oven burner during each test, were time-averaged during the burner-on period of the run but following about 5 minutes after initial burner turn-on. Emission factors for NO, NO_2, NO_x and CO, for each test and oven burner, have been obtained and are shown in Table VI.

The emission factor data for NO and total NO_x appear to be mostly affected by the maximum temperature of operation (from bake to self clean), with the bake operation producing lower levels of NO and NO_x while the higher temperature broil and self-clean operations have resulted in higher NO and NO_x levels.

Emission levels of NO_2 do not appear to be significantly affected by the type of operation, except in Range-oven No. 2, when broiling produced lower NO_2 levels than the baking cycles. Similarly, CO emission factors for Range-oven No. 1 were found to be inversely proportional to the temperature level maintained during each operation (highest during the baking cycle and lowest during the self-clean cycle).

Data Analysis and Comparisons

For each cooking appliance, emission factors were determined for each individual range-top burner, fired with two types of fuel, rich and lean, as discussed earlier. With these data, we have searched to establish whether there are any relationships between emission factors and burner position (left, right, front or rear) or fuel type. A comprehensive statistical treatment of the entire set of data would be the most rigorous approach to provide the answers sought. However, we have gained valuable insight by employing the relatively simple t-test approach for comparing two mean values.[5]

We have performed a parametric analysis based on the t-test, comparing pairs of mean emission rates either from two different burners or resulting from using lean or rich gas on the same burner. The major conclusions drawn from this analysis are as follows:

- For a specific range and with only minor exceptions, NO, NO_2 and NO_x emission factors are independent of burner position, left, right, front or rear.

- The NO, NO_2 and NO_x emission factors were not substantially affected by the fuel gas composition, rich or lean. However, some systematic trends were observed, but were found not to be statistically significant. The NO emission rates for Range Nos. 1 and 3 tended to be somewhat higher when the rich gas was used, while the opposite was true for Range No. 2. For all three ranges, NO_2 emission rates increased slightly when the rich fuel was used.

- For Range No. 1, CO emission rates were found to be higher from the rear burners (0.383 and 0.272 lbs per million Btu) than the front burners (0.096 and 0.138 lbs per million Btu). Although not as pronounced, Range No. 2 exhibited similar trends. For Range No. 3, the highest CO was found for the right front burner, with the other burners exhibiting lower values.

- The CO emission rate was not affected by fuel gas composition, rich or lean.

Data Precision

In a preliminary statistical error analysis, during the test design period, we assumed that a desirable emission rate characterization level should have a sample mean which can be determined to be within ±5%, at the 95% confidence level. For the oxides of nitrogen emission factors, we have accomplished this goal for most appliances tested. This is primarily due to the fact that, during any particular test, the nitrogen oxides reached a nearly constant emission rate very quickly (usually within 5 minutes).

With the carbon monoxide emission factors, we could not obtain the desired level of precision for most appliances, because the carbon monoxide emission rate would be high at the start of the run when the combustion pot surface was cold and would normally decrease throughout the 1/2 hour test period.

Acknowledgement

The support provided by the Gas Research Institute is acknowledged.

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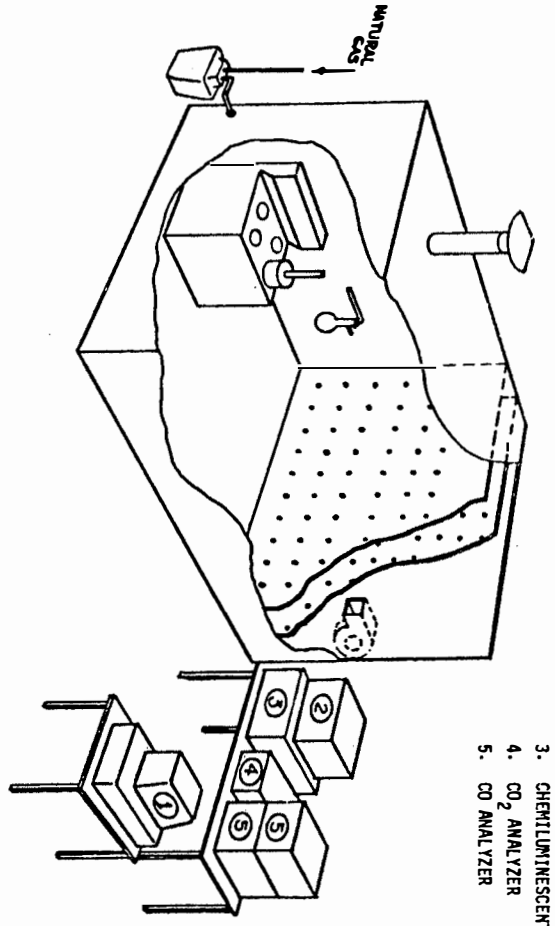

1. IBM COMPUTER
2. HYDROCARBON ANALYZER
3. CHEMILUMINESCENT ANALYZER
4. CO_2 ANALYZER
5. CO ANALYZER

Figure 1. IGT indoor air quality test chamber and data acquisition system

Table I. Air free concentrations of NO, NO_2 and CO from range-top burners.[a]

Range	Burner[b]	Gas	No. of Tests	Fuel Input Rate, Btu/hr	Ave. Sample CO_2, %	Flue Gas Concentration, (ppm) Air Free Basis NO	NO_2	CO
1[c]	LF	Lean	14	8850	1.44	62.4	20.5	148
	LF	Rich	9	8950	1.49	64.3	20.7	77
1	LR	Lean	11	8760	1.48	61.5	23.7	587
	LR	Rich	4	9060	1.42	59.8	24.5	687
1	RF	Lean	6	8860	1.37	64.6	22.3	103
	RF	Rich	4	8910	1.58	64.9	23.1	137
1	RR	Lean	6	8680	1.46	69.1	21.9	316
	RR	Rich	4	8870	1.50	61.5	21.7	190
2[c]	LF	Lean	4	8870	1.48	60.9	17.0	85
	LF	Rich	3	8530	1.48	54.3	22.4	97
2	LR	Lean	3	8660	1.46	58.8	16.4	199
	LR	Rich	3	7990	1.39	53.7	20.2	121
2	RF	Lean	2	8570	1.39	59.2	19.1	216
	RF	Rich	4	8620	1.44	57.6	21.5	205
2	RR	Lean	3	7950	1.42	55.8	19.6	300
	RR	Rich	3	8860	1.50	53.0	25.5	323
3[d]	LF	Lean	6	9520[e]	1.28	61.2	24.2	128
	LF	Rich	4	9890	1.04	61.3	25.1	87
3	LR	Lean	5	9130	1.22	55.8	25.8	73
	LR	Rich	4	9200	1.02	58.3	27.1	68
3	RF	Lean	4	9340	1.02	58.6	25.4	253
	RF	Rich	3	9470	1.02	60.4	24.4	209
3	RR	Lean	4	9420	1.37	61.8	23.1	137
	RR	Rich	3	9800	1.05	68.9	23.0	84

a Properly Adjusted Blue-Flame.

b LF = Left Front, LR = Left Rear, RF = Right Front, RR = Right Rear.

c With Non-Standing Pilot Ignition.

d With Standing Pilot (220 Btu/hr) Ignition.

e Includes Pilot Input.

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Table III. Emission factor data for NO, NO_2, NO_x and CO from the 4 top burners of a gas-fired range with standing pilot ignition.*

Gas Range	Top Burner**	Gas	No. of Tests	NO		NO_2		NO_x (As NO_2)		CO	
				Avg.	S.Dev.†	Avg.	S.Dev.	Avg.	S.Dev.	Avg.	S.Dev.
				lbs/10^6 Btu							
3	LF	Lean	6	0.0409	0.0005	0.0248	0.0006	0.0862	0.0032	0.080	0.014
3	LF	Rich	4	0.0411	0.0007	0.0258	0.0007	0.0838	0.0024	0.054	0.004
3	LR	Lean	5	0.0373	0.0002	0.0264	0.0020	0.0812	0.0032	0.046	0.009
3	LR	Rich	4	0.0391	0.0012	0.0279	0.0023	0.0871	0.0011	0.043	0.009
3	RF	Lean	4	0.0392	0.0009	0.0260	0.0009	0.0869	0.0027	0.158	0.008
3	RF	Rich	3	0.0405	0.0021	0.0251	0.0008	0.0895	0.0024	0.131	0.015
3	RR	Lean	4	0.0413	0.0014	0.0237	0.0029	0.0861	0.0005	0.086	0.005
3	RR	Rich	3	0.0462	0.0001	0.0236	0.0012	0.0932	0.0013	0.053	0.004

* For CO_2 Concentrations and Fuel Input Rates See Table 1.

** LF = Left Front, LR = Left Rear, RF = Right Front, RR = Right Rear.

† Standard Deviation.

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Table II. Emission factor data for NO, NO_x and CO from the 8 top-burners of 2 gas-fired ranges with non-standing pilot ignition.*

Gas Range	Top Burner†	Gas	No. of Tests	NO		NO_2		NO_x (As NO_2)		CO	
				Avg.	S.Dev.**	Avg.	S.Dev.	Avg.	S.Dev.	Avg.	S.Dev.
				lbs/10^6 Btu							
1	LF	Lean	14	0.0417	0.0008	0.0210	0.0004	0.0852	0.0017	0.092	0.025
1	LF	Rich	9	0.0431	0.0006	0.0213	0.0010	0.0876	0.0008	0.048	0.013
1	LR	Lean	11	0.0411	0.0006	0.0243	0.0007	0.0860	0.0013	0.366	0.045
1	LR	Rich	4	0.0401	0.0009	0.0252	0.0008	0.0867	0.0019	0.430	0.078
1	RF	Lean	6	0.0432	0.0010	0.0228	0.0009	0.0884	0.0013	0.064	0.015
1	RF	Rich	4	0.0435	0.0013	0.0237	0.0006	0.0869	0.0025	0.086	0.029
1	RR	Lean	6	0.0462	0.0005	0.0224	0.0002	0.0915	0.0022	0.147	0.044
1	RR	Rich	4	0.0412	0.0006	0.0223	0.0008	0.0869	0.0020	0.119	0.013
2	LF	Lean	4	0.0407	0.0020	0.0174	0.0023	0.0798	0.0053	0.053	0.010
2	LF	Rich	3	0.0364	0.0007	0.0230	0.0002	0.0788	0.0009	0.061	0.002
2	LR	Lean	3	0.0393	0.0006	0.0168	0.0002	0.0771	0.0011	0.124	0.010
2	LR	Rich	3	0.0360	0.0029	0.0208	0.0030	0.0760	0.0014	0.076	0.042
2	RF	Lean	2	0.0396	0.0009	0.0196	0.0015	0.0803	0.0002	0.135	0.018
2	RF	Rich	4	0.0386	0.0039	0.0221	0.0027	0.0814	0.0073	0.128	0.033
2	RR	Lean	3	0.0373	0.0014	0.0201	0.0014	0.0764	0.0024	0.187	0.018
2	RR	Rich	3	0.0355	0.0024	0.0262	0.0010	0.0777	0.0047	0.202	0.047

* For CO_2 Concentrations and Fuel Input Rates See Table 1.

** Standard Deviation.

† LF = Left Front, LR = Left Rear, RF = Right Front, RR = Right Rear.

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Table V. Comparison of emission factor data for range-top burners
(Emission factor, lbs/10^6 Btu)

Range No.	Number of Burners	Source	NO	NO_2	NO_x	CO
Properly Adjusted Blue-Flame						
1	4	IGT/IITRI	0.041	0.023	0.086	0.138
2	4	IGT/IITRI	0.036	0.021	0.079	0.129
3	4	IGT/IITRI	0.041	0.025	0.087	0.068
(18)	72	A.G.A.L.	0.049	0.020	0.096	0.055
Yellow-Tipping Flame (Air Shutters Closed)						
1	4	IGT/IITRI	0.039	0.030	0.091	0.23
2	4	IGT/IITRI	0.036	0.034	0.087	0.30
3	4	IGT/IITRI	0.036	0.035	0.091	0.30
(18)	72	A.G.A.L.	0.039	0.032	0.092	0.40

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Table IV. Air free concentrations of NO, NO_2 and CO from 12 range-top burners operating with yellow-tipping flame.[a]

Range	Burner[b]	No. of Tests	Fuel Input Rate, Btu/hr	Ave. Sample, CO_2, %	Flue Gas Concentration (ppm) Air Free Basis NO	NO_2	CO
1[c]	LF	2	8680	1.42	63.1	28.5	360
1	LR	2	8770	1.44	53.0	30.8	833
1	RF	4	8840	1.41	61.2	28.3	361
1	RR	2	8890	1.42	56.0	29.9	503
2[c]	LF	2	8780	1.53	63.3	25.8	251
2	LR	2	8440	1.55	62.8	28.4	363
2	RF	5	8580	1.49	44.2	38.8	842
2	RR	2	8940	1.50	38.5	41.6	1160
3[d]	LF	2	9750[e]	1.01	46.7	41.5	1170
3	LR	2	9280	1.00	46.6	29.2	235
3	RF	3	9720	1.02	45.4	41.8	1010
3	RR	2	9810	1.06	61.8	29.5	364

a Primary Air Shutters Closed.
b LF = Left Front, LR = Left Rear, RF = Right Front, RR = Right Rear.
c With Non-Standing Pilot Ignition.
d With Standing Pilot (220 Btu/hr) Ignition.
e Includes Pilot Input.

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Retyped from original letter:

Sunday Nov. 13th, 1983

Mr. Morrell:

I attended BPA's Portland Meeting Wednesday November 2nd, 1983. I wish to be recorded as agreeing with the comments of Commissioner Mike Lindberg!

If one must wait until every eventuality is explored nothing would ever be accomplished. Do not exempt 70% of the region's electrically heated residences from "housetightening measures." Be creative - educate the consumer, agree to monitor for problems and then let the consumer decide. All risk is relative. I notice you do not exempt homes occupied by smokers or those with fireplaces.

Enough said. Please notify me when BPA decides and why the decision you choose was chosen.

My address is:

Nancy Meyer
4025 SW 58th
Portland, OR 97221

Thank you.

Sincerely,

/s/ Nancy Meyer

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Table VI. Emission factor data of NO, NO_2, NO_x and CO from the range-oven burners.

Range	Burner	Gas	No. of Tests	NO Avg.	NO S.Dev.	NO_2 Avg.	NO_2 S.Dev.	NO_x (As NO_2) Avg.	NO_x (As NO_2) S.Dev.	CO Avg.	CO S.Dev.
				lbs/10^6 Btu							
1	Bake[a]	Lean	2	0.0339	0.0002	0.0295	0.0017	0.0810	0.0034	0.1592	0.0141
	Broil[b]	Lean	3	0.0544	0.0007	0.0268	0.0002	0.1103	0.0011	0.0433	0.0026
1	Broil	Rich	4	0.0537	0.0004	0.0264	0.0009	0.1076	0.0014	0.0351	0.0016
	Self-Clean[c]	Rich	3	0.0627	0.0023	0.0280	0.0005	0.1244	0.0042	0.0373	0.0050
2	Bake	Rich	4	0.0326	0.0074	0.0258	0.0036	0.0948	0.0126	0.0444	0.0135
	Broil	Lean	4	0.0680	0.0006	0.0164	0.0018	0.1243	0.0020	0.0320	0.0091
3	Broil	Lean	4	0.0512	0.0003	0.0225	0.0006	0.1017	0.0007	0.0278	0.0002
	Broil	Rich	5	0.0505	0.0006	0.0231	0.0003	0.0948	0.0012	0.0330	0.0019

a. Bake Test: Thermostat at 500°F, Burner Cycles Normally.

b. Broil Test: Thermostat at Broil, Burner-On Continuously.

c. Self-Clean Test: Thermostat at Clean, Programmed Burner Sequential-Operation.

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603 24th Avenue East
Seattle, Washington 98112

To:
Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

November 11, 1983

COMMENTS ON BPA's "EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM" DRAFT E.I.S.

I believe that BPA should proceed immediately with the Proposed Action to tighten homes, reduce air infiltration, and save energy. This program of energy conservation must include a large fraction of homes in the region. Therefore I favor several measures to mitigate indoor air pollution problems by excluding a few high risk homes, and by protecting indoor air quality in certain homes which have a high risk of health problems from pollutants.

Mitigations by Exclusion. Certain features of homes give them a high risk of indoor air pollution problems. Homes should be excluded from tightening by BPA unless: (1) unvented combustion appliances are vented to the outside, and (2) unvented crawl spaces are vented and the earth covered with a plastic film vapor barrier. Vents and vapor barriers can remove or exclude water vapor and other pollutants at low cost. 1

Other homes with likely pollutant sources should be excluded from tightening unless the air quality is tested and pollutants are only present at low levels.

Mitigations by Action. Measuring pollutant levels in the indoor air is the most important action in deciding if a home has a high risk from some pollutant. Testing air quality can warn of an existing hazard before tightening a home, decreasing air exchange rate with outdoors, and making the problem worse. Guestimating pollutant levels is not accurate because source strength varies widely and effects of occupant lifestyle are unpredictable.

Homes should be excluded from tightenting by BPA unless they are tested for (1) formaldehyde in homes with urea-formaldehyde (UF) foam insulation and in mobile homes, and (2) radon in homes with slab-on-grade, basements, or well water.

Formaldehyde. Before tightening any home with UF foam insulation or any mobile home, I believe that formaldehyde should be below 0.1 ppm (parts per million)(=120 micrograms per cubic meter) in the afternoon, which is the time of highest expected daily levels. Homes with UF foam insulation should not be excluded automatically from tightening.

My testing experience shows that foamed homes average 0.05 ppm, which is about half of a typical mobile home formaldehyde level. Concentration levels found before 1980 were usually higher, because the UF in foam insulation and particleboard resin were newly manufactured and had a higher formaldehyde emission rate. The UF foam insulation in existing homes has aged about four to eight years now, since most were foamed 1975-1979.

I expect that most homes with aged UF foam insulation will be below 0.1 ppm formaldehyde for a one hour peak, and nearly all below 0.1 ppm for a 24 hour average. I expect that many mobile homes will be below 0.1 ppm for a one hour peak, and most below 0.1 ppm for a 24 hour average. The Draft EIS quotes higher formaldehyde

averages because the samples were mostly taken when the UF in foam or particleboard was newer, and before mobile home manufacturers converted to "low fuming" particleboard or replacement building materials.

I believe the goal after tightening a home should be to keep the formaldehyde below 0.1 ppm for an afternoon sample. Therefore any home with UF foam insulation above 0.06 ppm formaldehyde in the air should take extra measures to seal off wall sources before tightening the home. Measures to reduce indoor formaldehyde include interior vapor barriers and sealing interior air leaks in foamed walls. 2

Mobile homes may be completely filled with particleboard and other formaldehyde sources, so these homes cannot benefit from vapor barriers and sealing as easily as homes with UF foam insulation limited to the exterior walls. Mobile homes are therefore the best candidates for air-to-air heat exchangers to reduce formaldehyde levels in the air.

Formaldehyde monitoring. A passive sampler is the easiest way to collect formaldehyde vapors for analysis. However, most passive samplers are not very sensitive. They cannot measure 0.1 ppm formaldehyde after a few hours of exposure. They must be exposed for one to seven days before analysis. That long term average concentration includes lower levels at night, which can hide higher daytime peak levels. A passive sampler is often chosen for an unofficial test because it costs less than a single "official" test.

I urge BPA to require an "official" formaldehyde test with three samples before making any decision about tightening any mobile home or home with UF foam insulation. An official test has several advantages: 3
(1) A trained technician takes samples and verifies the correct procedure and length of time sampled. (A homeowner can make a passive sampler get a lower reading by opening windows or by covering or removing the sampler temporarily.)
(2) The active sampling method using air pumps and water impinger collectors (as recommended by NIOSH in Method P&CAM 125) is more accurate and more sensitive than passive samplers.
(3) An afternoon sample of a few hours or less would be better to measure the higher daytime formaldehyde levels expected.
(4) Three simultaneous tests would be valuable, measuring two different rooms indoors (one closed up, one larger and more open) and one outdoors (to detect any nearby outdoor source adding to indoor levels).
(5) The cost of three official samples is less than for three passive samplers.

Formaldehyde models. Formaldehyde is the pollutant that requires the most study to model air quality changes with temperature, humidity, and ventillation rate. All three factors influence emission rate from building materials, in a more complex equilibrium than other common pollutants. Formaldehyde should be monitored whenever an air-to-air heat exchange ventillator is in use, because the formaldehyde level is reduced less than the other pollutants by a given increase in air exchange rate. Consumers need to know how well any ventillation might help their formaldehyde problem, because that might be their only solution to high formaldehyde (and other pollutants) if their home is filled with many source such as particleboard. Other air cleaning methods such as fan/filter/adsorbent systems should also be installed and air pollutant levels monitored to model their effectiveness in cleaning the air. 4

Moisture. Many homes have problems with high humidity, especially west of the Cascades. Water vapor is a problem because of condensation, decay, clammy feeling, and the growth of mold. Mold can become a major problem. Water vapor also increases formaldehyde emissions from UF foam and resin glues. 5

Exhaust fans should be required in bathroom and kitchen to remove water and other odors. A timer switch is a good way to encourage exhausting water for 10-20 minutes

5 whenever the problem is greatest. Exhaust fans and timers are good low cost measures to improve indoor air quality. An air-to-air heat exchange ventillator is even more effective in improving indoor air quality while saving some heat, but the cost is much higher.

Air-to-air Heat Exchange Ventillators. I believe that a heat exchange ventillator is the best way to improve indoor air quality without losing as much heat energy as simple exhaust fans. The design should exhaust water, not recover it, to reduce indoor levels of both water and formaldehyde.

6 The homeowner should pay for more of the cost of a heat exchange ventillator than for other weatherization measures because:
(1) It cleans the air and benefits the home occupants more than it saves power for the region.
(2) It is more experimental than other weatherizing. Homes with heat exchangers and sources of formaldehyde should be monitored to measure actual reduction in formaldehyde levels, and also other pollutants.
(3) It is a more expensive option than exhaust fans, or a dehumidifier, or a filter fan with pollutant traps. The purchase and installation price of $650 quoted in the Draft EIS seems like a minimum cost, and probably costs much more for a whole house system including ductwork.
(4) It is an active device that requires some attention and interest from the homeowner.

1 Disclosure. BPA should always inform homeowners of possible problems with the occupant's health from indoor air pollutants. Information should include not only wood stoves and smoking, but also sources of radon and formaldehyde. Radon is an exotic and newly recognized pollutant, so few people know about its potential problems.

Formaldehyde is mostly known and discussed regarding urea-formaldehyde (UF) foam insulation, which is widely recognized as a source. Particleboard and interior plywood bonded with UF resin glues should also be publicized as a source of formaldehyde that is more widespread and less recognized than UF foam insulation.

Sincerely,

Richard Knights

Richard Knights, President
Blue Sky Testing Laboratories
603 24th Avenue East
Seattle, WA 98112

public power council
500 W. Eighth Street · Suite 110
Vancouver, WA 98660
(206) 694-6593
(503) 241-3163

November 14, 1983

Mr. Anthony Morrell
Bonneville Power Administration
P. O. Box 3621 - SJ
Portland, Oregon 97208

Dear Mr. Morrell:

Enclosed are the comments of the PPC Conservation Committee on BPA's draft EIS on the Expanded Residential Weatherization Program.

Thank you for the opportunity to comment on this important subject.

Very truly yours,

Al Aldrich
Conservation Director

AA:je
ZZ:2:02

DRAFT

Comments on BPA's Draft Environmental Impact Statement
on Indoor Air Quality Under the Expanded
Weatherization Program

From the
Public Power Council Conservation Committee
November 14, 1983

The Public Power Council Conservation Committee, composed of representatives of the BPA area consumer-owned electric utilities, appreciates this opportunity to comment on BPA's draft EIS on the Expanded Residential Weatherization Program. The region's public power utilities have followed closely the issue of indoor air quality since it first appeared several years ago. As the primary operators of BPA's residential weatherization program, we have been--and will be--significantly affected by any major change in program conditions, such as the one identified as the proposed action.

In general, the issues addressed by the draft EIS are complex and not easily resolved. The EIS obviously presents a large amount of information on the subject, much of which is helpful. PPC utilities, however, do feel that the

information could have been presented in an improved manner in several instances. Some additional observations in that regard follow later in these comments.

While the issues are complex and not easily resolved, PPC utilities strongly feel that it is time the region and BPA move forward to resolving these issues to the extent they can now be resolved.

The PPC Conservation Committee has a number of specific recommendations regarding what course BPA should take. In addition, there are comments of a more general nature on recommendations for improving the presentation of the information in several cases.

In summary, here are the recommendations for future action. The recommendations are subsequently discussed in some detail.

1 Consumer Information: Consumers in all classes of homes should be provided information regarding the possible effects of house tightening measures on indoor air quality.

Waiver of Liability: All consumers should be required to sign a consent form to receive house tightening measures.

Weatherization: All types of homes should be weatherized. None should be categorically excluded. However, the homes should be broken down into four distinct categories. Each category would be treated somewhat differently for the purposes of indoor air quality

considerations. The four categories are:

1. Homes meeting the present program criteria. These homes should continue to receive all house tightening measures.
2. Homes with structurally related pollutants. These include homes with urea formaldehyde foam insulation, well water, slab on grade construction, a basement or an unvented crawl space, and mobile homes. These houses should receive house tightening measures, followed by monitoring, followed by mitigation by action if monitoring demonstrates that pollutants exceed some threshold amount.
3. Homes with consumer lifestyle-related sources. These include homes with wood stoves, portable kerosene space heaters, smokers, paints, and insecticides. Because these sources are totally under consumer's control, providing information to these consumers is the most effective means of controlling the indoor air quality in these homes.
4. Homes with permanently unvented combustion appliances. These homes should receive some form of ventilation for the combustion appliance.

Consumer Information. All consumers should be provided information regarding the possible effects of house

tightening measures on indoor air quality. Consumers should be provided with sufficient information so that they can make an informed decision whether to accept or reject house tightening measures. Information such as Bonneville's indoor air quality pamphlet with some revision would be appropriate.

Waiver of Liability: Requiring all consumers to sign a waiver of liability protecting BPA and utilities seems to be a prudent legal course. PPC utilities' judgment is that requiring such a waiver would not significantly reduce the number of consumers who would take advantage of the program.

Homes meeting the present program criteria: These homes should continue to receive all house tightening measures. Like all other consumers, the consumers in this class should be provided information regarding indoor air quality. These consumers may later add a wood stove or portable space heater, new furniture or carpeting or other lifestyle-related sources. Consumers should be apprised of the impacts of these sources even though they do not presently fall into one of the previously identified exclusion criteria.

Structurally related pollutant sources: Certain pollutant sources exist because of the construction of the home. These include homes with urea formaldehyde foam insulation, slab on grade construction, basements, unvented

crawl space, well water, and mobile homes. Fortunately, inexpensive monitors exist for the pollutants associated with these classes of homes, specifically, radon and formaldehyde.

Bonneville should offer house tightening measures to these classes of homes. After the house tightening is completed, the home should be monitored for the pollutant associated with the structural class of the home. If the monitoring indicates the existence of pollutants in excess of a level established by Bonneville, mitigation by action should be provided.

Homes with lifestyle-related sources: Certain pollutant sources exist because of consumer choices regarding lifestyle. These include homes with wood stoves, unvented portable kerosene heaters, smoking, paints, and insecticides. Because all of these sources are directly under the consumer's control, the PPC believes that the most effective means to control the sources is through consumer information. In addition, the presence of these sources is intermittent depending upon consumer use. The consumer should be informed of the proper means to control these sources during their use.

Pollutant emissions on a wood stove would depend substantially on the individual's use of the stove. The emissions will vary directly with the extent of the use of

the stove by the consumer. Pollutant emissions also depend upon how well the stove and its seals are maintained and how often the chimney is cleaned.

PPC believes that Bonneville's approach to wood stoves and indoor air quality should be consistent with Bonneville's assumption respecting heat loss methodology. The current BPA heat loss methodology assumes that homes with wood stoves will not be operated, and hence do not affect energy savings. A similar assumption would necessitate a conclusion that the wood stove will not be operating and contributing to a reduction in indoor air quality. If on the other hand, BPA assumes a level of wood stove operation which would cause a pollution problem then the reduced energy savings available in the home should be recognized in the heat loss methodology.

2

Permanently unvented combustion appliances: Although permanently unvented combustion appliances are clearly contributors to a reduction in indoor air quality, the occurrence of these sources in electrically heated homes throughout the region is rare. Ventilation should be provided for homes with permanently unvented combustion appliances. Ventilation need not be an air-to-air heat exchanger. A simple exhaust fan is less expensive and can be controlled to operate at the times the consumer operates the appliance.

Other Comments: Despite the numerous citations in the draft EIS, one citation which is not listed is a 1981 study done by Lawrence Berkeley Laboratory for BPA. That study indicates no significant problems with radon and suggests that proper use of ground vapor barriers could reduce radon problems. At the least, vapor barriers should be installed prior to radon testing in homes, as this appears to reduce potential radon problems. 3

The PPC recommendation treats mobile homes and apartments no differently than other classes of homes. Good public policy dictates that these dwellings should not be excluded because of their form of construction. In addition, BPA should immediately commence to develop a program for weatherizing these structures. In the case of mobile homes, cost-effectiveness and structural considerations may limit what can be done, but nevertheless these structures have been out of the residential weatherization program for too long.

Moving to other areas of comment, the draft EIS does not do a good job of discussing other types of mitigation besides air-to-air heat exchangers (AAHX). This is unfortunate because AAHX are relatively expensive and seem to be heavily affected by actions of the consumer. Clearly, BPA should increase the discussion of other possible mitigation actions, and increase the discussions of AAHX 4

operations and potential limitations.

Although BPA has done a good job of discussing many aspects of this issue, one area which seems to have been ignored is a general discussion of other sources of acquiring 75 megawatts and the cost and potential health effects of those alternatives. A thorough discussion of those topics is most likely beyond the scope of this EIS, but it would be very helpful to have an idea of the consequences of the main alternatives. 5

Other areas where the draft EIS could be improved as a document which would aid decisionmakers in the region is in the area of comparing some of the health effects. It is difficult for the typical reader to compare some of the health effects of the many alternative actions. While the effort to present somewhat summarized data, followed by more detailed appendices, is appreciated, the data could be rearranged in some cases to aid comparisons of various alternatives. 6

Further, the region typically now discusses costs of resources in mills per kilowatthour; it would be helpful if the costs of the various alternative actions could be expressed in those terms for comparison with other resources. 7

Also, the discussion of the health effects would be aided by a discussion of the impact of the different levels of air changes per hour. 8

NORTHWEST POWER PLANNING COUNCIL

SUITE 200 • 700 S.W. TAYLOR STREET
PORTLAND, OREGON 97205 • (503) 222-5161

Toll free number for Idaho, Montana & Washington: 1-800-222-3355
Toll free number for Oregon: 1-800-452-2324

November 14, 1983

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

The Northwest Power Planning Council has reviewed Bonneville's Draft Environmental Impact Statement (DEIS) on "The Expanded Residential Weatherization Program." The Council's comments adopted at its November 2-3 meeting are enclosed.

In summary, the Council believes that the DEIS should be revised to include:

1 1. More direct comparisons between the health risk associated with the substitution of thermal generation alternatives for conservation.

2 2. Expanded discussion of mitigation-by-action alternative.

3 3. Recognition of the uncertainties surrounding the absolute magnitude of the potential health risk resulting from "house tightening" measures.

4 Finally, the Council recommends that given apparent cost-effectivess of mitigation-by-action alternatives, Bonneville, weatherization program should be expanded to include financing for house tightening with mitigation-by-action.

Sincerely,

Edward Sheets

Edward Sheets
Executive Director

MF-114

DANIEL J. EVANS
Chairman
Washington
Charles Collins
Washington
Keith Colbo
Montana
Gerald Mueller
Montana

NORTHWEST POWER PLANNING COUNCIL

SUITE 200 • 700 S.W. TAYLOR STREET
PORTLAND, OREGON 97205 • (503) 222-5161

Toll free number for Idaho, Montana & Washington: 1-800-222-3355
Toll free number for Oregon: 1-800-452-2324

Robert (Bob) Saxvik
Vice-Chairman
Idaho
W. Larry Mills
Idaho
Alfred A. Hampson
Oregon
Roy Hemmingway
Oregon

COMMENTS
of the
NORTHWEST POWER PLANNING COUNCIL
on
BONNEVILLE POWER ADMINISTRATION'S
DRAFT ENVIRONMENTAL IMPACT STATEMENT ENTITLED
"THE EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM"
(AUGUST 1983)

COMMENT SUMMARY

The Northwest Power Planning Council's Plan for meeting the future electrical energy needs of the Region includes the most comprehensive and aggressive conservation program in the nation. Throughout the development of its plan, the Council carefully weighed the potential environmental consequences (both positive and negative) of alternative approaches to supplying the Region's need for electricity. In general, the Council concluded that the environmental impacts created by relying on the more efficient use of existing resources were significantly less than those created by the addition of new generating resources.

Nonetheless, the Council recognized that potentially adverse environmental effects could result from the use of some energy conservation measures. In these instances, the Council concluded that the most appropriate policy was to accept measures for which cost-effective mitigation strategies were available. Those measures which, despite mitigation, might

result in negative environmental impacts larger than generation alternatives were rejected.

Bonneville's efforts to understand and quantify indoor air pollution and its potential health effects are commendable, and should continue. However, a thorough understanding of the issue may take a long time. Moreover, there will probably never be consensus on how much health risk is tolerable. Until the subject is better understood, the Council believes that the most prudent policy may be house tightening with mitigation-by-action. BPA should evaluate this alternative more thoroughly. In particular, the cost-effectiveness and health effects of this alternative should be compared to the thermal generation option available to meet the region's electrical energy needs. There may be cheaper and/or more energy conserving ways to maintain indoor air quality than by installing air-to-air heat exchangers and the cost-effectiveness of these devices may be improved if location and control operations are thoroughly studied. The Region's ratepayers cannot afford to forego the development of the least expensive resource nor should its citizens be subjected to an increased health risk or other environmental degradation. The Council believes that if these mitigation-by-action strategies are as effective as they appear to be in minimizing health risk and are cost-effective to the Region, Bonneville should adopt and finance them as part of its weatherization program.

SPECIFIC COMMENTS

The data available on the potential long-term health effects of reducing the air leakage rates of residential structures is at best extremely limited. Consequently, direct comparisons between the public health and environmental effects of such measures and those created by conventional electric

power generation technologies such as coal and nuclear-fired power plants are clearly needed.

After reviewing Bonneville's Draft Environmental Impact Statement (DEIS) on its Expanded Residential Weatherization Program, the Northwest Power Planning Council concluded that the DEIS:

1. Fails to adequately address the cost-effectiveness of mitigation-by-action alternatives.
2. Fails to adequately describe the potential health and environmental impacts which will result from substituting thermal generation for conservation, including those produced by consumer responses to higher electric rates.
3. Fails to heed its own admonishments against using precise estimate (i.e., absolute value) of increased health risk for purposes other than making relative comparisons between alternatives.

These points are discussed below. Recommendations for addressing the DEIS's inadequacies are provided.

COST-EFFECTIVENESS OF MITIGATION

Bonneville does not adequately address the cost-effectiveness of mitigation-by-action alternatives. Due to the latency period for cancer, it will be many years before potential long-term health effects of chronic low-level indoor pollutant exposure are precisely understood. Moreover, our understanding of the health effects of indoor pollutants is presently confounded by extreme variation of individual sensitivity to certain household substances. In addition, indoor emissions vary widely on an individual house basis. Concentration levels tend to be more directly related to sources such as certain pieces of furniture, stove flue leaks, cigarette smoke, etc., than to the air leakage rate of a home. Therefore, the Council believes that given the uncertainty surrounding the potential health effects of "house tighten-

the uncertainty surrounding the potential health effects of "house tightening," actions must be taken to ensure that indoor air quality is maintained.

The mitigation-by-action alternatives proposed in the DEIS prescribe an air-to-air heat exchanger to maintain existing ventilation rates where potential indoor air quality problems might result from the installation of house tightening measures. The Council prefers this alternative where it can be shown to be cost-effective compared to thermal generation options.

Recommendation. Discussion of mitigation-by-action should be expanded to include a cost-effectiveness analysis and variations on the mitigation-by-action techniques discussed should be explored. Specifically:

1. Consideration should be given to the cost-effectiveness of house tightening measures installed in conjunction with mechanical ventilation with heat recovery. The FEIS should identify those situations where this strategy is cost-effective.

2. Consideration should be given to the cost-effectiveness of house tightening measures installed in conjunction with mechanical ventilation without heat recovery. In certain circumstances this strategy might be cost-effective when an air-to-air heat exchanger would not be. One example would be a home whose only apparent air quality offender is an occasionally-operated wood stove. Ventilation could be accomplished by a fan, without heat recovery, operated only during wood stove operation. The FEIS should identify situations where this strategy is cost-effective.

3. Consideration should be given to the cost-effectiveness of devices which remove air contaminants without ventilation. These could include paper and fabric filtration devices, charcoal filter devices, electrostatic precipitaters, and dehumidifiers. The FEIS should identify situations where this strategy is cost-effective.

ALTERNATIVE CONTROL STRATEGIES

Bonneville does not adequately address the cost-effectiveness of alternative control strategies that may be used in conjunction with mitigation-by-action. Even within a single house, there are extreme variations in air quality. Although infiltration is nominally expressed as a constant rate,

houses do not leak at a constant rate. They may leak excessively when someone leaves a window open, when children are running in and out, and during windy weather. The same houses may become quite stagnant when none of the above conditions occur.

Air leakage rate is not the only factor affecting indoor air quality which varies over time. Emission rates can be extremely time-variable as well as location-variable. For example, benzo(a)pyrene (BaP) can be emitted in large quantities when a wood stove is stoked or a cigarette smoker lights up. Humidity and aerosols may become highly concentrated in confined locations when someone uses the shower or aerosol spray products in the bathroom during cooking and dishwashing activities in the kitchen.

Most devices for controlling air quality have a substantial operating cost. It follows logically that effectiveness and economic viability of air cleaning or mechanical ventilation with or without heat recovery is highly dependent upon location and operating schedule.

The DEIS assumes that when a heat exchanger is used for air quality mitigation, the original air exchange rate is maintained. However, it may be possible to reduce a home's air exchange rate yet maintain or improve original air quality by better control and strategically locating air quality maintenance devices.

Prudent location can accomplish spot removal of emissions from known emitters with greatly reduced flow volumes. Conversely, prudent location can ensure thorough flushing of dispersed contaminants. New or existing bathroom and kitchen exhaust fans are well located for removal of many pollutants concentrated near their source. Outside makeup air can be admitted into existing furnace ducting or at a through-the-wall location remote from exhaust locations. It may be prudent to admit outdoor air near free-

standing wood stoves or through unheated interior spaces (if volatile or toxic household chemical products are not stored there). Excessive ventilation through outside makeup air inlets during windy weather can be minimized by one-way dampers.

Recommendation. The FEIS should direct much more attention to location of mechanical ventilation/filtration devices and the scheduling and control of these devices' operation. The FEIS should identify when specific control strategies are cost-effective. These strategies should include at least the following: dehumidifiers, time clocks, outdoor anemometers, thermal sensors near showers, stove flues, or range hoods, special detectors which switch on when certain known critical contaminants exceed acceptable levels, etc., and certain combinations of the above. In addition, increased air circulation to disperse potential pollutants should be studied and discussed in the FEIS treatment of mitigation.

ALTERNATIVE MITIGATION-BY-ACTION STRATEGIES

5 **Bonneville does not adequately address alternative technologies for mitigating potential indoor air quality problems.** It may be advantageous to exhaust stale house air through a utility space containing a heat pump water heater. This could allow some heat recovery from the stale air before it exits the house. Heat pump water heaters which allow direct exhausting of house air, through their evaporator coils, are available in Sweden.

Recommendation. The FEIS should explore the cost of adapting domestic heat pump water heaters for this operating mode. This would likely require better aerosol filtration and lower water flow rates and/or higher temperature differential for operation. Also a larger than usual tank size might be required to ensure adequate thermal storage to accommodate the

time mismatch between ventilation needs and hot water needs. This strategy may be more cost-effective than an air-to-air heat exchanger in some applications because recovery of waste heat can occur year-round.

HEALTH IMPACTS OF THE NO-ACTION ALTERNATIVE

6 **Bonneville does not adequately describe the health and other environmental impacts of its no-action alternative, particularly related to the substitution of thermal generation for conservation.** The Air Quality section states that 74.4 annual megawatts of additional electric energy would be needed without the proposed action. The additional emissions from coal or nuclear generation of this energy are given in Table 2.4. However the impact of these emissions on ambient air quality are not discussed. Nor does the DEIS discuss the health impacts associated with the thermal generation alternatives, such as coal and uranium miner deaths and acid rain.

Moreover, as BPA acknowledges, some consumers will install "house tightening" measures on their own in response to the higher electric rates caused by the substitution of higher cost thermal resources for conservation. The DEIS does not quantify these impacts. Indeed, it appears that it has been assumed for purposes of estimating the "no action" alternatives public health impacts, that no additional consumers will install house tightening measures in response to higher rates.

In addition to producing a systematic overestimate of the incremental health impacts, the adoption of BPA's "no-action" alternative results in an undesirable public health policy. Under the no-action alternative, some consumers will undertake "house tightening" measures themselves. In some cases, these measures could exacerbate indoor air pollution resulting in potential increased health risk. However, if the no-action alternative were

adopted, BPA could neither readily identify which consumers might be at risk nor intervene with acceptable mitigation measures. Thus, the Region may incur both the health and environmental pollution created by substituting thermal resources for conservation and the potential health effects of indoor air quality deterioration.

The Land Use section discusses the additional acreage committed to generate 74.4 megawatts in the absence of the proposed action. This impact, along with the increased emissions information of Table 2.4, are the only apparent reference to impacts from the 74.4 megawatts of additional generation.

Fish and Wildlife, Socioeconomic and Institutional Effects, Water Quality, and Health Effects sections do not appear to consider any impact from the additional 74.4 megawatts of thermal generation.

The DEIS fails to provide an adequate discussion of the health and other environmental impacts associated with the no-action alternative. Without such information, no reasonable judgment regarding the relative significance of the proposed action versus continuation of the status quo is possible.

Recommendation. These sections should discuss health impacts of the 74.4 megawatt thermal generation and compare them to the proposed action.

UNCERTAINTY OF HEALTH IMPACT ESTIMATES

The DEIS cautions the reader (page viii) against relying on the precise number given for increased health risk resulting from house tightening due to the immature nature of the estimating procedure and data used. A similar caveat is given on page 2.10. Unfortunately, the DEIS does not heed its own admonishment. Two instances of this failure are of particular concern.

The DEIS states that under the proposed action the "estimated health effects increase the regional lifetime risk of developing lung cancer from 4.0036 percent . . . to 4.0235 percent. This .0114 percent increase in the risk of contracting cancer implies a level of precision that is well-beyond that merited by the available data on typical pollutant concentration levels or dose-reponse relationships at lower than observed exposure levels. Moreover, since this "difference" assumes that all pollutant sources are present in all houses that are tightened it represents a "worst case" estimate of increased risk.

Recommendation. The FEIS should characterize its conclusions and data at a level of precision which appropriately reflects the uncertainty in the impact data and method of estimation.

In Chapters 3 and 4 the DEIS compares the indoor pollutant guidelines/standards promulgated by several entitites (e.g., EPA, OHSA, ASHRAE, states, etc.) to the "typical" concentrations that might occur is residential buildings. Unfortunately, the reader is not reminded that these "typical" concentrations assume that all sources of indoor pollutants are present in a "typical" house. The standards/guidelines referenced in the DEIS set absolute exposure levels. It is widely recognized that there is considerable uncertainty surrounding both "typical" pollutant concentration levels and dose-response relationships comparing these standards to the level of increased exposure anticipated when house tightening measures are installed in "worst case" buildings is of limited value. For example, estimated "typical" pollutant concentrations could vary by a factor of four or five. Given this wide variance, one cannot reasonably assert that "typical" concentration levels are or are not, above or below some established standard.

Recommendation. The FEIS should limit comparisons between absolute exposure levels estimated for regulatory/advisory purposes and "typical" exposure levels developed for the expressed purpose of making relative comparisons.

COMMENTS ON THE DRAFT EIS (DOE/EIS - 0095), THE EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM.

Chris Attneave, 85328 Willamette, Eugene, OR 97405 November 1983

1 The purpose of an environmental impact statement is to bring to public attention some problem that may come to exist as a result of a contemplated federal action and to compare the projected consequences with those to be expected from not taking the action or from taking some alternative course(s) of action.

Bonneville is to be commended for dealing with the problem of indoor air quality but it would be a great shame if the findings of this EIS were used to justify witholding house tightening measures from 70-80% of the region's electric heat customers. Concern that one aspect of a BPA program might in some degree contribute to health problems in a very few of the more than 3,000,000 customers affected must be tempered with some sense of proportion.

The measures being withheld are ones which are encouraged or made available to some of these households by other government programs. They are also measures with the customer can implement for himself if resources are available. Building codes and good building practices beyond the requirements of local codes make these a feature of many new houses which would not have been eligible under the BPA program had they been older houses which are more in need of energy saving measures.

2 To the extent that house tightening has been offered to many Northwest houses which did not run afoul of the present criteria, the potential exists that the residents may in one way or another take actions such as buying a wood stove, remodelling to include an area on a slab, buying a kerosene heater, having foam insulation put into walls, switching to a gas range, closing off the vents in the crawl space, and so on. It is conceivable that a family or succession of families might do all those things and have four or five smokers besides.

3 The argument has been made that these things are voluntary actions which are not the responsibility of BPA but are things that the homeowner chose to do yet they are not actions which are against the law or ones which would be implemented only after the homeowner were fully warned about the possible consequences of taking such actions in a house that had been tightened. One can make a better case for the proposition that the Proposed Action (offering tightening measures to all houses) accompanied by education about possible air quality problems and mitigation measures that might be taken would truly offer the homeowner an informed choice.

The problem of lack of choice on the part of succeeding owners or renters is raised as a difficulty with letting a present resident make an informed choice which might later be foisted upon unsuspecting future occupants. It has been suggested that the energy consumption history of a housing unit is an important bit of information that utilities might be required to make available to renters or buyers. Perhaps BPA could require that utilities provide on a routine basis a weatherization "history" including information about any possible air quality problems. This would apply, of course, only to those measures implemented by utilities which participate in Bonneville sponsored weatherization programs. The history which the utility would keep on file would address possible pollution sources identified at the time of the weatherization so the prospective new resident could judge for himself whether these conditions still existed and how important they would be to him.

4

The "history" could not reflect later actions of the previous resident(s) but could be accompanied by an informative pamphlet telling the new resident what to look for. In addition, the utility might be required to make available, at cost, formaldehyde (and maybe also radon) monitoring devices for those new residents who wanted a reading of the actual situation.

This approach is suggested not only out of a concern for achieving all cost-effective conservation in the most efficient and orderly fashion, but in the belief that other factors such as smoking, occupational and hobby exposure, introduction of substances such as insecticides and cleaning products into the house, etc. are likely to be far more important in causing respiratory and lung cancer problems than the effects of house tightening would ever be, at least in respect to those items now leading to exclusion from the program.

Ultimately, indoor air quality has to be the responsibility of the individual who will make the decision to clean, or not to clean, the filters in a forced air system, or to start off the day in a cloud of hair spray and/or cigarette smoke. Bonneville has made a genuine contribution by calling attention to the problem and by helping to educate the public to the risks and some of the possible solutions. (On this subject, the issue backgrounder is very well written but goes much too far in stressing risks and not far enough in exploring possible solutions and in pointing out other air air quality concerns such as moisture and other contributors to poor air quality. I would urge that this paper be rewritten before it is distributed more widely.)

There is another reason why it is appropriate to leave the decision on house tightening to the individual. To the extent that house tightening may have undesirable effects, these fall almost entirely on the individuals receiving the benefit of a more comfortable house and lower electric bills. By contrast, the effects of added generation in the form of a coal plant, for instance, are felt by an entirely different set of individuals.

5

It seems to me that the EIS is deficient in fully describing the benefits of the proposed action. On page xiii, it is suggested that saving 74.4 average MW at 4¢ per kilowatt hour would represent a saving of $26,000,000 per year, but 4¢ a kilowatt hour surely underestimates the cost per kilowatt hour in coming years and perhaps even next year. Not only will consumers save much more than that, they will have houses that are more valuable and very much more comfortable.

6

With respect to the costs cited for different possible programs, it is not clear what portion of that cost would be paid by the homeowner and what part by BPA (and the homeowner through bills). Comparison of the costs with costs of replacement power by coal or nuclear should take into account the uncertainty involved with the operating costs of these which could go up substantially over time while the program costs for conservation are a known one time thing and the measures once in place are not likely to break down completely or go on strike or otherwise confront the region with unexpected sudden shortages or price hikes.

Reference is made to the fact that storm windows and house tightening are popular measures. I think the reason is not hard to find. At a given air temperature, the flow of air from drafts and/or the effect of window areas radiating heat away will be a big factor in how comfortable a person will be. With these two things taken care of, the occupants of a house may well settle for a lower thermostat setting so that the energy saving goes beyond just the calculation of what is not lost from the house but reflects instead the amount of energy required to make the occupants comfortable inside. I believe on the basis of a conversation with Walt Pollock several years ago that there may even be some evidence on the magnitude of this effect.

7

(As a sometime sufferer from arthritis type pain in my wrist, the benefit of not being in a draft or next to a single pane window is particularly obvious to me. In research on stress related diseases which are increasingly recognized as being a significant source of health problems, cold is often used as a powerful stressor. Making it possible for people to be really comfortable in their homes should not be overlooked as a positive contribution to good health.)

To the extent that reduction of air infiltration helps to reduce the stirring up of air and dust within the house, the occupants will be less apt to breathe particulates which would otherwise settle out and be removed during house cleaning. (The EIS suggests that this might be particularly important in cases where radon is present and radon daughters become attached to particulates which then lodge in the lungs.)

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Anything that tends to encourage a flow of air across windows (forced air systems, small heaters with fans, baseboard heaters below the window, etc.) will cost more in heat loss than would be the case if the air were more nearly still. Drafts within the house can obviously have the same effect.

It appears that the basic data upon which the calculations in the EIS are performed falls far short of the desirable level. This impression may be due in part to the way in which the information is presented and discussed, but at least in some cases I think there are clearly not the kind of studies on which firm conclusions can be based.

On the matter of radon, for instance, it is not clear that radon levels inside houses are at all well understood as to source, distribution within a house, relation to number of air changes, and relation to lung cancer. Granting that dealing with very small effects makes for great difficulty, it would seem that more certainty would be required before concluding that this so clearly a serious problem that 627,150 houses should be excluded from tightening measures. (This is the sum of those lacking a vented crawl space and 15% of the remainder who might be presumed to have well water.)

8

Assuming that the calculations of health effects of radon are correct (and I would question whether it is logical to assume that most (?) lung cancers in non-smokers can be attributed to radon background levels) (see F.10), do we have any evidence that radon levels within the house would be greatly increased by house tightening? A very simple experiment could be made by measuring radon levels in residences before and after tightening for a relatively small administrative cost plus the cost of two radon monitors and results could be available within 6-8 months. In fact, this makes a great deal more sense to me than plunging right into the proposed mitigation by providing heat exchangers for those residences above a certain level when it is not even clear that these would accomplish the objective.

I would propose that a utility within the mineralized area and another outside that area be selected for such a program to be implemented in connection with the ongoing BPA program for those customers who are willing to volunteer their homes as sites for the experiment. Note that they would be volunarily assuming a risk that they might bring on themselves if they implemented these weatherization measures outside the BPA program. Specifically, I would urge you to consider Lane Electric Coop in the Eugene area as a possible utility to work with in the nonmineralized area. Acceptance of the conservation program has been enthusiastic but there is great disappointment in the restrictions which preclude all the rural customers who are on well water (maybe 75%) and some of the others from receiving the full benefit of BPA weatherization because of concern for radon which is quite unlikely to be a serious problem in our area.

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As you can see from the enclosed map, Lane Electric serves the largest area in Lane County with a service area stretching from the valley area around Fern Ridge Lake up to the mountains (about 90 miles) and reaching about 50 miles north and south. The variety of areas covered should make up for any local effects that might obtain in a smaller area and the program could be easily coordinated from the office in Eugene.

I am not able to make detailed comments on the calculations of various pollutants as presented in the EIS, but I would like to make some general observations using the radon calculations as an example.

The task of the reader is made extremely difficult by the discussion in rotation of each pollutant under each topic. Taking one topic (radon, formaldehyde, etc.) and sticking with it would have made it much easier to follow. Every attempt should be to stick with the same units. The reader is invited to compare a standard of 3 pCi/liter with the Canadian unit of, for instance, amounts greater than 0.15 WL v. Swedish standards for "Maximum-exiting buildings" (is this a typo, and "existing" is intended) which is said to be 200 Bg/m^3 or (0.027 WL)[(c)]. If this is not crystal clear the reader might turn to the glossary where "working level" is defined as "A quantity of short-lived radon daughters that will result in 130 thousand million electron volts (MeV) of potential alpha .. particle activity per liter of air.." and the reader is referred in turn to the definitions of MeV and radon daughters which are no help. (It is possible that in this case the footnote (c) which was omitted would have explained everything. I know that working level was defined in more helpful terms somewhere in the document, but have not been able to locate it.)

9

(It may be that footnote (c) referred the reader to pp 3.7 & 3.9 where there is some discussion of working levels in terms of pCi/liter but the discussion there is not as precise or clear as one could wish given the elaborate calculations on these numbers found in other parts of the EIS.)

The approach taken in the Sample Computation on A.12 begins to take a more reasonable approach in giving alternative values in meters and feet, and gallons and liters, so that the reader is not forced to turn to the calculator to relate the water usage in the example to the table on A.14 which is entirely in terms of gallons. The convention of using * to indicate multiplication may baffle some readers, especially when it occurs in the same line with x to indicate the same thing.

10

Assuming the reader survives to page A.14, he is promptly plunged into a whole new set of of equations involving Ci (which has no relation to pCi), W which stands for wall emission rate and has nothing to do with water, and so on. Surely other letters of the alphabet could have been found for the section on formaldehyde.

An even more fundamental problem arises from the difficulty in assessing the basic data on which tables such as A.10 are based. Did Bruno's work deal specifically with the Northwest? How many cases in our area were studied and does the range represent some confidence interval or merely the range of observed cases? Hollowell's
11 data on Concrete is said to apply to "both regions" but, again, is this NW data and is it reasonable to expect that concrete made with local rock would be identical in the two areas? Is it reasonable that EPA rates for well water in the nonmineralized area would be a third of that in the mineralized regions when soil emanations differ by a factor of 10?

Taking all this at face value and using the maximum values in the computation, we find that the family of four in the small house in the example we see that the air infiltration rate could be reduced to .276 ACH before reaching the cutoff point of 3 pCi/liter. According to Table A2 the likely value for ACH after all tightening measures is .656 and the value of .276 falls well below the suggested range of .410 to 1.230 for such residences. There would seem to be no reason whatever for BPA not to have tightened such a house.

(The suggestion in the middle of page 4.37 that all residences with well water except those with ventilated crawl spaces would be assumed to exceed the 3 pCi/liter standard is somewhat puzzling in light of this.)

Perhaps this an appropriate point to mention a failing of the document that it fails entirely to consider some low tech fixes for some of the possible problems that are raised. Are there houses with crawl spaces
12 that couldn't be vented? Oregon law requires that wells be vented and those that are not could surely be vented for less than the cost of an air to air heat exchanger. Persons with unvented kerosene heaters might find that getting rid of them would be well worth it if it helped them to qualify for the BPA program. (After all, these are presumably electrically heated homes.) Air filtering and introduction of outside air to stoves would seem to answer some of the problems associated with wood burning at a lesser cost and perhaps greater efficiency than air to air heat exchangers.

Just as it seems that data for the Northwest with respect to radon is quite lacking (a study in Butte for the Montana legislature will hardly tell us all we'd like to know), the heavy reliance on one study in the Mid-South for data on wood stove emissions seems very questionable.
13 Some discussion of each item in the bibliography would give the reader a better idea of where the study was made, what the sample size was, how readings were obtained, and so on. Of course, the conscientious reader might obtain each of the works referred to and dig this out for himself but few would have the time to do that and meet the deadline for comments.

In the case of the Northwest, there are many stoves of a newer type, the fuel would likely be different, and there are some of the older and very efficent central sawdust furnaces which are very well vented, although they are used less and less as sawdust has become difficult to obtain.

The EIS would be much easier to read and understand if the data had been presented in a more straightforward manner. On page ix, for instance, the lifetime risk of a person developing lung cancer (the national average) is given as 4%, and it is said that about 7% of this may be caused by indoor air pollution (from sources other than any caused by smoking indoors?) and that the present program may raise the average (presumably only in the region) lifetime risk to 4.0036%.

14 Assuming we are only talking about the region, does this refer to a risk for those who are having their houses weatherized (completely? partially or completely?) being raised to 4.0036%, or is this figure across the whole region including oil heat customers and all the others who are not even eligible for BPA programs?

If this seems like a strange question, consider that the original 4% includes everyone whether or not they smoke.

This kind of difficulty is compounded by the unfortunate choice of the word "typical" to describe a worst-case residence and the confusion
15 in all that follows as to which values are derived from a worst-case analysis and which estimates of health effects are tempered by likely values or average values which are used in some places.

The reader can try to work out an example, but in most cases this is extremely difficult (perhaps even impossible from the directions (not) given except by a process of trial and error) to see how a value in one of the tables had been reached. The sample radon calculation is very helpful and more of that should have been done.

Working through this example with an average house of 340 m^3 instead of the smaller house used gives slightly higher values (.8 v .76pCi/liter and 1.002 v .99 after tightening). I did not try to adjust downward from the 4 persons in the example for the 3.49 in each household across the region. This would lower water use and radon levels.

Having done this, one might expect to find agreement with concentrations for radon in the No Action/Proposed Action Table 4.18 for a house of this type. Including the background .25 pCi/liter, the totals from the example become 1.05 and 1.252 instead of the 1.2 and 1.4pCi/liter given in the table for this type of house before and after tightening.

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Thus it would appear that effects estimated for the proposed action do indeed take the conservative approach of the worst-case basis, but when these are compared to the present situation or the no action case are we making equally conservative (worst case) assumptions about air quality in homes that are weatherized today and in ones that are not. It is not clear, for instance, that the same saturation level should be used since it is suggested that people are more eager for weatherization services when the full treatment is included. (Not knowing the saturation level is another big - 15% - uncertainty.)

The "assumptions" on 4.2 and 4.4 are not that much help because it is hard to know when they come into play. The source terms and use rates are said to be for the heating season. What does this mean? In the discussion of cancer from BaP which would occur under the Proposed Action and in the elimination of woodstoves condition, it appears that the cigarette induced cancers in nonwoodstove homes (2) plus those in the woodstove homes attributable to smoking (.87) are added to those from effects of the stoves to make up the 4.5 expected cancers (4-5) under the Proposed Action. It also appears that the number of cancers attributed to woodstoves is the result of operating those stoves for 8 hours a day year round. (This can't mean operating during the 6 month heating season in such a way as to yield a year round average of 8 hrs/day because one could not do this so as to get an average of 16 hrs/day and that is given as a possible high value.)

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On the other hand, it does not appear that the cigarette source term was not artificially manipulated to apply only to the heating season - although I can think of a reason why that might be done. A very real flaw in the EIS is any consideration of the effect of windows being opened at some times of the year. Much of the Northwest does not have an air conditioning load and summer temperature control depends in large part on opening windows. Assuming that the overestimation of time of woodstove use were corrected, this factor should still affect some of the other pollutants such as radon and formaldehyde.

The assumption that the proposed action would have no effect on the amount of wood being burned is nonsensical. Tightening of houses like any other weatherization measure would have the effect of shortening the heating season for that house as well as reducing the amount of heat required for that house during the heating season. (Potentially the saving could be as much as an amount of wood equivalent to 26.1 av MW which is a great deal of wood!) In many parts of the region, wood is not all that cheap and is not likely to become any more so. I think it is certain that there would be some reduction in wood use and a corresponding improvement in air quality.

17

The assumption that additional generation would be from coal or nuclear plants may not be appropriate. Are these the proper type of generation (base load) to replace what is not achieved through conservation?

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18

The whole treatment of apartments is curious. What have you got against apartment dwellers? Since when are apartments all on the ground floor and how many have wood stoves and kerosene heaters when they are also basically electrically heated? Sure it would save money and cut down on the health hazards not to do anything for them but the analysis of apartments has got to be the least credible of any in the EIS.

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Figure 4.2 which compares air exchange rates over time is dropped into the document with no explanation of what time scale is intended and a mysterious (second) paragraph at the top of p. 4.5 that suggests that the assumption that air infiltration rates will increase over time and eventually rise to pre-tightening rates has been used in the EIS. I see no evidence of any such assumption being used anywhere in rates of infiltration expected to result from the program.

20

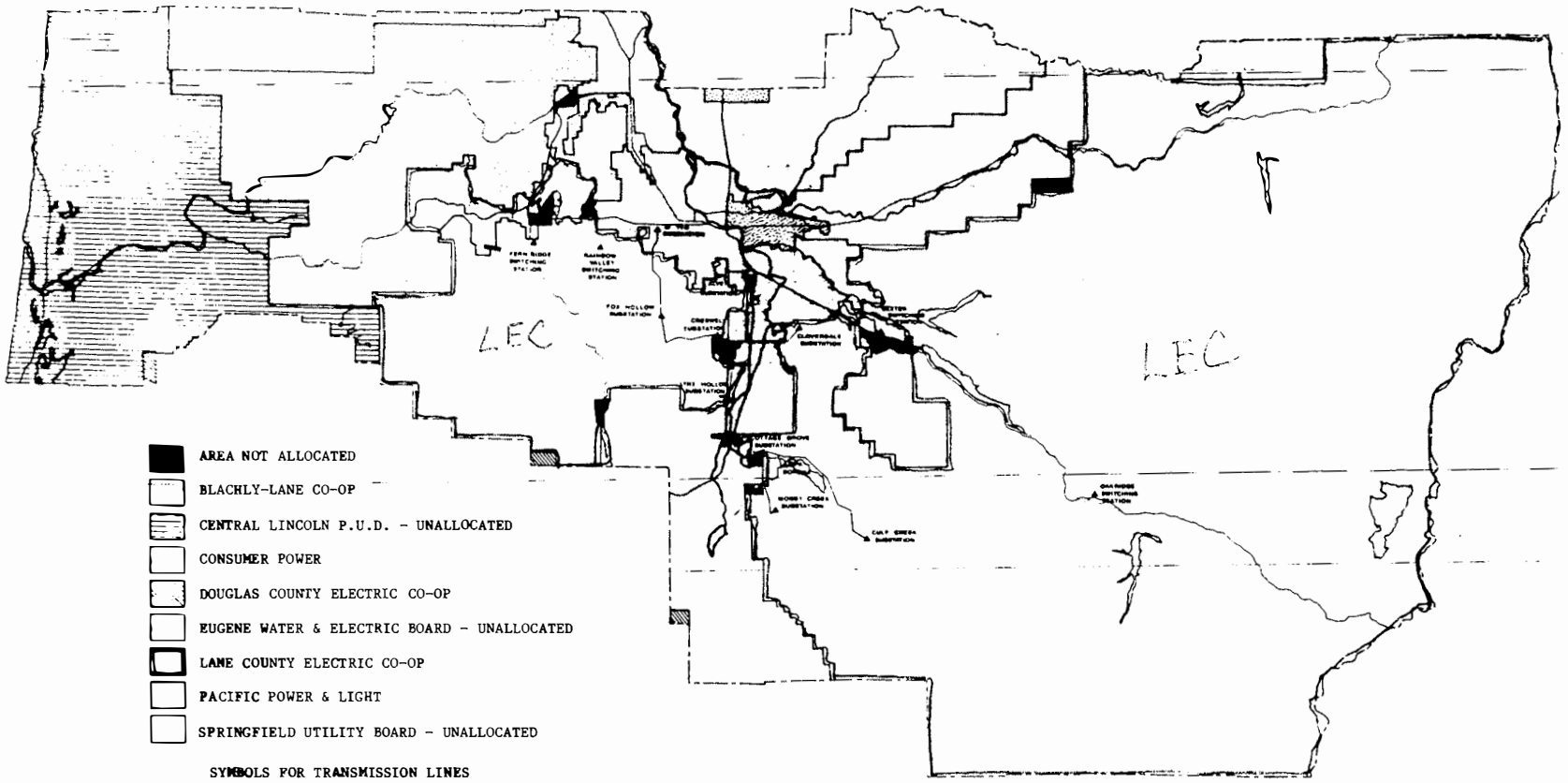
On p. 4.4 the volume for single family detached is given as 340 m^3 but A.8 (Table A.3) gives this as 350 m^3. An important assumption that should have been mentioned here is the 75% occupancy figure. Certainly this would not be appropriate for school children or people who work and shop. With the majority of households tending to have at least two persons employed, it is difficult to see how enough people would be left in the categories that might stay home quite a bit (retired or children in the summer or housewives who hardly ever left the house) to even approach such a figure.

Time simply does not permit further comments. Be clearer in the next draft of the EIS and adopt the Proposed Action.

Chris Attreave

85328 Willamette
Eugene, Oregon 97405

ELECTRICAL UTILITIES



FORMALDEHYDE INSTITUTE
1075 CENTRAL PARK AVENUE, SCARSDALE, N.Y. 10583 (914) 725-1492

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November 10, 1983

Mr. Peter T. Johnson
Administrator
Bonneville Power Administration
Department of Energy
P.O. Box 3621
Portland, OR 97208

Re: Draft Environmental Impact Statement,
Expanded Residential Weatherization Program

Dear Mr. Johnson:

The Formaldehyde Institute, Inc. (the Institute),[1/] appreciates this opportunity to comment on the draft environmental impact statement (EIS) accompanying proposed

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1/ The Formaldehyde Institute, Inc., is a not-for-profit trade association with over 65 member companies and associations, representing all phases of the formaldehyde industry. Members include manufacturers and distributors of formaldehyde; manufacturers and distributors of resins and adhesives containing formaldehyde; and industrial users who manufacture and distribute a wide variety of products containing formaldehyde. The objectives of the Institute are to provide manufacturers and industrial users of formaldehyde and formaldehyde-containing products with technical and scientific information relating to the potential health effects of formaldehyde, to develop protocols and sponsor appropriate health effects testing of formaldehyde and formaldehyde-containing products, to cooperate with federal and state agencies in the development of standards and regulations related to formaldehyde and formaldehyde-containing products, to provide the industry with a mechanism for communicating with such government agencies, and generally to take such action as may be proper to encourage the continued safe use and manufacture of formaldehyde as a major organic chemical in the United States.

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revisions in the Bonneville Power Administration (BPA) Weatherization Program and the "Issue Backgrounder" booklet, "Health Impacts of Home Weatherization."

The Institute agrees with BPA that indoor air pollution in excessively tightened homes is an important health issue. However, the Institute believes that the draft EIS and the "Issue Backgrounder" booklet grossly exaggerate the risk of cancer from formaldehyde. The draft EIS claims that four people will develop cancer each year in the Northwest region from existing levels of formaldehyde (as a baseline condition) and that one additional cancer would develop every four years from elevated levels of formaldehyde if additional homes are included in the weatherization program.

The Institute has not been able to review in depth all details of the procedures used by BPA to derive its estimates of the health effects of indoor air pollutants. These comments focus on two questions, the validity of BPA's 1 predictions of cancer risk from formaldehyde exposure, and the accuracy of BPA's calculation of formaldehyde exposure levels. For the reasons set out below, the Institute believes that the predictions of cancer risk from formaldehyde exposure are based on use of overstated exposure levels and a discredited quantitative risk assessment whose assumptions are not supported by scientific evidence. As this comment demonstrates, and as borne out by the recent NCTR Consensus Workshop, there is

no evidence of cancer risk to man at prevailing (or past, higher) levels of exposure. The Institute urges BPA to correct exaggerated predictions of cancer risk that can only alarm homeowners and needlessly depress real estate values -- adverse consumer impacts which are unwarranted by the scientific evidence.[2/]

Summary

For generations, formaldehyde has been used in the workplace -- at much higher levels than currently prevail in residences (or in the workplace) -- without any demonstration of elevated cancer risk in exposed workers. Contrary to the suggestion in the "Issue Backgrounder" booklet that there is evidence that formaldehyde causes nasal cancer in man, epidemiologic studies covering thousands of workers have shown neither any elevation in nasal or upper respiratory cancers nor any statistically significant elevation in other cancers that may fairly be attributed to formaldehyde.[3/]

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2/ Formaldehyde is produced commercially at the rate of seven billion pounds a year in the United States. Formaldehyde in its various applications appears in products aggregating 8% of the gross national product. Formaldehyde resins are used in the production of a wide variety of products, including plywood, particleboard, and permanent press fabrics. (Urea-formaldehyde foam insulation has always been a very minor use.) Members of the Institute as manufacturers and users of formaldehyde and products containing formaldehyde are concerned to assure the accuracy of claims about the health effects of formaldehyde and to avoid unsubstantiated claims of cancer risk.

3/ See attached exhibit book for cited studies and further information on formaldehyde.

In tests conducted by the Chemical Industry Institute of Toxicology (CIIT), a statistically significant number of rats contracted cancer only at 14.3 ppm, levels much higher than humans are exposed to or could tolerate for a few minutes. Lacking any evidence that the formaldehyde levels found in homes cause cancer in animals, let alone humans, the draft EIS relies on a mathematical model to extrapolate a risk of cancer to humans from the CIIT rat data. It is incorrect simply to extrapolate from high dose animal tests in a single species to predict human risk at lower doses, in light of the long favorable human experience with formaldehyde. Such extrapolation ignores evidence of inter-species differences between man and the rat; evidence of a threshold or "no effect" level; and evidence that the mechanism by which formaldehyde causes cancer in rats at high doses is such that it does not cause cancer at low doses. Moreover, although the mathematical model indicated that the most likely estimate of risk was essentially zero, the draft EIS improperly adopts the 95% upper confidence limit as its prediction of risk.

The theory that the CIIT formaldehyde tests indicate unreasonable cancer risk to man has been specifically rejected by the Fifth Circuit in Gulf South Insulation v. CPSC, 701 F.2d 1137 (5th Cir. 1983), Ex. 4. The Gulf South court set aside the Consumer Product Safety Commission's ban of urea-formaldehyde foam insulation (UFFI). CPSC had relied

primarily on a mathematical extrapolation of risk to humans from the CIIT rat data, which predicted a risk of cancer of 51 in a million based on levels of formaldehyde which CPSC claimed prevailed in UFFI residences.[4/] In an unanimous decision, the court held that CPSC's "finding that UFFI poses an unreasonable risk of cancer is not supported by substantial evidence on the record as a whole." 701 F.2d at 1147.

The court stated that the current epidemiologic studies of formaldehyde workers show no statistically significant excess of cancer and criticized as "unsupportable" CPSC's "exclusive reliance" on the CIIT rat test in its quantitative risk assessment to the exclusion of other data. Although the court did not need to address the assumptions of CPSC's risk assessment in detail in view of its conclusion that CPSC's data base was inadequate and that its sole reliance on the CIIT rat test was a fatal flaw, the court observed that "substantial questions" were raised as to the key assumptions incorporated in CPSC's quantitative risk assessment model, and that such models are no better than the data and assumptions on which they are based. The prediction of cancer risk in the draft EIS is based upon the same discredited quantitative risk assessment.

4/ CPSC contended that exposures in UFFI homes were 0.2-0.3 ppm after installation and that levels at the end of a nine-year period averaged 0.08 ppm. See 47 Fed. Reg. at 14377.

The draft EIS also relies on a highly theoretical calculation based upon laboratory data, rather than available home measurement data, to obtain a prediction of formaldehyde exposure levels. BPA's calculation ignores the effects of absorption and other mechanisms which operate to reduce formaldehyde levels in residences. For example, the draft EIS concludes that formaldehyde levels in UFFI homes are 0.2-0.3 ppm, while controlled studies based on actual home measurements show formaldehyde levels in UFFI homes of 0.04-0.06 ppm.

I. Evidence of Potential Carcinogenicity

Question as to the potential carcinogenicity of formaldehyde arises primarily from tests by the CIIT which showed a 44 percent incidence of nasal tumors in rats at 14.3 ppm, 0.9 percent incidence (not statistically significant) at 5.6 ppm, and zero incidence at 2.0 ppm. The rats were exposed for six hours a day, five days a week, for up to two years (virtually the lifetime of the rats). In mice similarly exposed, CIIT found a 0.9 percent incidence (not statistically significant) at 14.3 ppm, and a zero incidence at 5.6 ppm and 2.0 ppm.[5/] A New York University study also showed nasal carcinomas in rats exposed to 14.6 ppm.[6/]

5/ Battelle Memorial Institute, Final Report on a Chronic Inhalation Toxicology Study in Rats and Mice Exposed to Formaldehyde to Chemical Industry Institute of Toxicology, revised Dec. 31, 1981, Ex. 5.

6/ Albert, et al., "Gaseous Formaldehyde and Hydrogen Chloride Induction of Nasal Cancer in the Rat," 68 J. Nat'l Cancer Inst. 597 (1982), Ex. 7.

The human epidemiologic experience with formaldehyde, including the most recent scientific evidence reviewed in October 1983 at the NCTR Consensus Workshop, is reassuring that exposure to formaldehyde does not present a significant risk of cancer to humans and suggests reasons why it is wrong to extrapolate from high-dose rat tests to predict human risk at far lower exposure levels.

A. The Human Epidemiologic Experience

The only type of cancer observed in rats in the CIIT study was nasal cancer. Based on this result, it is highly likely that if formaldehyde were to pose a cancer risk to man, it would be a risk of nasal cancer rather than any other type of cancer, for two reasons. First, for known carcinogens, cancer in humans generally occurs at the same site where it is observed in the experimental animals; if formaldehyde were a human carcinogen, then, nasal cancer would be the expected effect. More importantly, formaldehyde is rapidly metabolized. It is highly unlikely that it would travel to points in the body beyond the site of contact.[7/] Given the likelihood that nasal cancer would be the observed effect if formaldehyde were carcinogenic, it is reassuring to note that nasal cancer is extremely rare, despite the ubiquity of formaldehyde

7/ Swenberg, et al., "Non-Linear Biological Responses to Formaldehyde and Their Implications for Carcinogenic Risk Assessment," Carcinogenesis (June 14, 1983), Ex. 23.

exposure in daily life. The rarity of nasal cancer in the United States generally suggests that individuals exposed to formaldehyde must not be experiencing significant cancer risk. See Affidavit of Dr. Robert A. Squire, Ex. 17, ¶ 37.

Epidemiologic studies are an effective way to evaluate the potential adverse health effects of formaldehyde and correct for errors in simply extrapolating animal results to man. No epidemiologic study has attributed any nasal or other cancer to formaldehyde, even though for decades workers have been exposed to formaldehyde levels many times higher than levels in homes. See Affidavit of Dr. Walter C. Barnes, Ex. 16, ¶¶ 3, 38. In fact, the incidence of overall respiratory tract cancers in the studies has been normal or lower than expected. A study of 2,490 formaldehyde workers by Marsh found no nasal cancer and no dose-response relationship between formaldehyde exposure and respiratory or other cancer.[8/] Similarly, a study of 2,026 formaldehyde workers by Wong found no nasal cancer mortality or excess respiratory cancer mortality.[9/] A study of 1,106 morticians by Walrath and Fraumeni of the National Cancer Institute also disclosed

8/ Marsh, "Proportional Mortality Among Chemical Workers Exposed to Formaldehyde" (Nov. 21, 1980), in Formaldehyde Toxicity (Gibson, ed., 1983), Ex. 1, at 237.

9/ Wong, "An Epidemiologic Mortality Study of a Cohort of Chemical Workers Potentially Exposed to Formaldehyde, with a Discussion on SMR and PMR" (Nov. 21, 1980), in Formaldehyde Toxicity, Ex. 1, at 256.

no nasal cancer mortality or unusual level of respiratory cancer mortality.[10] Levine's study of 1,477 morticians licensed over a 20-year period showed no deaths from nasal cancer, and upper respiratory cancer was less than expected.[11]

A recent case control mortality study analyzed 481 cancer deaths among Du Pont employees. Mortality rates among the formaldehyde workers were no higher than among other workers. The statistical "power" (ability to detect a significant excess cancer risk) of this study was comparable to what could be expected from a cohort study of 2,650 formaldehyde workers followed for at least twenty years.[12]

A report was recently presented by Professor Acheson, the chief medical officer of Great Britain, on a large-scale study of formaldehyde workers. Records on 7,716 workers who entered the workforce before 1965 were traced through 1981. Although exposure levels in the early years

10/ Walrath & Fraumeni, "Proportionate Mortality Among New York Embalmers" (Nov. 21, 1980), in Formaldehyde Toxicity, Ex. 1, at 227.

11/ Levine, "Mortality of Ontario Undertakers" (Dec. 1982), in Formaldehyde: Toxicology, Epidemiology and Mechanisms (Clary, Gibson & Waritz, eds., 1983), Ex. 2, at 127, 130-32).

12/ Fayerweather, et al., "Case-Control Study of Cancer Deaths in Du Pont Workers with Potential Exposure to Formaldehyde" (Dec. 3, 1982), in Formaldehyde, Ex. 2, at 47.

were high, there were fewer cancers than expected. Acheson found no nasal cancer deaths among the 1,621 men who had died by the end of the period.[13] For a discussion of these and other studies, see Barnes Aff., Ex. 16, ¶¶ 6-24.

The numerous epidemiologic studies now cover thousands of formaldehyde workers, with no indication of an association, let alone a causal connection, between nasal cancer and formaldehyde. As the Fifth Circuit found in Gulf South v. CPSC (even before the release of the latest study results covering almost 8,000 workers):

> Eleven epidemiologic studies involving a total of 10,000 [formaldehyde] workers were introduced into the record. None of the studies' authors found a statistically significant increase in the number of cancers among workers exposed to formaldehyde compared to the general population.

701 F.2d 1137, 1145 (5th Cir. 1983).

The recent NCTR Consensus Workshop on Formaldehyde addressed the formaldehyde epidemiologic studies. The Consensus Report, issued by a panel which included some well-known advocates of the theory that formaldehyde presents cancer

13/ British Medical Research Council Environmental Epidemiology Unit, "Formaldehyde Study - Interim Report," summarized in The Lancet 26 (July 2, 1983), Ex. 8. Acheson has described as insignificant an excess of lung cancer mortality at one of the six plants when compared to the male population of England and Wales, since there was no excess when compared to the incidence in the local population in the area of that plant, and no excess in other plants (nor evidence of an association with lung cancers in other studies). Id.

risk, found no "persuasive evidence of a causal relationship between exposure to formaldehyde and cancer risk." The panel concluded that there was no evidence of substantial nasal cancer risk although that possibility could not yet be excluded for those subpopulations which had been exposed in the workplace for more than 20 years (studies with longer term "latency" would be required to resolve this issue). The panel also found that there was no convincing evidence of lung cancer.14/

14/ The NCTR panel noted that studies of professional groups who preserve human tissues with solutions containing various chemicals, including formaldehyde, have shown very slight increased risk of brain cancers. However, other evidence does not support attribution of brain cancer to formaldehyde. Studies of industrial workers in fact have shown a deficit of brain cancer. (It has been suggested that socioeconomic status or close association with the medical profession may account for the more frequent diagnosis of brain cancer among the pathologists, anatomists and embalmers.) Since these sporadic excesses have only been observed in professionals who handle human tissue, they may be related to a number of other causal factors, such as contact with other chemicals, excreta, human tissue, bacteria, or viruses. Because the epidemiologic studies of formaldehyde-exposed persons fail to show consistency, dose-response relationships, duration of exposure and other relationships expected of a real human carcinogen, the studies do not in any way suggest that exposure to formaldehyde has caused cancer in humans.

Moreover, based on scientific knowledge of the mechanisms of toxicity, metabolism detoxification, repair and carcinogenicity of formaldehyde in animals, it is extremely unlikely that formaldehyde would have an effect other than at its point of contact. Formaldehyde is rapidly metabolized and is unlikely to collect anywhere other than the point of contact. There also has been no evidence of brain cancer in any of the animal studies. See Barnes Aff., Ex. 16, ¶ 33; Letters from Maureen O'Berg, Ph.D., and Neil Krivanek, Ph.D., Ex. 15.

B. The Error of Extrapolating Human Risk From the Results of the CIIT Tests

Lacking evidence that formaldehyde is a human carcinogen, the draft EIS bases its prediction of risk on the CIIT rat data. For many reasons, the fact that rats developed nasal cancer after exposure to 14.3 ppm of formaldehyde does not indicate significant cancer risk to man at lower doses. First, human beings simply cannot tolerate -- even for a few moments -- exposure at the highly irritating 14.3 ppm doses to which the rats were exposed. At these levels, the epithelial lining of the nasal cavity is destroyed, the cell's protective mechanisms are overwhelmed, and (as discussed below) the cytotoxic doses cause tissue damage and eventually cancer. But humans are not exposed to these extremely high doses. The discomfort of the irritant effects at high levels precludes chronic exposure to levels comparable to those that caused cancer in the rats.

Second, there is a very steep dose-response curve to the CIIT results. While formaldehyde apparently led to cancer in 44 percent of the rats at 14.3 ppm, there was no statistically significant incidence of cancer in rats at 5.6 ppm, nor any incidence at 2 ppm. There was no statistically significant incidence of cancer in mice at any dose -- even with lifetime exposure to 14.3 ppm. These data are consistent with a no-effect level (but, of course, do not define that level).

Third, there is evidence that the cancer observed in rats at high doses is related to the "cytotoxic" effects of those high doses, thus indicating that cancer will not occur at low doses. Cytotoxicity is the capacity to induce cell death. In the CIIT study, high doses of formaldehyde caused acute injury and death of cells in the rats' nasal cavities; surviving cells, probably injured, then rapidly divided to replace the dead cells. CIIT regards this cell death and attendant proliferation of injured cells as an essential precondition to the cancer observed; the evidence suggests that this is because formaldehyde acts on DNA only during cell division.[15/] Squire Aff., Ex. 17, ¶¶ 30, 42.

Moreover, there is also substantial evidence of several biological protective mechanisms (e.g., cell repair, detoxification, mucus absorption of or reaction with formaldehyde, and immunologic, tumor-associated rejection mechanisms) that prevent or mitigate carcinogenic effects at low exposure levels. For example, the nasal mucus acts as a protective barrier against low concentrations of formaldehyde, but becomes saturated and permits formaldehyde to reach the epithelial cells only at high concentrations.[16/]

15/ See Swenberg, et al., "Effect of Formaldehyde Exposure on Cytotoxicity and Cell Proliferation" (Nov. 1982), in Formaldehyde, Ex. 2, at 225; Swenberg, et al., "Mechanisms of Formaldehyde Toxicity" (Nov. 21, 1980), in Formaldehyde Toxicity, Ex. 1, at 132; Swenberg, et al., "Non-Linear Biological Responses to Formaldehyde and Their Implications for Carcinogenic Risk Assessment," CIIT, Carcinogenesis (June 14, 1983), Ex. 23.

16/ See Morgan, et al., "Formaldehyde and the Nasal Mucociliary Apparatus," Formaldehyde Toxicology Seminar,

(Footnote Continued)

Fourth, any assumption that man will respond to formaldehyde in the same manner as the rat is arbitrary. It is significant that the CIIT (and other) studies demonstrate considerable variation in response even among rodent species. In contrast to the rats in the CIIT study, the mice studied by CIIT showed no statistically significant incidence of cancer even at 14.3 ppm, and no cancer at 5.6 ppm or 2 ppm. The different response in mice apparently reflects the fact that what is important is the dose that reaches the target organ, not the concentration of formaldehyde in the air. The mouse must be exposed to twice the concentration in air to which the rat is exposed to achieve similar effects on nasal tissues, even though both species are obligatory nose breathers. See Squire Aff., Ex. 17, ¶¶ 18, 28, 34-36. In a subchronic study by Bio/dynamics, hamsters exposed to 3 ppm for 22 hours a day for 6 months (25% more hours than the CIIT study) showed no effects, although a mild cellular change which often accompanies irritation appeared in the rat and the monkey. See Squire Aff., Ex. 17, ¶ 21. In another study, by Dalbey, lifetime exposure of 30 ppm once a week produced no tumors in hamsters, nor did lifetime exposure to 10 ppm five times a week.[17/] The marked inter-species difference in the effects of

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(Footnote Continued)

Nov. 1982, in Formaldehyde, Ex. 2, at 193; Swenberg, et al., "Mechanisms," in Formaldehyde Toxicity, Ex. 1, at 135.

17/ Dalbey, "Formaldehyde and Tumors in Hamster Respiratory Tract," Toxicology 24:9 (1982), Ex. 6.

formaldehyde suggests that it is erroneous to extrapolate from the CIIT tests in predicting risk to man.

II. Reliance on CPSC's Quantitative Risk Assessment to Predict Cancer Risk Is Unsupported

No scientific body has ever concluded that formaldehyde has in fact caused cancer in man. Even CPSC admits that "[f]ormaldehyde is not one of those substances" as to which "there is direct evidence of human carcinogenicity." CPSC Brief in Gulf South at 23.

Although there is no direct evidence that formaldehyde is a human carcinogen at the levels that actually prevail in residences (or indeed at any level), the draft EIS predicts an annual incidence of four cancers in the Northwest region from existing levels of formaldehyde and one additional cancer every four years from elevated formaldehyde levels if the expanded weatherization program is implemented. These predictions are based on incorporation of assumed exposure levels into a quantitative risk assessment -- a statistical procedure which is not biologically validated.

The draft EIS adopts the discredited CPSC formaldehyde risk assessment, which used the Global 79 computer program, to extrapolate from rat data at high doses to predict the risk of cancer to humans at low exposure levels where no cancer has been observed. However, mathematical risk assessment models are merely statistical constructs which are no better

than the data and biological assumptions on which they are based.[18/] The risk assessment prepared by CPSC did not take into account all available health effects data, and the model and the prediction of risk was based explicitly on assumptions which are subject to serious question.[19/] While it might be acceptable to construct a risk assesment extrapolating from rat data when there is no other data available, such extrapolation is not appropriate when there is human data.[20/] Moreover, to obtain its predictions of cancer risk, the draft EIS ignores the mathematical model's prediction of a most likely risk of "essentially zero" and instead used the model's 95% upper confidence limit.

A. The CPSC Risk Assessment Failed To Incorporate All Available Data

The quantitative risk assessment prepared by CPSC and

18/ See Affidavit of Professor Robert L. Sielken, Jr., Ph.D., Ex. 24, ¶¶ 4-5.

19/ As discussed below, these include assumptions that effective doses are proportional to administered doses, that there is a cancer risk at any level of exposure, that benign tumors should be treated as identical to malignant tumors, and that there is low dose linearity. See, e.g., Sielken Aff., Ex. 24, ¶ 12; see also Gulf South, 701 F.2d at 1147 n.19.

20/ For a discussion of the human epidemiologic data and evidence of non-linearity in the dose response to formaldehyde, see Swenberg, et al., "Non-linear Biological Responses to Formaldehyde and Their Implications for Carcinogenic Risk Assessment," CIIT, Carcinogenesis, June 14, 1983, Ex. 23.

adopted by BPA was not designed to incorporate the full range of relevant scientific considerations. The risk assessment used only the rat data from the CIIT study, in which about 44% of the rats exposed at the 14.3 ppm level developed cancer and about 1% of the rats developed cancer at 5.6 ppm. No rats developed cancer at 2 ppm. The risk assessment ignored this evidence of a threshold level below which no carcinogenic response is observed. The CPSC risk assessment also ignored the data on mice in the same study, which would have resulted in much lower predictions of risk. (No cancers were found in mice exposed to 2 ppm or 5.6 ppm and there was no statistically significant incidence even at 14.3 ppm.)[21/]

There are a number of mathematical models, incorporating different theories or assumptions about the biological processes that lead to cancer, which can be used to guess at risks at low levels of exposure.[22/] Estimates of risk at low doses may vary by several orders of magnitude depending on the model chosen. CPSC arbitrarily chose the model that predicts the highest risk. Other models would have fit the experimental

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21/ The multistage (Global 79) model's best estimates using the rat data are approximately 70 times greater than the model's estimates using the mice data. Sielken Aff., Ex. 24, ¶ 7.

22/ These models include the probit, logit, Weibull, multihit, and linear models, as well as the multistage and one-hit. See Sielken Aff., Ex. 24, ¶ 8.

data better and would have yielded substantially lower estimates of risk. Sielken Aff., Ex. 24, ¶ 9. For example, the Weibull model, which is from the same model family as the multistage model used in the Global 79 computer program, provides a better fit to the CIIT data.[23/] At 3 ppm, the Global 79 multistage model's predictions are 13 times higher than the Weibull model; at 1 ppm, they are 76 times higher; at .5 ppm, they are 235 times higher; and at .1 ppm, they are 3,265 times higher. Sielken Aff., Ex. 24, ¶ 10.

Mathematical models are of limited utility because they do not deal with the full range of experimental data, nor do they address the complexities of extrapolation from rat to man. At best, meaningful predictions can be derived from mathematical models only when the results of their application to animal data are considered in conjunction with human data (such as epidemiologic studies) and qualitative biological data

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23/ Sielken Aff., Ex. 24, ¶ 10. This is because the Weibull model allows the predicted dose-response curve to be as steep as the experimental data's dose-response curve; the multistage model restricts how steep the predicted curve can be. Because the multistage model used in Global 79 restricts how quickly the risk predictions may fall as the exposure levels decrease, the multistage model predicts much higher risk at low levels.

Global 79 includes an indicator of how well the risk predictions fit the experimental data. In performing the risk assessments, OSHA's scientists apparently ignored (or perhaps chose not even to check) the computer program's warning that the multistage model they had selected was not a good fit. Sielken Aff., Ex. 24, ¶ 9.

(such as the type of tumor produced in the experimental animals, whether the tumor is benign or malignant, the mechanism by which tumors appear to be induced, inter-species comparisons, time-to-tumor information, and actual dose delivered to the target tissue and other factors).24/

As noted above, the Fifth Circuit rejected CPSC's sole reliance on the Global 79 predictions, to the exclusion of other available animal and human data:

24/ Sielken Aff., Ex. 24, ¶ 5. See generally a report of the National Center For Toxicological Research and the Society of Toxicology, Fund. App. Toxic. 3:129, 135 (1983), Ex. 25:

> [I]t would appear that mathematical models cannot be used at this time to clearly delineate the shape of dose-response curves below the observable response range. In addition, these models do not account for shifts in metabolite patterns that may occur as a result of changes in dose level, enzyme induction, or the dosing regimen. Further, they do not factor in biological defense mechanisms such as detoxification or genetic repair which may function at markedly different levels of efficiency below the observable range. . . .
>
> [L]ow dose risk assessment procedures do not take into account significant interspecies differences. Successful interspecies conversion requires consideration of factors such as differences in pharmacokinetics and metabolism, nutrition and physiology, as well as species specific biological or biochemical defense mechanisms.

See also National Academy of Sciences, Regulating Pesticides at 6 (1980) ("[O]ur present understanding does not permit us to draw reliable numerical inferences from the kind of laboratory data normally available about the effects of pesticides and other compounds on the development of cancers in humans.")

> While the Commission correctly notes that the epidemiologic evidence is not conclusive, its exclusive reliance on the Chemical Institute study in its Global 79 risk assessment is equally unsupportable . . . . As Dr. Higginson aptly stated, it is not good science to rely on a single experiment, particularly one involving only 240 subjects, to make precise estimates of cancer risk.

Gulf South, 701 F.2d at 1146. The court referred to a letter in which the former director of the International Agency for Research on Cancer, Dr. John Higginson, cautioned CPSC about the dangers of extrapolating from data on a single species of animals to predict effects on man:

> Today few experienced experimental oncologists would make any attempt to extrapolate mathematically the degree of human risk from animals, although such attempts were fashionable among biostatisticians in the early '70s when the complexities inherent in modern theories of carcinogenesis in man were not appreciated. Exact estimates as to the number of cases of a cancer that might be expected to occur in man based on a single experiment are silly and simply ignore biological realities.25/

B. The Underlying Assumptions of the CPSC Risk Assessment Are Unsupported

1. The assumption that the effective doses are proportional to administered doses is erroneous

The risk assessment prepared by CPSC and adopted by BPA was based upon the critical assumption that response is

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25/ Letter to CPSC Chairman Steorts, Feb. 12, 1982, Ex. 26.

directly related to the administered (or ambient) levels of formaldehyde. In fact, response is correlated with the effective (or delivered) doses that reach the target organ.[26] The CPSC risk assessment simply assumed that the ambient levels are proportional to effective doses over the entire dose spectrum. To do so is plainly wrong, for it ignores how the body can handle low doses differently from high doses, e.g., the protective effect of mucus, cell repair, and immunologic mechanisms.[27] In ignoring the divergence between administered and delivered doses, the Global 79 mathematical model vastly overestimates risk.[28]

Moreover, the CPSC risk assessment assumed that, at a given ambient level, the delivered dose to man was the same as the delivered dose to the rat. This assumption ignores

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26/ See Squire Aff., Ex. 17, ¶¶ 8, 32-33; Hoel, et al., "Implication of Nonlinear Kinetics on Risk Estimation in Carcinogenesis," 219 Science 1032 (Mar. 4, 1983), Ex. 27.

27/ See, e.g., Prod. Safety & Liab. Rep. (BNA) 770 (Nov. 12, 1982); Swenberg, et al., "Mechanisms of Formaldehyde Toxicity," in Formaldehyde Toxicity, Ex. 1, at 132; Swenberg, et al., "Induction of Squamous Cell Carcinomas of the Rat Nasal Cavity by Inhalation Exposure to Formaldehyde Vapor," Cancer Research 40:3398-3401 (1980), Ex. 21; Gibson, "Risk Assessment Using a Combination of Testing and Research Results," 1980 CIIT Conference, in Formaldehyde Toxicity, Ex. 1, at 295.

28/ According to Hoel: "The mathematical models typically used for low-dose extrapolation are shown potentially to overestimate risk by several orders of magnitude when nonlinear kinetics [i.e., a relationship between administered and delivered dose that is not directly proportional] are present." Hoel, Ex. 27, at 1032.

substantial evidence of significant interspecies differences in reactivity to formaldehyde -- in particular, differences between man and the rat in breathing rate and method, anatomy, and mucous flow. See Squire Aff., Ex. 17, ¶¶ 33-36. Failure to account for these differences has a significant effect. If, for example, when all differences are taken into account, the delivered dose to man were approximately one-fourth the delivered dose to the rat, and this information were incorporated into the equation of the Global 79 multistage model, the risk predicted for man would be one sixty-fourth that which is predicted by Global 79 without taking into account the differences in delivered dose to rat and man. Sielken Aff., Ex. 24, ¶ 13.

The invalidity of assuming equivalent delivered doses for different species is illustrated by the difference in results between the rats and the mice in the CIIT study. If the risk assessment can assume that the delivered dose is the same for rats and man, surely one would think that it is the same for rats and mice. But this is not the case. Mice in the CIIT study had almost no cancer. While both rats and mice are obligatory nose breathers (in contrast to man, who breathes through both mouth and nose), the mouse adjusts its breathing rate when exposed to formaldehyde and does not contract cancer as readily as the rat. The model using the rat data cannot be an accurate predictor for what occurs in mice unless a conversion factor is applied to take this into account.[29] As

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29/ Squire Aff., Ex. 17, ¶¶ 18, 28, 35; Sielken Aff., Ex. 24, ¶ 7.

the Fifth Circuit noted, the assumption that effective and administered doses are equivalent is "of questionable validity":

> The Commission assumed that at identical exposure levels the effective dose for rats is the same as that for humans. The industry points out that the effective dose for mice is much less than that for rats and argues that it is far more sensible to assume that rats equal mice than that rats equal humans.

Gulf South, 701 F.2d at 1147 n.20.

2. The assumption that there is a cancer risk at any level of exposure ignores evidence of a threshold level

The CPSC risk assessment assumed that some risk must be present at even the lowest exposure levels. The Fifth Circuit also regarded the assumption that there is no threshold below which formaldehyde poses no risk of cancer as an assumption of "questionable validity." Gulf South, 701 F.2d at 1147 n.20. Such an assumption "leads inescapably to the conclusion that ambient air [which contains formaldehyde] is carcinogenic." Id.

The rarity of nasal cancer despite over ninety years of widespread occupational exposure to formaldehyde provides practical evidence of a threshold. An important criterion for acceptance of a health risk projection is whether the results agree with findings of human epidemiologic studies.30/ If the

30/ The Subcommittee on Environmental Carcinogenesis of the National Cancer Advisory Board has stated: "Negative data

(Footnote Continued)

number of excess nasal cancer deaths predicted by the mathematical risk assessments were actually occurring, they would be detectable, and would have appeared, in even small epidemiologic studies. However, none of the existing studies has observed any nasal cancer mortality, much less a level that approaches the level of OSHA's quantitative predictions. See Barnes Aff., Ex. 16, ¶ 37.

The no-threshold assumption is also undermined by the Bio/dynamics low-level exposure study where monkeys, rats, and hamsters were exposed 22 hours a day for six months to formaldehyde at 0.2 ppm, 1.0 ppm, and 3.0 ppm. (While it was a subchronic study, the total hours of exposure exceeded those in the CIIT tests by 25%, and there was much less recovery time between exposures.) No cell changes and indeed no adverse effects whatsoever were observed at 0.2 or 1.0 ppm. A mild cellular change which often accompanies irritation was observed at 3.0 ppm in the rat and the monkey but no change was observed in the hamster.31/

(Footnote Continued)

> on a given agent obtained from extensive epidemiologic studies of sufficient duration are useful for indicating upper limits for the rate at which a specific type of exposure to that agent could affect the incidence and/or mortality of specific human cancers." General Criteria for Assessing the Evidence for Carcinogenicity of Chemical Substances: Report of the Subcommittee on Environmental Carcinogenesis, National Cancer Advisory Board, 58 J. Nat'l Cancer Inst. 461, 462 (Feb. 1977).

31/ This type of cellular change is reversible when exposure ceases.

Furthermore, the CPSC risk assessment ignored evidence that cancer observed in rats at high doses is related to the cytotoxic effects of those high doses -- evidence that cancer will not occur at low doses.[32/] As discussed above, it appears that the high "cytotoxic" doses of formaldehyde led to the acute cell injury, cell death, and the cancer in the rats' nasal cavities in the CIIT study. Moreover, recent research indicates that formaldehyde acts on DNA only during cell division, which occurs at an increased rate as a result of exposure to cytotoxic doses. At doses that are not cytotoxic, biological protective mechanisms prevent or mitigate carcinogenic effects of formaldehyde. For example, nasal mucus acts as a saturable protective barrier against low concentrations of inhaled formaldehyde. It is therefore highly unlikely that cancer would develop at low exposures which do not cause cell injury and increased cell proliferation. See Squire Aff., Ex. 17, ¶¶ 9, 41-44.

C. The Use of an Upper Confidence Limit Is Improper

Even the Global 79 multistage model used in the draft EIS predicted a most likely level of risk which CPSC has described as "essentially zero." However, CPSC resorted to

32/ See G. Williams & J. Weisburger, 221 Science 6 (1983), Ex. 22 (suggesting that carcinogenicity of cytotoxic agents may disappear as dose is lowered).

using a 95% upper confidence limit as the quantitative prediction of risk; the draft EIS follows the same approach.

Unlike the "maximum likelihood estimate," which is a model's best guess of the risk at a certain exposure level, the 95% upper confidence limit is not a prediction of risk at any given dose. Rather, the confidence limits define a range within which it can be said with a specified degree of certainty that the true risk will actually fall. See Sielken Aff., Ex. 24, ¶ 15. Thus, the 95% upper confidence limit is the upper boundary of a range within which there is a 95% certainty that the actual risk will fall. Gulf South, 701 F.2d at 1141.[33/] Use of upper confidence limits to generate "up-to" estimates does not provide substantial evidence of unreasonable risk. 701 F.2d at 1146-48.

Not only was the use of the Global 79 95% upper confidence limits in the CPSC risk assessment an improper use of the upper confidence limit concept, but it was also based on the unsupported assumption that the dose-response relationship is linear at low doses. (In other words, the dose-response curve is a straight line drawn through zero, such that risks at low exposures are proportional to risks at higher exposures,

33/ For example, one could say that there is a 95% probability that in the Seattle Seahawks' 16 game season, they will win between 0 and 15 games; that statement may be true, but it does not predict the most likely number of actual wins.

and the only point where there is no risk is at zero exposure.) See Squire Aff., Ex. 17, ¶ 44; Sielken Aff., Ex. 24, ¶ 16. For this linearity hypothesis to be sustained, among other things, formaldehyde must be both an initiator and a promoter of cancer, it must act by way of genetic toxicity, its effect must be additive to (and act by the same mechanism as) that of other presumed carcinogens to which man may be exposed, and the delivered doses to the target site must be directly proportional to administered doses.[34/] The risk assessment offers no support for these suppositions, and they are not supported by the biological evidence. Such assumptions ignore evidence that the rapid metabolism and detoxification of formaldehyde, cellular repair processes, and the protective action of mucus could prevent virtually all formaldehyde from reaching the cell nucleus at low concentrations. Moreover, there is evidence that formaldehyde acts on DNA only during cell proliferation, which occurs at an increased rate only upon exposure to toxic levels of formaldehyde. See Squire Aff., Ex. 17, ¶¶ 30, 40-42.

The low dose linearity assumption causes the 95% upper confidence limits determined by Global 79 to be many times larger than the corresponding maximum likelihood estimate at low doses. For example, the Global 79 95% upper confidence

34/ Sielken Aff., Ex. 24, ¶ 12; Carlborg, "Mathematical Cancer Risk Assessment for Formaldehyde," Formaldehyde Toxicology Seminar, 1982, in Formaldehyde, Ex. 2, at 33-34.

limit at 0.1 ppm is 619 times larger than the corresponding maximum likelihood estimate. By contrast, when the upper confidence limits are computed using the classical statistical approach of the Weibull model, the upper confidence limit at 0.1 ppm is only 7.3 times larger than the corresponding maximum likelihood estimate. The combination of the linearity assumption in the Global 79 multistage model's upper confidence limit and the Weibull model's better fit to the data have a particularly dramatic effect. The Global 79 multistage model's 95% upper confidence limit at 0.1 ppm is 275,000 times larger than that of the Weibull model; at 0.5 ppm it is 1,133 times larger; at 1 ppm it is 124 times larger; and at 3 ppm it is 7.1 times larger. Sielken Aff., Ex. 24, ¶ 16.

In sum, the draft EIS utilizes the Global 79 multistage model and adopts the 95% upper confidence limit as its prediction of risk -- the only prediction of risk greater than essentially zero. The favorable human epidemiologic experience with formaldehyde, the evidence of a threshold level below which formaldehyde poses no risk of cancer, and the predictions of other risk assessment models which are more consistent with the scientific evidence, indicate that it is inappropriate to conclude that there is any risk of cancer from either the existing levels of formaldehyde or from elevated levels of formaldehyde if additional homes are included in the weatherization program.

III. The Formaldehyde Exposure Levels are Exaggerated

The pervasive problem with BPA's calculations of indoor exposure levels is that they are mathematical exercises computed on the basis of laboratory tests in disregard of controlled studies providing actual home measurement data. The calculations are based on claimed emission rates from building and furnishing materials, combustion sources and UFFI, ignoring well-recognized suppression agents and absorption phenomena that are at work in real world conditions. Moreover, the calculations assume that the emission rates from materials are equal to those observed under laboratory conditions and that formaldehyde emissions remain constant over time, and they also involve a number of other assumptions about the characteristics of typical residences, including the fresh air exchange rate, the bulding volume, and the mass of formaldehyde-emitting material in the home. It would have been more accurate and less speculative to use actual home measurement data.

For example, the exposure levels claimed to prevail in the UFFI homes as a result of the mathematical formula are unrepresentative of actual conditions. The draft EIS apparently assumes that formaldehyde levels of 0.2 to 0.4 ppm are found in UFFI homes.35/ See Draft EIS at pp. 2.13, 4.7.

35/ The draft EIS states that residences without UFFI have levels of from 12 to 25% of the levels in residences with UFFI, or 0.025 to 0.1 ppm.

Although these levels pose no health risk, it should be noted that they are erroneous. Contrary to the draft EIS, controlled studies based on actual measurements demonstrate that the formaldehyde levels found in UFFI homes are far lower -- in the range of 0.04 to 0.06 ppm, which are barely above background levels.36/

University of Iowa data presented to CPSC in January 1982 demonstrate the formaldehyde concentrations in randomly selected homes averaged 0.059 ppm in UFFI homes and 0.063 ppm in non-UFFI homes,37/ an insignificant difference. Similarly, an extensive Canadian government study demonstrates that while formaldehyde concentrations averaged 0.054 ppm in 1,146 UFFI homes that were the subject of "inquiries," and 0.04 ppm in 651 randomly-selected UFFI homes, concentrations in 378 non-UFFI homes averaged 0.034 ppm -- a difference of not more than 0.02 ppm.38/ In like manner, a 1978 study by Dr. Sidney I. Firstman while he was at the Georgia Institute of Technology found that

36/ Although the Formaldehyde Institute's members do not market or install UFFI, the Institute has experience with UFFI, beginning from the time the Institute proposed product standards to DOE and CPSC to avoid improper installations.

37/ See Dr. Clyde Frank, Comments on CPSC Proposed Ban on UFFI (April 6, 1981), Ex. 28, at 46.

38/ The Report on the National Testing Survey to the Board of Review by the Urea Formaldehyde Foam Insulation Information and Coordination Centre, Dec. 14, 1981, Ex. 29.

UFFI "appears to add, at most, 0.01 ppm formaldehyde" to the air in a sample of UFFI homes in New York and New Jersey.39/

The highly theoretical predictions of formaldehyde levels in UFFI homes calculated in the draft EIS were based on chamber tests conducted by the Franklin Institute Research Laboratory ("Franklin Institute") and the Oak Ridge National Laboratory ("ORNL"). The Franklin Institute tests purported to extrapolate from experimental panels of UFFI and predict formaldehyde levels in a room insulated with UFFI averaging 0.13 ppm. Data from these tests fail to indicate the formaldehyde levels to be found in UFFI homes for several reasons. First,

39/ See Testimony of Dr. Firstman before the Subcommittee on Rural Housing and Development, Senate Committee on Banking, Housing and Urban Affairs, in Ex. 28, at 49-59. Other studies have confirmed these results. Anders and Shor have reported on the results of over 10,000 badge-type analyses done for homeowners throughout the United States. They found "comparable concentrations of formaldehyde in homes with and without UFFI." L. Anders & R. Shor, "Formaldehyde Concentration Measured in U.S. Residences by Diffusional Samplers and Impingers," American Industrial Hygiene Conference (May 22, 1983), Ex. 30. Records of home measurements compiled by the Tennessee Department of Health found that formaldehyde levels in UFFI homes averaged slightly less than in non-UFFI homes. Tennessee Department of Health, "Summary of Air Monitoring Studies" (1983), Ex. 31. Measurements collected by the Minnesota Department of Health also found that UFFI homes had slightly lower values. Minnesota Department of Health, "In the Matter of a Proposed New Rule Relating to Formaldehyde," 7 MCAR 1.448 (1981), Ex. 32. Robert Orheim of the Northwest Environmental Laboratories in Seattle, Washington found an average value of 0.05 ppm formaldehyde in about 600 UFFI homes and 0.025 ppm in about 17 control homes without UFFI. R. Orheim, Chemical & Engineering News 60:2 (April 26, 1982), Ex. 33.

the tests ignored the fact that when UFFI is properly installed, in external walls, much of any formaldehyde emitted from it is vented to the exterior. Second, the tests did not reflect the capacity of drywall to absorb formaldehyde.40/ Third, the test panels were stored in conditions to render them unfit for testing. Before the panels were shipped to ORNL, they were exposed to extremes of temperature and humidity.41/

In addition, ORNL attempted to correlate static conditions with dynamic conditions like those in actual living spaces where there is air flow and exchange, but it did not test the panels in spaces approximating actual room sizes. ORNL admitted that its methodology in predicting formaldehyde

40/ In the Franklin Institute experiment, the test panels were sealed in test chambers intended to simulate wall cavities, and then measurements of formaldehyde were taken from nitrogen gas that was forced through the chambers. Rates of transmission of formaldehyde through the drywall membrane in the test chambers were then calculated. However, during the tests, formaldehyde was permitted to distribute itself into the chambers, the walls of the chambers, and the drywall membrane. Thus, formaldehyde evaporated from multiple sources, and the observed levels did not reflect transmission through the single source of the drywall membrane. Because the high absorption capacity of drywall was ignored by the tests, evaporation rates in the test chambers cannot be equated with transmission rates into actual living spaces.

41/ The panels were stored horizontally in a open carport, under black plastic sheeting, for a period of nine to twelve months. 47 Fed. Reg. at 14408. During that time, the panels were exposed to extremes of temperature, humidity, and precipitation that are far in excess of those to which one could reasonably expect UFFI to be exposed in the wall cavity of a building.

levels under dynamic conditions based on levels under static conditions could "lead to errors of 2- to 3-fold assuming the ratio is constant with time and environmental conditions."[42/]

The Fifth Circuit criticized CPSC's use of the in-home and the Franklin Institute/Oak Ridge Lab studies as bases for a quantitative risk assessment:

> The in-home study focused on complaint residences, not average residences, not randomly selected residences. The Franklin/Oak Ridge Labs studies reflected conditions similar to an unheated, unair-conditioned home, not an average home. The similar results achieved by the two studies validate neither. The studies were inadequate to serve as a data base for the Global 79 risk assessment.

Gulf South, 701 F.2d at 1145. The draft EIS utilizes the same exposure data rejected by the court.

The calculations of formaldehyde exposure levels in the draft EIS also failed to take into account the fact that formaldehyde levels in UFFI homes decrease rapidly over time. Even CPSC, which argues that levels in UFFI homes are 0.2-0.3 ppm at the time of installation, concedes that levels in UFFI homes approach 0.1 ppm after a year.[43/] Since there have been

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42/ A. Hawthorne, et al., Oak Ridge National Laboratory, "An Evaluation of Formaldehyde Emission Potential from Urea-Formaldehyde Foam Insulation: Panel Measurements and Modeling" (Sept. 1981), Ex. 34, at 38. ORNL and CPSC personel acknowledged that the ORNL and Franklin Institute studies produced data that were "not good enough for making correct extrapolations for room concentrations." See Dr. Clyde Frank, Statement to Jan. 29, 1982 Briefing of CPSC Commissioners, Ex. 35, at 2-3.

43/ M. Cohn, "Revised Carcinogenic Risk Assessment For Urea Formaldehyde Foam Insulation" (Oct. 26, 1981), Fig. 3, Ex. 36.

few if any installations in the Northwest region in the past year in view of the ban, it is most unlikely that UFFI homes would have levels which approach, much less exceed, 0.1 ppm.

With respect to the issue of formaldehyde exposure levels in manufactured housing, the draft EIS assumes that levels of 0.2 to 0.3 ppm are typically found. Draft EIS at pp. 2.13, 4.7. However, those units which would perhaps benefit from the weatherization program are the older units which predate the 1976 HUD regulations imposing strict energy efficiency requirements. These homes are at least seven years old and it is unlikely that they would have elevated levels of formaldehyde. A study of Minnesota manufactured homes by Garry suggests that after four years, formaldehyde levels in manufactured homes are 0.1 ppm or less.[44/] Newer units are likely to be energy efficient and not to need the increased tightening from the weatherization program.

IV. Conclusion

The draft EIS offers a prediction of risk which is unsupported by the weight of scientific evidence and which has already been discredited by the Fifth Circuit. Correction of the draft EIS will not only serve the interest of scientific accuracy, but avoid unnecessary alarm and loss of property

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44/ Garry, et al., "Formaldehyde in the Home: Some Environmental Disease Perspectives," Minnesota Medicine 63:107-111 (1980), Ex. 37.

value. We urge BPA to review the scientific evidence on the carcinogenicity of formaldehyde issue and the actual home experience as to exposure levels prior to finalizing the EIS. The Institute would be pleased to consult with you and to otherwise assist in your efforts to revise the draft EIS.

Sincerely,

C. T. Howlett, Jr.
Chairman, Government Affairs
Committee
Formaldehyde Institute, Inc.

PNUCC

PACIFIC NORTHWEST UTILITIES CONFERENCE COMMITTEE

November 14, 1983

Anthony Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, Oregon 97208

RE: PNUCC Response to Draft EIS

Dear Mr. Morrell:

PNUCC, on behalf of the region's utilities, is pleased to comment on the Bonneville Power Administration's Draft Environmental Impact Statement (DEIS) on the expanded Residential Weatherization Program. While the comments below have not been fully reviewed by PNUCC's Executive Committee due to time constraints, they are representative of utility attitudes on the DEIS. Generally, utilities feel that unencumbering the Regional Weatherization Program is significant and necessary.

1 The proposed Bonneville Power Administration alternative of expanding the weatherization program is generally supported by the region's utilities. The utilities are not, however, totally satisfied with the presentation of calculations and technical detail in the DEIS. Most have cited difficulty or inability to track development of values in the DEIS. Standard calculations and measures of risk were not demonstrated clearly in the document.

2 PNUCC believes all residences in the region should be weatherized, that informed consent should be solicited prior to weatherization, and that factual information should be supplied to customers as it is developed. The region's utilities believe mitigation by information, allowing the consumer to make an informed decision, is appropriate.

3 Active mitigation prescribed in the DEIS was needlessly confined to "air to air heat exchangers." This ignores the appropriateness of using "ventilation" or "mechanical ventilation." Heat recovery devices, such air to air heat exchangers, should be evaluated for cost effectiveness against alternative ventilation strategies such as operable window usage, exhaust fans, outside air intakes, and source control strategies. BPA has not identified additional mitigation strategies and thus the weatherization program may be unnecessarily hampered by the DEIS.

PNUCC · 520 SW SIXTH AVENUE, SUITE 505 · PORTLAND, OR 97204 · (503) 223-9343

Anthony Morrell
November 14, 1983
Page 2

4 Additional research, some of which is currently underway, is not referenced in the DEIS. With the uncertainties inherent in the document, the additional research commitments specified are appropriate. Answers to questions posed in the DEIS should be sought to the maximum extent practicable consistent with future budget considerations.

Sincerely,

Randall W. Hardy
Executive Director

RH:se:141EE

WATER AND LIGHT DEPARTMENT

City of McMinnville, Oregon 97128

P.O. Box 638 130 NORTH BAKER STREET • PHONE 472-6158 • 222-1466

November 14, 1983

Anthony R. Morrell
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

Subject: EIS on Expanded Residential Weatherization Program

1 We feel that an appropriate mitigation for the possible health effects of house tightening measures would be to make all information on the subject available to all customers.

2 The files on the health hazards of house tightening measures should be constantly updated and made available to the public or the serving utility.

3 We feel that the present residential conservation programs should go forward as scheduled and funded.

Sincerely yours,

Alan H. Jones
General Manager

AHJ:man

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Department of Energy

LABOR & INDUSTRIES BUILDING, ROOM 102, SALEM, OREGON 97310 PHONE 378-4040

November 14, 1983

Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621 - SJ
Portland, OR 97208

Dear Mr. Morrell:

BPA has requested comments on its Environmental Impact Statement (EIS) titled "The Expanded Residential Weatherization Program", August 1983, DOE/EIS-0095. BPA has been criticized for undertaking the EIS. However, the Oregon Department of Energy (ODOE) appreciates BPA's forthright attempt to quantify the health impacts of the proposed program. Historically all new endeavors have unanticipated effects. BPA's scrutiny of its program will help avoid many pitfalls.

ODOE is committed to cost-effective conservation as a means of meeting the region's energy needs. However, ODOE believes that issues raised in the EIS regarding the health impacts and cost-effectiveness of conservation must be addressed. ODOE has the following comments:

1 1. ODOE questions the cost and savings estimates in the EIS. If, in fact, both the costs and health impacts identified in the EIS are correct they would indicate BPA should not proceed with the proposed program. Adverse health impacts may be 10 to 100 times greater than other energy resources and the costs are twice as high. ODOE believes that BPA should review this conclusion by taking the following actions:

   a. Review the cost of the proposed program and compare that cost to other generating resources. According to the cost and savings estimates given in the EIS, the proposed action is not cost-effective. BPA projects a total program cost of $794 million to save 75 average megawatts or approximately $10,500 per average kilowatt. ODOE estimates other generating resources would cost from $4,000 to $6,500 per average kilowatt.

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   b. Reconcile the cost and energy savings estimates in the EIS with other estimates. The Regional Power Council estimates the cost of a program similar to that proposed by BPA to be $3,500 per average kilowatt. BPA has also used different estimates in the past (for example, see the Technical Appendix, Draft Technical Assessment of the Potential for Conservation and End-Use Renewable Resources, April 1981, p. A-31.) The estimates are also not consistent with ODOE's experience that tightening measures for homes, including storm windows, can be cost effective for displacing any fuel resource, including new electrical generating resources.

   c. Base the cost effectiveness determination of a program on total costs to the region, not just the costs to BPA. This is also the position taken on determining cost-effectiveness by the Regional Council. BPA states the proposed action is cost-effective because the costs to BPA are less than 35 mills per kilowatt-hour.

2 d. Compare health effects: BPA estimates that the proposed program would cause nearly 10 cancers per year in order to save 75 average megawatts. Various organizations (Ford-Mitre, Argonne National Laboratories, Nuclear Regulatory Commission and Union of Concerned Scientists) have estimated the health impacts of other resources over the fuel cycle. Estimates by these organizations indicate that the proposed program causes greater health effects than other resources except wind and hydro. BPA should present a comparison of the health effects of the proposed program to those of other resources.

3 e. Establish a decision criterion for acceptable levels of health impacts.

   ODOE's preferred method of doing this is to include the health effects in the environmental costs component of a cost-effectiveness calculation. This is done in the case studies being done for BPA by ECO-Northwest, assessing the environmental costs of Boardman and Frederickson. In this method, an explicit cost or range of costs for health effects and mortality is set. This is added to the direct program costs to get the total cost to society of the program. This methodology is suggested by the Regional Act, when it requires environmental costs to be calculated.

   An alternate way to do this is to set a threshold or standard on health effects above which effective mitigation would be required or if mitigation is not possible the proposed program would be modified to meet the threshold or standard. For example, the US Nuclear Regulatory Commission has adopted the following policies:

   > "Societal risks to life and health from nuclear power plant accidents should be as low as reasonably achievable and should be comparable to or less than the risks of generating electricity by viable competing technologies."

"The risk to an individual or to the population in the area near a nuclear power plant site of cancer fatalities that might result from reactor accidents should not exceed one-tenth of one percent (0.1%) of the sum of cancer fatality risk resulting from all other cancers."

4 2. In any case BPA should provide information on health impacts and suitable mitigation measures whether or not BPA pays directly for the conservation. Citizens need good information for evaluating conservation measures.

ODOE believes that the above issues should be resolved before completion of the EIS and a decision by BPA. ODOE is willing to assist BPA in this effort.

Sincerely,

Lynn Frank
Director

LF/DWG:cs
0659K

cc: Peter Johnson

Natural Resources Defense Council, Inc.

25 KEARNY STREET
SAN FRANCISCO, CALIFORNIA 94108
415 421-6561

Washington Office
1725 I STREET, N.W.
SUITE 600
WASHINGTON, D.C. 20006
202 223-8210

New York Office
122 EAST 42ND STREET
NEW YORK, N.Y. 10168
212 949-0049

COMMENTS OF THE NATURAL RESOURCES DEFENSE COUNCIL, INC.

ON THE BONNEVILLE POWER ADMINISTRATION'S

DRAFT ENVIRONMENTAL IMPACT STATEMENT:

THE EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM

Submitted by:

David B. Goldstein, Ph.D.
Ralph Cavanagh

November 14, 1983

New England Office: 17 ERIE DRIVE • NATICK, MA. 01760 • 617 655-2656
Public Lands Institute: 1720 RACE STREET • DENVER, CO. 80206 • 303 377-9740

NRDC COMMENTS ON
THE EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM DEIS

This statement constitutes the comments of the Natural Resources Defense Council, Inc. (NRDC) on The Expanded Residential Weatherization Program, a Draft Environmental Impact Statement (DEIS) released on September 14, 1983 by the Bonneville Power Administration (BPA). NRDC is a national, nonprofit environmental organization with more than 43,000 members and contributors, some 2100 of whom reside in the Pacific Northwest. NRDC's involvement in Northwest electrical energy issues, which began in 1974, has placed particular emphasis on the development of conservation resources as an alternative to more costly and environmentally destructive generating facilities.

I. Introduction and Overview

An environmental impact statement on a weatherization program has several features that distinguish it from analyses of generating facilities. First, a weatherization program potentially can have both positive and negative effects on the human environment; it cannot be evaluated on the assumption that "no action" is environmentally preferable. Also, the mitigation measures for the primary environmental impacts addressed in this DEIS do more than merely limit or reduce damage; as shown below, the proposed measures will actually produce an environment characterized by less risk to human health than the status quo.

1

The draft environmental impact statement does a reasonably competent job of analyzing the risks of increased indoor air pollution from several major pollutants, and of calculating the possible effects on human health from an unmitigated weatherization program. The indoor air quality problem is treated seriously, as it must be, and the analysis of health risks properly incorporates a number of conservatisms (e.g., the use of linear dose response curves). The structure of the analysis is generally reasonable and objective.

But there are major flaws in the DEIS, which render it inadequate as a decision document for Bonneville. As explained below, the problems are both technical and conceptual. These comments point the way toward an improved analysis that will help Bonneville maximize the economic and environmental benefits of a region-wide weatherization program.

We argue first, in section II, that the DEIS makes inappropriate use of averaging in calculating the concentrations of indoor air pollutants before weatherization and after mitigation. The DEIS errs in its use of average parameters, rather than distribution functions, to calculate air pollution concentrations, and the document incorrectly applies averaging in one of its key equations. As a result, BPA is driven to overlook major net indoor air quality improvements associated with "mitigated" weatherization, compared to a scenario in which no program expansion occurs.

2

Another weakness of the DEIS is its artificially constrained and in some respects distorted treatment of mitigation strategies. The agency focuses excessively on ways to increase ventilation rates, while overlooking more effective and less costly approaches that would attack indoor air pollution at the source. These issues are explored in section III.

Equally troubling is the document's failure to address with specificity the public health impacts of power supply alternatives to an expanded weatherization program. While BPA has calculated some of the direct impacts associated with the additional power generation that would be needed under the "no action" alternative, the DEIS nowhere converts these environmental insults into estimates of human mortality and morbidity. Moreover, the DEIS grossly understates both the potential energy savings of a properly designed weatherization program and the magnitude of displaced fossil fuel generation and residential wood-burning. As explained in section IV below, remedial analysis will show that -- even without mitigation -- a region-wide weatherization program is preferable on health grounds to the power plants it will displace. Section V raises a number of additional technical points, which strengthen our conviction that the DEIS understates net benefits associated with region-wide weatherization.

II. Inappropriate Averaging Techniques

The DEIS relies heavily on theoretical modeling of indoor air pollution. No empirical measurements of indoor air pollutant concentrations as a function of air changes per hour (ACH) are presented.* Instead, changes in concentrations are calculated theoretically. The basic equation used in this exercise appears on page A.5 of the DEIS:

average daily concentration = $(Mt_1)/[24\ IV]$

where M is the source emission rate, t_1 is the time duration of the source, I is the infiltration rate, and V is the house volume.

The equation suggests that a two-fold reduction in interior air change rate will result in a two-fold increase in the concentration of pollutants within the house. It also shows that a variation in source strength of a given percentage will have the same effect on pollutant concentration as a variation in infiltration of the same percentage. As demonstrated below, this equation may yield correct results for any particular point in time, but it cannot be used to calculate the daily average as defined and used in the DEIS.

Research on indoor air pollutants has shown that the variation between houses of the source strength term (M) is more

*Notably, however, informal discussions with BPA staff have indicated that available data on radon concentration (from several hundred houses) show no correlation between ACH and radon concentrations.

than three orders of magnitude, whereas the variation in infiltration rate (I) is typically no more than one order of magnitude. The projected change in infiltration rates under the Bonneville weatherization program is only 20-40%. Thus, variations in source strength will swamp variations in infiltration rate.*

The existence of extreme variations in source strength relative to infiltration rate means that there will be a parallel variation in the pre-program air quality of individual Northwest houses. See, for example, Figure 4.1 of the DEIS (p. 4-3), which hypothesizes "typical," low, and high ranges of pollutant concentration that can be expected by virtue of variations between houses. But rather than constituting a speculative or illustrative vehicle for defining best and worst cases, this figure actually represents the realistic variation in a distribution function describing pollutant concentrations in the region's homes. That is, some homes are currently at the upper

*The extreme variation in source strength, compared to the relatively minor changes in air infiltration, may explain why the data collected by Bonneville show no correllation between air changes per hour and radon concentrations: the noise in the source strength term drowns out the signal in the air infiltration rate term. On the other hand, there is an equally plausible hypothesis that reduced air changes per hour will not cause increased radon concentrations within a house; the same factors that reduce outdoor air infiltration may also reduce the source strength term (for example, by restricting the passage of radon and its daughters into the building). This means that the DEIS may err in associating lower infiltration with higher radon concentrations.

62

end of the spectrum defined in the figure, while others are at the lower end. This has important consequences for program design and mitigation, which the DEIS overlooks.

By using the equation and assumptions noted above, Bonneville has failed to average properly in two dimensions. First, as already indicated, a correct analysis must develop averages based on distribution functions for the conditions before and after weatherization. In contrast, the DEIS looks only at "typical" houses. Second, these averages must be calculated over time as well as over houses. The time averaging is performed incorrectly in the DEIS.

To see this, note that the equation properly describes the concentration during any hour, rather than the average daily concentration. If the air infiltration rate (I) is permitted to vary over the hours of the day, as it inevitably will if infiltration is the only source of ventilation in the house, the daily average concentration will be the average of 24 individual hourly concentrations. But the average of 24 "1/I's" is not equal to to 1 over the average of 24 "I's" (the DEIS assumption), and the difference has profound implications for indoor air quality: it means that relatively leaky houses which periodically experience low infiltration rates may have high instantaneous and average values of pollutant concentrations. As an illustration, consider a house which spends half of the year at an infiltration rate of .1 air changes per hour, and the other half of the year

at a rate of .9 air changes per hour. The average infiltration rate is .5 air changes per hour; thus, normalizing Mt_1/V in the equation to 1, one would calculate -- using the DEIS method -- that the average pollutant concentration is 2 (or $\frac{1}{.5}$). However, the actual concentration would be an average of $\frac{1}{.9}$ (or 1.11) and $\frac{1}{.1}$ (or 10). The average of these two values is 5.5, which is 170% larger than the result incorrectly calculated from the DEIS formula.

This example illustrates the general observation that when indoor ventilation varies, as it does in non-weatherized houses, the DEIS formula under-predicts indoor pollutant concentrations in the base case. If the house is merely tightened, and the same variability in infiltration rate persists, the DEIS's conclusions are not affected by this error. But in the mitigate-by-action scenarios that Bonneville proposes, the improperly averaged formula obscures an important environmental benefit of air-to-air heat exchangers. Heat exchangers will ensure that air infiltration rates never drop below a predictable minimum level. Thus, maximum indoor pollution concentrations in the worst hour are reduced from levels observed in the base case. Stated differently, sizing the heat exchanger to maintain measured pre-weatherization levels of air exchange will ensure net improvements in post-weatherization air quality. Average infiltration (I) will remain the same, but average pollutant

concentrations, which vary as 1/I, will be reduced. Even with the linear dose-response curve used in the DEIS analysis, a proper calculation will show that the mitigation-by-action alternatives significantly reduce the number of deaths and diseases caused by indoor air pollution.*

This error in averaging over time is only part of the problem. It is also important to note the effects of the variation between houses. In a base case without a Bonneville weatherization program, a number of houses in the region are likely to experience seriously unsafe indoor air quality. Without a weatherization program, it is unlikely that air quality will be improved or even monitored in these houses; actually, conditions will often worsen as residents do some weatherization on their own without any mitigation measures. In contrast, a mitigation strategy that matches heat exchangers to air quality needs can identify unsafe houses and provide sufficient ventilation (or other mitigation) after weatherization to ensure safe occupancy conditions. Again, net public health improvements will result.

In summary, these combined failures to consider distributions of indoor air quality -- both over time and among houses -- invalidate the DEIS's claim that a weatherization program, even with mitigation, will worsen average indoor quality

*This effect is even more pronounced if there is a threshold in the dose-response curve.

in the region. Proper accounting for these two effects yields the conclusion that a mitigation-by-action strategy will reduce current exposures to indoor air pollutants.

7 III. Mitigation Strategies: Going After the Source

The conclusions of the preceding section become even more robust when one considers the additional options available to Bonneville for improving indoor air quality. The agency apparently has not grasped that mitigation measures aimed at source strength are inherently more effective than those addressing only infiltration rates. Accordingly, the options that dominate the EIS are ventilation-enhancing heat exchangers and categorical exclusion of certain housing types from the program.* No attempt is made to study mitigation measures not directly related to infiltration rates. For example, venting combustion appliances will be much more effective as a means of reducing indoor pollutant concentrations than ventilating the whole house. Removing sources of formaldehyde (for example, by working toward enactment of state or federal standards limiting installation of products that create excessive emissions) would also be much more effective at controlling this pollutant than heat exchangers. For radon, it is likely that mitigation

*The exclusionary policy is clearly inappropriate; as shown in section II, occupants of "problem houses" will reap net health gains under "mitigation-by-action" policies, even as Bonneville increases its capture of cost-effective conservation resources.

strategies designed to reduce the introduction of radon into the house would work better than ventilation. For pollutants produced by wood stoves, sealed combustion systems with tight flues can virtually eliminate emissions to the room area. Not all of these and related options are or need be exclusively Bonneville's responsibility, but "[t]he mere fact that an alternative requires legislative implementation does not automatically establish it as beyond the domain of what is required for discussion, particularly since NEPA was intended to provide a basis for consideration and choice by the decisionmakers in the legislative as well as the executive branch." NRDC v. Morton, 458 F.2d 827 (D.C. Cir. 1972).

8 IV. Estimating the Environmental Impacts of the No-Action Alternative

A. Health Impacts of Coal-Fired Generation

The Northwest Power Planning Council has concluded that the region's "marginal resource" -- the most expensive supply source potentially in prospect over the next two decades -- is a coal-fired power plant. Coal's contribution will have to increase if demand growth continues and weatherization is cut back.

In evaluating the environmental consequences of weatherization, Bonneville has used reductions in air infiltration to predict pollutant concentrations and resulting effects on mortality and morbidity. For consistency, the DEIS

must follow a similar causal chain in evaluating the impacts of coal-fired power plants that would be needed in the absence of a weatherization program. But the DEIS fails even to carry the analysis from power plant emissions to pollution concentrations in the atmosphere, much less to relating these concentrations to estimates of mortality or morbidity. We show in this section that had the authors done so, the DEIS would show more lives saved through reduction of power plant emissions than would be lost through even nonmitigated weatherization.

The DEIS estimates total weatherization savings at 74.4 average megawatts. For reasons discussed below, this calculation underestimates achievable savings by a factor of about nine. But even if it were correct, the coal alternative is a net environmental loser.

The figure of 74.4 average megawatts is equivalent to some 650 million kilowatt-hours per year. As calculated in Appendix 2 to NRDC's Model Plan,* the quantifiable environmental costs of equivalent production by a new coal-fired plant would be approximately $13 million per year, almost all of which represents future deaths attributable to the mining,

*R. Cavanagh, M. Gardner, and D. Goldstein, Model Electric Power and Conservation Plan for the Pacific Northwest (Northwest Conservation Act Coalition, 1982). See also Letter from Ralph Cavanagh, NRDC, to Shepard C. Buchanan, BPA, Re Draft Assessments of Environmental Costs, October 26, 1983 (copy attached) (reviewing deficiencies in BPA-commissioned study of deaths attributable to construction and operation of new coal-fired plants.)

transportation, and combustion of coal. At the $1 million per statistical death valuation used in the Model Plan, this means that approximately 13 deaths per year would be caused by the additional power required to substitute for the BPA weatherization program. In contrast, the DEIS predicts an additional 9.25 annual deaths from a nonmitigated weatherization program. Thus, the program is environmentally beneficial even without mitigation; this disparity in impacts becomes overwhelming when the effects of mitigation are properly analyzed, as explained above in Section II.

B. Magnitude of Savings from an Expanded Residential Weatherization Program

In at least four major respects, Bonneville has understated the reliable energy savings attributable to a region-wide weatherization program. First, the estimate of 74.4 average megawatts excludes savings from measures which are intended only partially to reduce infiltration, and which have additional energy savings associated with their installation (such as storm windows). Second, it ignores the effect of measures that do not significantly reduce air changes per hour but are currently excluded from the BPA weatherization program (such as wall insulation). Third, it excludes the energy savings available from "house doctoring," a sophisticated method for reducing infiltration in houses that is exceptionally cost-effective when mitigation measures would already be required without it.

Finally, the technical method for calculating energy savings is incorrect. These points are discussed separately below; we emphasize here that a more accurate savings estimate will greatly improve the projected cost-effectiveness of mitigation measures, by expanding the base of electricity savings over which mitigation costs can be spread.

As a preliminary matter, we note a puzzling internal inconsistency. The DEIS total of 74.4 average megawatts averages to 685 kilowatt-hours per year per eligible household. A calculation on page 3.20, representing the regional potential for energy savings through leak plugging (including residences already eligible) shows a potential for 123 average megawatts, or 1132 kilowatt-hours per household actually weatherized. Yet the predictions of savings due to infiltration reduction on page K.7 typically exceed 1500 kWh/year. Thus, Bonneville may be under-counting the energy savings attributable to infiltration reduction, even before it enters the progression of errors described below.

In any event, it is clear that the BPA savings estimate makes no allowance for the effect of storm windows in reducing conduction heat losses through a building. Adding double-pane windows (compared to single) to a house saves approximately 2500 kWh/yr, according to the Council's Northwest Conservation and Electric Power Plan (Appendix K, pp. K-3 to K-4). This is greatly in excess of the savings predicted from infiltration

reduction, but it is an inextricable part of the net benefits that will emerge if mitigation for indoor air quality problems permits a Bonneville program to go forward. Counting the full costs of storm windows (which are used to derive the 794 million dollar cost estimate that appears at page xiv of the DEIS) is unfair and inconsistent unless the full savings from storm windows (in addition to infiltration reduction) are considered. This distortion takes on major proportions, because storm windows account for the lion's share of program costs in the DEIS.

Also, Bonneville is currently excluding wall insulation from its weatherization program on indoor air quality grounds. NRDC has always felt that this was inappropriate, because (as the DEIS concedes) the data linking wall insulation with reduced infiltration are extemely weak; nevertheless, if the program goes ahead, this measure (which offers mainly reductions in conduction losses) can no longer be omitted. The savings from adding wall insulation to the BPA program are estimated at 127 average megawatts, a figure that surpasses the total savings attributed in the DEIS to infiltration reduction. These savings are part of the environmental benefits of a mitigation-by-action alternative.

By the same token, the DEIS errs in omitting the potential contribution of house doctoring, which is not currently a part of the Bonneville weatherization program. Assuming mitigation-by-action, this exclusion can and should cease. The rest of the EIS assumes that air changes per hour will be 1/2 or larger for a

typical house following the weatherization program. If this is the case, house doctoring provides a clear and unchallengable potential for additional conservation. If heat exchangers are already part of the mitigation-by-action program, the additional costs of house doctoring are minimal compared to the large savings it would produce. The DEIS itself acknowledges a potential contribution from this source of 76 average megawatts (p. 2-55).

Finally, the DEIS calculates savings in Appendix K using an over-simplified degree day approach, in contrast to the computer-based simulation modeling used by the Regional Council and by Bonneville for purposes of preparing its regional demand forecasts. The simplified method "predicts almost 40% lower savings than the [Council's] plan,"* and its abandonment is long overdue.

Correcting all the DEIS's errors and omissions would produce a revised estimate of approximately 650 average megawatts in region-wide weatherization savings -- a nine-fold increase over the DEIS figure. Estimates of benefits attributable to avoided coal generation must be revised upward to compensate. In addition, as noted at the outset, the cost-effectiveness of mitigation measures will improve dramatically.

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*See, e.g., Comments of the Natural Resources Defense Council, Inc. on the Northwest Power Planning Council's Draft Regional Conservation and Electric Power Plan, p. 71 (March 18, 1983).

9

V. Other Technical Issues

A. Cost of Mitigation Measures

The DEIS overstates the cost of mitigation significantly in its undocumented cost projections for heat exchangers. It assumes a $650 installed cost per unit, with a "low case" cost of $600 and a "high case" of $700. Our data indicate that actual average and low costs are significantly less. High case costs, applicable to a house with unusually large ventilation requirements, could exceed $700.

A compilation of heat exchangers on the market in late 1981/early 1982 showed that six different models were available at a retail price of $400 or less.* These models are typically the low-capacity units that are appropriate for retrofit applications. In fact, the lowest-capacity, lowest-cost unit on the list ($120) supplies enough air to compensate a .14-ACH infiltration reduction in a 1200 ft^2 home -- an 18% reduction from the typical air exchange rate of 0.8 ACH used in the DEIS (Table A.2). Installation of any of these units is simple, and should not take more than an hour. Thus, a realistic range of costs would be from $200 to $450, or less if wholesale prices are lower than retail, or if BPA can secure volume discounts. The

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*Source: W.A. Shurchiff, "Air to Air Heat Exchangers for Houses," Solar Age (March 1982). Since this article was published, heat exchangers became mandatory for new houses with certain fuel sources or in certain climate zones in California, so a wider selection is likely to be available today.

DEIS's $650 mean cost estimate is probably too high by a factor of two.

10 B. The DEIS Ignores the Benefits of Reducing Wood Heat Use

Appendix C to the DEIS describes current outdoor air pollution levels in the Northwest. Many regions are characterized by high concentrations of outdoor pollutants caused by woodburning. A BPA weatherization program will reduce wood combustion as well as electricity consumption. While precise quantification is difficult, it is clear that expanded BPA weatherization can make inroads on mortality and morbidity by reducing outdoor air pollution. But this prospect is completely ignored in the DEIS. The final statement should include estimates of reductions in outdoor air pollution emissions and the resultant reductions in concentrations and in mortality.

11 C. The Estimated Costs of Infiltration Reduction Are Too High

The DEIS cites a cost estimate of $794 million for the expanded weatherization program. This appears clearly excessive by reference both to alternative cost estimates and to the projected level of savings.

The proposed program targets 951,000 households, not all of which will respond. Yet even assuming 100% participation, $794 million is equivalent to $835 per house. In contrast, the Regional Council estimates that leak-plugging costs an average of

about $300 per house, while storm windows cost less than $1000. (Regional Plan Appendix K, pp. K1-3.) Since less than one-third of the region's electrically-heated houses are eligible for storm windows,* it is hard to see why BPA's costs are so high.

12 D. The DEIS Ignores Asbestos Hazards

Unlike the "Issue Alert" released with the DEIS by Bonneville, which at least mentions the problem of asbestos pollution, the DEIS itself is silent on the subject. But this is an area where a weatherization program offers Bonneville the opportunity to remedy a pre-existing health problem.

An undocumented number of heating systems in the Northwest used asbestos insulation in their furnaces or heating ducts. An expanded weatherization program offers BPA opportunities to reduce or eliminate the hazard as a cost-effective part of its program, as follows:

- o If ducts are insulated with asbestos, the program can remove the material and replace it with more effective (and safe) insulation; alternatively, the asbestos can be covered by new insulation, protecting it against chipping.

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*See R. Cavanagh, M. Gardner, and D. Goldstein, Model Electric Power and Conservation Plan for the Pacific Northwest (1982), Appendix 6, pp. 15-17 & 32 and Appendix 9, p. 13. The Model Plan results are based on the same survey (Elrick and Lavidge) used in the DEIS. This survey shows that less than 30% of the windows in the region's electrically heated houses are single-glazed.

- o If furnaces use asbestos insulation, they can be replaced with high-efficiency heat pumps.

13 E. Linear vs. Threshold Dose-Response Functions

The DEIS takes an inconsistent position with respect to the existence of thresholds for health effects of indoor air pollution. While the calculations of increased cancer risk are based on a linear hypothesis (which asserts that all incremental exposure, no matter how trivial, produces proportionate increases in cancer risk), the air quality guidelines proposed for mitigation purposes assume that there are threshold levels of pollution below which no harm will occur. This inconsistency means that the risk of mortality is a potentially important factor in deciding whether or not to do weatherization, but is not as important when deciding how much mitigation investment to provide.

As a practical matter, correcting this inconsistency would entail the use of a different mitigation strategy than those proposed in the DEIS. This strategy contemplates the universal installation of mechanical ventilation (such as air-to-air heat exchangers), with the size of the unit to be determined by the extent of infiltration reduction and the level of criterion pollutants measured in the house. This could be implemented as follows:

For a house without measurable pollution problems, a heat exchanger would be sized to exactly compensate the reduction in air

changes per hour caused by the weatherization.* If pollutant concentrations were high, heat exchanger size would be adjusted upward to meet some target level of concentration of the pollutant; alternatively, source-oriented pollution control techniques would be used. This strategy reduces time-average pollutant concentrations in all houses, while also addressing the "problem" houses.

Conclusion

The major deficiencies we have noted in the DEIS can be corrected within the analytic framework of the document. These comments are intended to provide constructive guidance to BPA in revising the DEIS and designing an expanded residential weatherization program. With the suggested revisions, the final EIS will demonstrate that a weatherization program can improve the quality of air both indoors and out, while saving substantial amounts of electricity in a cost-effective manner.

*If house doctoring is added to the program, as NRDC recommends, actual ACH reductions would be measured for each house.

Natural Resources Defense Council, Inc.

25 KEARNY STREET
SAN FRANCISCO, CALIFORNIA 94108
415 421-6561

Washington Office
1725 I STREET, N.W.
SUITE 600
WASHINGTON, D.C. 20006
202 223-8210

New York Office
122 EAST 42ND STREET
NEW YORK, N.Y. 10168
212 949-0049

November 14, 1983

APPENDIX TO NRDC COMMENTS ON THE EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM DEIS

Letter from Ralph Cavanagh, NRDC, to Shepard C. Buchanan, BPA, re Draft Assessments of Environmental Costs (October 26, 1983)

Natural Resources Defense Council, Inc.

25 KEARNY STREET
SAN FRANCISCO, CALIFORNIA 94108
415 421-6561

Washington Office
1725 I STREET, N.W.
SUITE 600
WASHINGTON, D.C. 20006
202 223-8210

New York Office
122 EAST 42ND STREET
NEW YORK, N.Y. 10168
212 949-0049

October 26, 1983

Shepard C. Buchanan
Office of Power and Resources Management
Bonneville Power Administration
Portland OR 97208

RE: Draft Assessments of Environmental Costs

Dear Mr. Buchanan:

This letter responds to your request for NRDC's comments on draft reports by ECO Northwest assessing environmental costs of coal and combustion turbine electrical generation facilities.

As I trust you realize, NRDC authored -- and submitted to Bonneville nearly two years ago -- a major effort to quantify generic environmental costs associated with five major electricity resource categories. Coal-fired plants were included; combustion turbines were not explicitly modeled, although many of the NRDC proposals were generalizable across technologies. To my astonishment, I discern no evidence in the ECO Northwest assessments that the authors so much as glanced at NRDC's work. More than injured pride moves me to protest, although the omission would speak volumes about BPA's receptiveness to public comment on technical issues unless -- as I hope -- you are moved to institute prompt remedial action (and I don't just mean listing in the bibliography!). What is most frustrating is that I'm convinced the ECO Northwest analysis would have benefitted greatly from a process that built on our work, eliminating the necessity for me to raise a number of fundamental objections at this stage of the process. The most important of these are

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summarized below, but I commend to you all a careful review of the NRDC report itself (Appendix 2: Environmental Costs, Model Electric Power and Conservation Plan for the Pacific Northwest (November 1982) (cited below as Environmental Costs; submitted in draft form to BPA on November 10, 1981).

Value of Human Life: For our comprehensive treatment, see Environmental Costs at 9-10, 14-25. ECO Northwest accords this crucial issue all of two paragraphs (Boardman, III-14). The draft's remarkably selective survey of the relevant literature suggests that the highest responsible "value of life" estimate is $750,000 (apparently 1980 dollars, although the authors decline to specify). As we demonstrate at length in Environmental Costs, the upper end of a reasonable range is at least four times greater (see, e.g., pp. 20-25).

Discounting Human Deaths: ECO Northwest uses a three percent real discount rate to assign a present value to future human deaths. This is bad economics and worse ethics. See Environmental Costs, p. 9:

> [D]iscounting [human deaths] leads to a manifestly unjust transfer of life-threatening hazards from our generation to future generations ... "Safety and lives cannot be banked at interest as money can and ... discounting risks is neither morally nor theoretically sound." [Quoting A. B. Lovins, "Cost-Risk-Benefit Assessment," 45 George Washington University Law Review 911, 918]

Does Bonneville really dispute this? If so, the region's citizens (not to mention their progeny) are entitled to some explanation.

Global Analysis of Carbon Dioxide: This section (Boardman III-15 to III-16) accords two gravely flawed paragraphs to a global threat that we addressed at length (Environmental Costs, pp. 40-43). The disparity in conclusions is staggering; NRDC found an upper bound of 123.6 mills per kWh, whereas ECO Northwest derives an estimate essentially equal to zero. The primary reason for the disparity is that ECO/Northwest has altogether ignored human deaths attributable to global famines arising from the catastrophic climate changes modeled in the Schneider and Chen study cited at page III-15; Schneider and Chen themselves address only property damage. If you (1) correct this omission; (2) assign appropriate human life values; and (3) refrain from discounting them into insignificance, carbon dioxide loadings will take on the major importance they in fact deserve. See Environmental Costs, pp. 42-43.

Other Comments: The "boomtown effects" analysis loses sight of the elemental fact that we are addressing environmental costs and benefits here. "Boomtown effects" end up as net benefits on the strength of reduced per capita tax payments by residents in the host county. We await with eagerness some indication of the relevance of these reduced tax payments to environmental costs and benefits. We would also welcome some source, even at the anecdotal level, for the proposition that $5000 is adequate compensation for the disruptions visited by plant construction on a pre-"boomtown" resident. For that purpose, we suggest that you contact a member of the staff of the Northern Plains Resource Council, an organization which -- unlike the authors of the draft -- has extensive experience with the social impacts of power plant construction in rural areas.

These observations by no means exhaust our areas of difference with the authors; we continue to feel, for example, that a social

discount rate of 3% is too high by a factor of at least three, for the reasons explained in Appendix 1 to the Model Plan (this is only relevant in the context of property damages since, as explained above, human deaths should not be discounted).* What I hope we will get in the final report is a serious treatment of the issues raised in our earlier work, and the corrections that -- for the reasons explained above -- are urgently needed. ECO Northwest's analysis amounts to an invitation to write environmental costs out of Northwest power planning; the entire region will be the loser if that invitation is accepted.

Thank you for the opportunity to comment. We look forward to receiving the final reports.

Yours sincerely,

Ralph Cavanagh

Ralph Cavanagh
Director
Northwest Energy Project

*We are puzzled by ECO Northwest's suggestion that its conclusions are "insensitive to the choice of a discount rate" (p. IV-1). Looking only to property damages associated with carbon dioxide loadings, a 3% real discount rate converts $5.1 trillion in 2100 to $139 billion today (p. III-5). A 1% rate yields a present value of $1.55 trillion. See Environmental Costs, p. 41. Any future cost or benefit occurring as an "annual flow" should similarly be sensitive to discount rate assumptions. How does ECO Northwest justify its assertion (p. IV-1) that discount rates are only relevant in the context of "one-time-only costs"?

Marcia Rundle
1130 Mountain View Drive
Missoula, Montana 59802

November 8, 1983

To: Bonneville Power Administration
Re: Expanded Weatherization Program Comments

1 Of the three action alternatives described, the "proposed action" is the best. However, eligibility needs to be increased by providing mitigation methods and by using House Doctoring and wall insulation. Air-to-air exchangers should be part of the plan.

I have three basic concerns with the Draft,

1.) that the eligibility requirements of homes are so strict that very few homes in Western Montana would qualify;

2 2.) that eligibility strictness may be the result of underestimating the amount of air exchanges in the existing housing stock, and, therefore, overestimating the effects of indoor air pollutants;

3.) that existing techniques for measuring air exchanges or modifying their effects have not been programmed into the Draft adequately.

I agree that indoor air quality is an important consideration, but vigorous action should be taken to overcome the problems.

Thank you for this opportunity to comment.

Sincerely,

Marcia Rundle

65

JOHN SPELLMAN
Governor

DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504 • (206) 459-6000

November 14, 1983

Mr. Anthony R. Morrell
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

Thank you for the opportunity to review the draft environmental impact statement for "The Expanded Residential Weatherization Program." We coordinated the review of this document with the other state agencies and received one comment letter from the Parks and Recreation Commission. Their letter is attached for your information.

If you have any questions, please call me at (206) 459-6237.

Sincerely,

Greg Sorlie
Environmental Review Section

GS

cc: Dave Heiser, Parks

64

JOHN SPELLMAN
Governor

STATE OF WASHINGTON
WASHINGTON STATE PARKS AND RECREATION COMMISSION
7150 Cleanwater Lane, KY-11 • Olympia, Washington 98504 • (206) 753-5755

September 23, 1983

RECEIVED
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DEPARTMENT OF ECO
ENVIRONMENTAL RE

TO: Barbara Ritchie, NEPA Coordinator
Department of Ecology
Lacey PV-11

FROM: David W. Heiser, E.P.
Chief, Environmental Coordination

RE: Draft EIS - Bonneville Power Administration -
"The Expanded Residential Weatherization Program"
(35-2650-1820/E-2590)

Staff of the Washington State Parks and Recreation Commission have reviewed this DEIS and offer the following comments. Washington State Parks has been engaged in a program to conserve energy by retro-fitting existing buildings and concurs with BPA's proposed action. We believe there are substantial energy savings yet to be made by such a program.

Secondly, we would like to be able to receive credit for insulation of residences done prior to the initiation of this program. We are currently engaged in a program which will place blankets on all hot water heaters and utilize other "house tightening" measures.

Thank you for the opportunity to provide comment on this program.

bh
cc: Bonneville Power Administration
Kris Kauffman, WSP&RC

LANE REGIONAL
AIR POLLUTION AUTHORITY

(503) 686-7618
1244 Walnut Street, Eugene, Oregon 97403

Donald R. Arkell, Director

November 14, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland OR 97208

Dear Mr. Morrell:

We appreciate the opportunity to review the draft EIS on "The Expanded Residential Weatherization Program." Using the available data, the draft takes a fairly thorough approach to the problem of indoor air quality impacts from the proposed action.

1 The reader is cautioned on several occasions that, due to input data variability, one should not rely on the magnitude of the projected impacts, but rather look at the relative differences between the impacts of the tested alternatives. However, upon reviewing the extreme range of values for input data, we believe it is doubtful that even an analysis of relative differences would be very meaningful. Because of the uncertainty of this database, there may not be a statistically significant difference between projected air quality impacts of the action and no-action options.

The results of the analyses show very high impacts of all of the pollutants, in many cases well above existing NAAQS, even for the no-action alternative. Even though the authors are correct in their interpretation that these high levels will not cause immediate deaths, the long-term chronic effects are not well known.

2 In view of this, we question the validity of OSHA workplace standards to evaluate the health impacts. OSHA standards were written for generally healthy adults under normal work conditions. The draft should acknowledge that in most instances it is the very young, the elderly, and the invalid that spend the majority of their time within their homes. The draft does recognize that there are no standards for indoor air quality. However, since the outdoor NAAQS are developed more for the health effects on the general population, these are probably more appropriate standards to use for evaluation of impacts.

3 Specifically, we would like to comment on the data discussed on page C.4. You should be aware that the Eugene-Springfield Metropolitan Area exceeded the 8-hour CO standard on two days during 1978 and 1980. Also, residential wood combustion from woodstoves and fireplaces has been identified as a significant source of both TSP and CO in this area.

4 We would recommend an accelerated research program to develop feasible active mitigation measures, and potential ways to help finance them.

If you have any questions regarding these comments, please feel free to call me at 686-7618.

Sincerely,

Ralph E. Johnston
Projects and Planning

REJ/mjd

7049 - 34th N.E.
Seattle, Washington 98115
December 3, 1983

In reply to: Copyright licence request.

Bonneville Power Administration
P.O.Box 3621-SJ
Portland, Oregon 97208

Attention Mr. Anthony R. Morrell

Dear Sir:

Be it known that licence is hereby granted to Bonneville Power Administration to reproduce, transmit, store, and distribute the material titled:

Draft E.I.S.
THE EXPANDED RESIDENTIAL
WEATHERIZATION PROGRAM

A Review

Sincerely,

Richard Lee Gilmore

Richard Lee Gilmore

Draft E.I.S.
THE EXPANDED RESIDENTIAL
WEATHERIZATION PROGRAM
A Review

ERRATA

COPYRIGHT Change by in second line to may.

page 1 Change evironmental in line three to environmental.
Change to in third line from bottom to too.
Move comma in eighth line from bottom from after "and" to after "was".
Insert hyphen into "co workers"

page 2 Change air in ninth line from bottom to are.

page 5 Change bloke in line seven to block.
Change posative in line eight to positive.
Change sparkes in line eight to sparks.

page 6 Change and in line ten to an.
Change porperly in line eleven to properly.

page 9 Change arrise in line fourteen to arise.
Change merchanants in fourth line from bottom to merchant's.

page 11 Change sotve in last line to stoves.

page 12 Change lions in second line to lion's.
Change no in line eight to not.

page 13 Change develope in line two to develop.
Change desighned in line four to designed.

page 14 Change ommisions in line three to omissions.
Change electrial in line four to electrical.
Change ignors in line six to ignores.
Change lafge in fifth line from bottom to large.
Change to in fourth line from bottom to too.

page 17 Change persperation in line seven to perspiration.
Change dialing in ninth line from the bottom to dealing.
Change theem in third line from the bottom to them.

page 18 Change condenstation in line nine to condensation.
Change descussed in the sixteenth line to discussed.

page 22 Change thouroughly in the sixth line to thoroughly.
Change beleive in line tenth line to believe.

page 20 Change some times in next to last line to sometimes.

Draft E.I.S.

THE EXPANDED RESIDENTIAL WEATHERIZATION PROGRAM

A Review

by

Richard Lee Gilmore

Design Consultant

November 1, 1983

66

The purpose of this report is not to question the real or imagined dangers of house tightening. It will be assumed, for the sake of argument, that all pollution sources mentioned in the draft evironmental impact statement (E.I.S.) by B.P.A. on the weatherization program dated August 1983, pose a clear and present danger. Active mitigation techniques will be explored for all pollution sources mentioned in the E.I.S. I will also cover simple and cost effective weatherization measures that should be included in the program to increase effective energy savings. Finally, I will discuss a major indoor air pollutant that is almost totally ignored by the E.I.S.

During my tenure as a residential energy auditor for Snohomish P.U.D., I had the opportunity to take part in the initial implimentation of the B.P.A. Buy Back Program. I felt the mitigations by exclusion were based on vastly overstated dangers, in some cases. The following is an example. A small two bedroom rambler with a vented crawl space had an attached garage converted to a family room. The details of the garage conversion are as follows:

1. A 6 mil plastic sheet covering the existing concrete garage floor.
2. Fiberglass insulation, with a vapor barrier, installed using a B.P.A. approved proceedure.
3. A continuous perimeter vent that exceeds all jurisdictional requirements.

This home was and, as far as I know, still is denied any house tightening measures under the Buy Back Program due to supposed concerns that radon gas would some how breach this barrier/venting strategy and contaminate the home.

The E.I.S. finding that the program, as it stands, is unpopular with many people is hardly surprising in light of the above example. I, and many of my co workers, became extremely frustrated. The situation I have described was all to common. I do not mean to imply that there are no real problems to be dealt with but, the E.I.S. seems to be sadly misdirected in it's priorities.

MITIGATION BY ACTION; TECHNIQUES NOT EXPLORED

Fire places and Other Wood Burning Appliances. To burn wood a source of oxygen is required. For most homes this source is found inside the room occupied by the appliance (see Fig. 1A). The rate at which air is drawn into the firebox depends on three things:

1. The size of the appliance.
2. The stage of the burn cycle.
3. The control decisions of the operator.

During the early stages of the burn cycle, a large amount of air is needed for efficient combustion. It is not unusual for a moderately sized wood heater to require over 40 c.f.m. of air. If the home is typical and inadequately tightened, this means 40 c.f.m. of cold and often dry outside air will be drawn into the house. In fact, the normal wood heating installation will, over the entire burn cycle, cause a net energy loss to the home through induced infiltration. The house will feel overly warm for a short while, but by the time the last ember has died, all the energy will be lost up the chimney. If, on the other hand, the home is properly weatherized, the stove will be starved for air and creosote will form and back drafting of smoke into the house will occur.

How then air the problems of inefficiency and indoor pollution handled? There are two minimum requirements for a safe and efficient installation. First, a source of combustion air must be brought in from outside the structure. This is surprisingly easy in most cases be they cook stoves, masonry fireplaces, or free standing units. Figures 1B and 2 show simple through the floor and wall strategies that work for most free standing units. Figure 3 depicts an unusual set of circumstances encountered only once in the hundereds of installations I have inspected. The intake vent penetrates the roof and is finished by a standard roof jack vent.

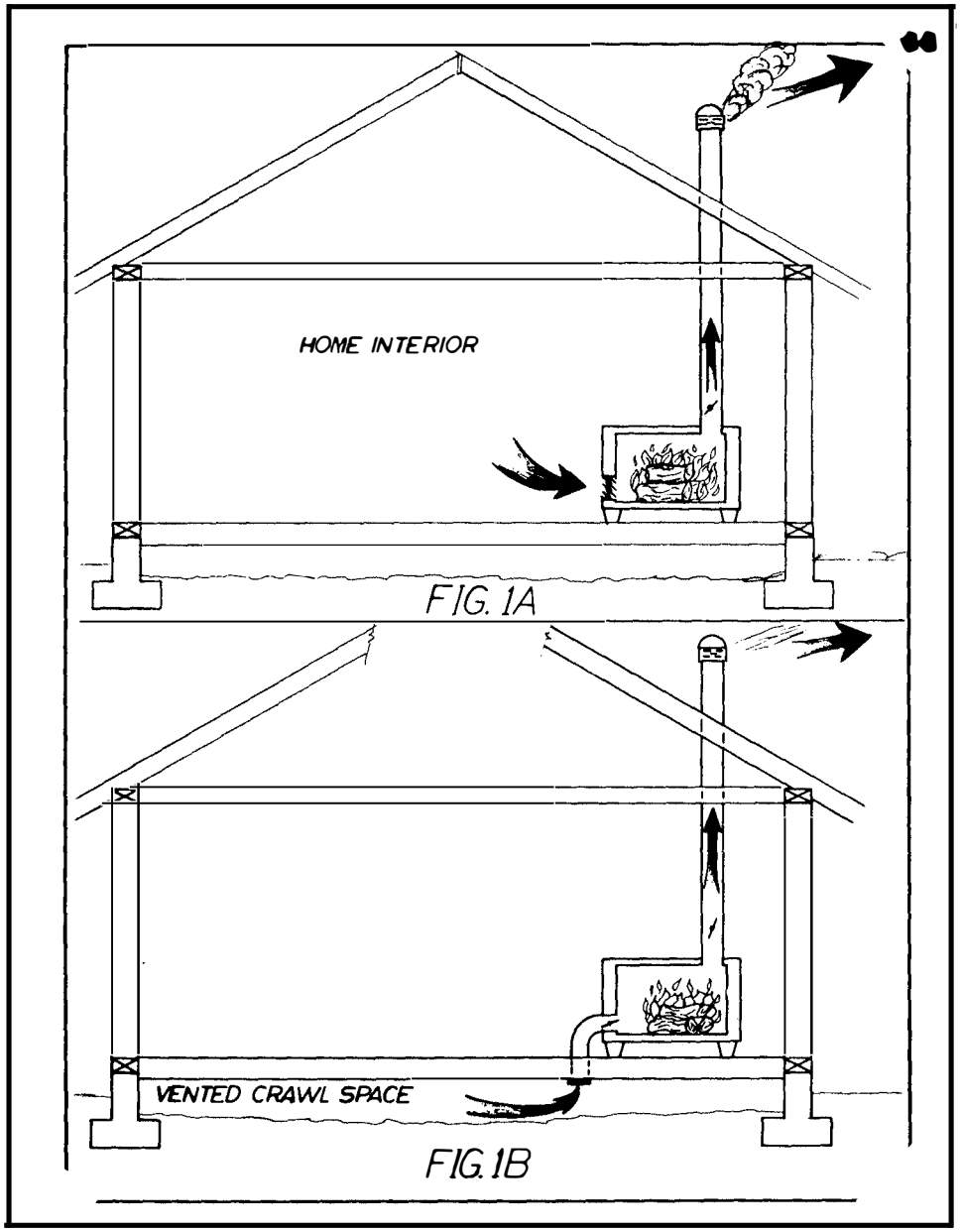


FIG. 1A

FIG. 1B

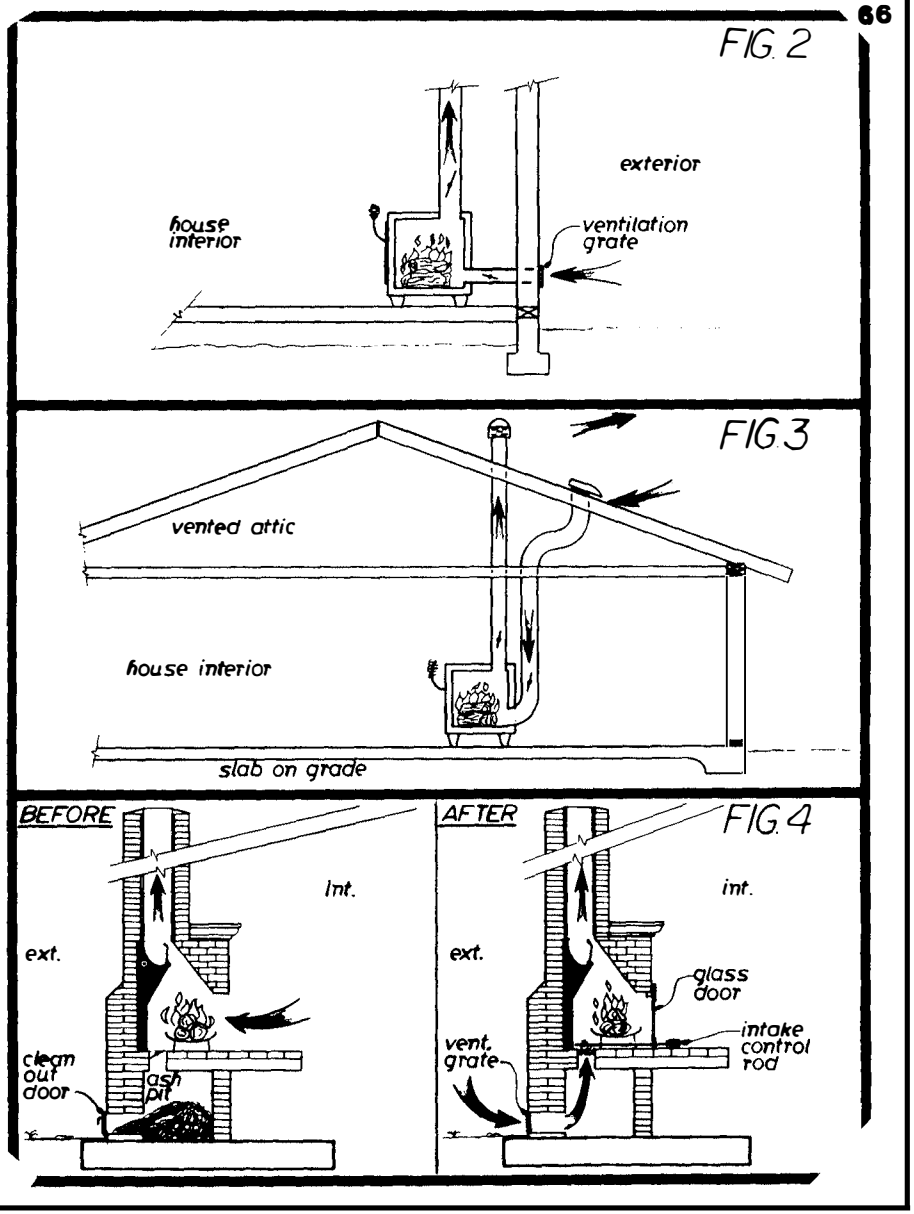


FIG. 2

FIG. 3

FIG. 4

Finally, figure 4 BEFORE and AFTER illustrates a common installation. The ash dump cleanout door is replaced with a screen. This is to prevent access to pests. The firebox ash dump door is replaced by an operable vent. The firebox opening is covered by glass fireplace doors. If there is not a built in "heat-o-later", I recommend the installation of one in conjuction with the glass doors. I have used this method on several fireplaces and everyone is continually amazed by the dramatic improvement in performance. The glass doors not only bloke smoke contamination, but provide a posative barrier to flying sparkes and embers.

The second requirement for a safe wood heat system is heat storage. This can be accomplished using water, masonry, or eutectic salts. If storage is not available to capture the excessive heat released in the early burn stages, the operator might waste heat by over ventilation (opening a door) or fall back on the dangerous and inefficient practice of starving the fire for oxygen by closing the dampers. Starving the fire for air does three things:

1. It lowers the temperature differential between the heat source and the heat absorber. This results in less efficient energy transfer.
2. Wood is a complex collection of fuels with various combustion temperatures that range from approximately 200 to 1,200 deg. F. Therefore, the higher the firebox temperature, the more fuels that will be consumed. Additionaly, if the fire is allowed to reach 500 to 600 deg. F. the wood alcohol will be burned and no significant creosote will form in a properly sized chimney. I have never had to sweep the chimney of an appliance I operate, though I give them regular inspections.
3. When a wood burning appliance is operated safely and efficiently, there is a significant reduction in outdoor air pollution. This is in direct contradiction to page 4.6 paragraph 5 of the E.I.S. This assertion is supported by the research of Prof. Richard C. Hill of the Univeraity of Maine.

Outside combustion air and a method of heat storage are two requirements of a safe wood heat installation, but any equipment is only as safe as it's operator. "Heater-related fires are caused almost exclusively by installation, operation, and maintenance errors, not by unsafe equipment" Wood Heat Safety by Jay Shelton, Garden Way, 1979. Example, wood smoke need not be released into the home when the appliance door is opened, as stated in the E.I.S., if the operator is aware of the damper controls and how to use them. Operator education is not peripheral to the indoor air quality issue, it is central.

I can see no need for and air to air heat exchanger (A.A.H.E.) based on the presence of a fireplace. However, a porperly tightened house requires one anyway, and its inclusion would only reduce the threat from the occasional puff of smoke that might occur.

Radon From Concrete and Soil. The methods of mitigation in the E.I.S. are good, as far as they go. However, ventilation of crawl or attic spaces and/or the use of A.A.H.E. is more effective when used in conjunction with barrier stratagies.

Interior Slab on Grade.

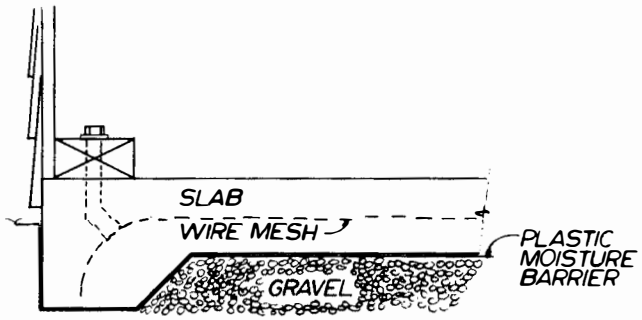
It is especially true in areas of high ground moisture content that prior to the pouring of concrete, a layer of plastic is installed to prevent moisture leaching through the floor (see Fig. 5.). I assume this plastic is also effective at inhibiting gasses from passing from the soil to the slab. let us take the concept of barriers one step further and apply an impermeable sealing coat to the cured concrete floor. This should stop gasses trapped in the slab from entering the home, thus drastically reducing the pollution an A.A.H.E. would have to handle. Retro-fitting this sealant is a possibility for problem homes that might be encountered in the mineralized regions. I propose the use of sealing coatings for concrete to be studied under the delayed option plan. This should not however, delay the immediate implimentation of the full weatherization program to all homes.

Homes With A Basement - Unheated Storage/Workspace.

If there is an entrance to the basement from the living area, that door should be fully weatherstripped and the frame caulked. Next, any penetrations through the ceiling of the basement for plumbing, electrical wiring, or any other holes should be caulked. The next concern is ventilation. The basement should be vented to prevent moisture problems. This would also reduce radon concentrations. Of course you will want to insulate the basement ceiling and the installation of a general vapor barrier might be considered.

Basement Living Area or Earth Sheltered Homes.

FIG. 5



TYPICAL NON-INSULATED SLAB DETAIL

In an earth sheltered home there is usually great attention paid to the tightness of contruction. This is true for all structures built with energy efficiency in mind. However, the common earth sheltered house has few places to leak air to begin with so ventilation is a high priority. A.A.H.E. are used as a matter of course. The massive amounts of concrete though, may be cause for some concern as to whether an A.A.H.E. provides sufficient protection. The techniques for sealing concrete could take on great significance in both earth sheltered homes and residences with basement living areas.

Whole House Plenums.

Though not mentioned in the E.I.S., this rather rare (in western Wa.) method of hot air distribution does disqualify a home from house tightening measures. The techniques of plastic sheeting and concrete sealing should solve any problems that might arrise.

Unventilated Crawl Space.

Most unventilated crawl spaces I encountered as an energy auditor were caused by the owners going to a local hardware store and buying kits packaged and advertised for the express purpose of damming vents to save energy. This does in fact work for a few months to a few years. Then the dry rot sets in and the structure eventually needs major repairs including installation of proper venting. The sale of material for blocking vents should be banned, and a public education program should be instituted to let people know why vents are necessary. I think leaflets and/or posters prominently displayed in the offending merchanants stores would be an effective and low cost start. The current requirements for vents and ground cover are adequate.

Well Water.

Water could be pumped into a storage tank that would allow the outgassing of radon before it enters the house. Some balance of temperature, time, and evaporation loss will need to be worked out based on the amount of radon found on each site.

Combustion Products From Sources Other Than Wood Appliances.

Mitigation in most cases is similar to that of the wood stove strategies mentioned earlier.

Portable Combustion Space Heaters.

The problems of the portable space heater are similar to the wood burning appliance only there is no chimney to carry combustion products away. These heaters are used to take advantage of the highly effective concept of zone heating. Heating only the area you are using is an excellent idea when you take into account humidity control, heat source, and ventilation needs. In the properly tightened home there is no room for appliances that consume interior air for combustion. There is also no room for an appliance that discharges combustion products into the home. In chemistry it is taught that total combustion yeilds three products: CO(2), H(2)O, and heat. This is true if there is ample oxygen, high enough temperature, and fuel without impurities. Rarely, outside of the laboratory, are any of these three criteria meet, let alone all three.

If a particular room has a high occupancy rate, then a permanent installation with proper intake and discharge vents might be appropriate. Education of the public is needed since subsequent property owners can, quite beyond the control of B.P.A., bring in portable combustion space heaters.

Natural Gas Furnaces and Hot Water Heaters in Living Areas.

Again, as with wood buring appliances, a source of combustion air must be brought in from outside the structure. Since furnaces and hot water heaters already have flues to vent combustion products, the necessary modifications are minimal.

Natural Gas Fired Ranges and Ovens.

All sotve and ranges, irregardless of their fuel types, should have an exhaust vent hood ducted to the exterior of the building. This hood will not only remove combustion products, but will also take care of the lions share of the cooking fumes and excess humidity. A properly sized and installed vent fan will draw 200 to 500 c.f.m. of air from the kitchen area. The simplest method of providing make-up air is to crack open a window that is closest to the cooking surface. This will create a localized air flow in the kitchen and have minimal effect on the rest of the home. Spot venting of the kitchen is especially important in floor plans where the kitchen is no segregated from the rest of the house by a door.

This technique for kitchen venting is extremely dependent on awarness of the necessity of spot ventilation. Education is the key to succuess in this case.

Cigarette Smoke

Smoking is its own reward. Unfortunately it seems to have a deleterious effect on other occupants. It is certainly irritating to most nonsmokers. In my auditing experience I found that more and more smokers are coming to grips with these ideas. In cases where one occupant smokes and wishes to minimize the effects on others, I have suggested a smoking room equipped with a separate ventilation system much like the one I outline for a bathroom. Again, education is the only realistic action available.

Ureaformaldehyde Foam Insulation, Formaldehyde Constuction Materials.

I strongly recommend A.A.H.E., monitoring and education over delay or exclusion.

Humans

If all other indoor air quality problems have been addressed, any problems produced by resperation will also be solved.

Exterior Air As A Pollution Medium.

Some areas, under certain conditions of weather and pollution generation, develope health threatening conditions in the ambient air. A tightly sealed home with controlled amounts of outside air introduced through a desighned ventilating system has a wonderful opportunity to protect the occupants from airborne hazards. Both electrostatic cleaners and fiber filters can be easily incorporated into the venting techniques I have mentioned.

For example, the use of a slightly opened kitchen window to allow make-up air for the exhaust fan can be fitted with a frame on a hinge. This frame, that folds out of the way when not in use, could hold any number of filter mediums available. This inexpensive system could handle many of the common air borne particulates. Cleaners could be installed on an A.A.H.E. or indoor systems might be installed. In any case, the tight home is going to allow less of the harmful outside pollutants in when compared to the ordinary leaky house.

WEATHERIZATION TECHNIQUES NOT COVERED

It is understandable that the program's weatherization be of a standard nature and address only the common problems of more typical construction types. There are some substantial ommisions. One major source of infiltration only partially covered by the present program is electrial penetrations. Currently, gaskets are supplied for outlets and switches on exterior walls only. This totally ignors how houses are built. Wiring is typically run through the attic. Holes are drilled through the top plates of the stud wall to run wiring through interior as well as exterior walls. If the attic is vented properly, air will leak through all walls, unless the holes were filled with caulk after the wire was run. In the thousands of homes I have inspected, I have never seen this detail.

Therefore, the least B.P.A. should do is provide gaskets for all switches and outlets. Ideally, the penetrations should be caulked. Another major penetration can be found in the ceiling where wires come through to supply light fixtures. It is not difficult to loosen the decorative cover of most fixtures and discover a hole about the size of a nickle that leads directly into the attic. This is easily sealed with a small amount of caulk. In most cases the fixture need not be disconnected.

There is however, one common light fixture that represents a major energy leak and danger to the occupants. This is the recessed can light that uses an incandescent bulb.

In operation the incandescent bulb produces a lafge amount of sensible heat as compared to visible light. If the bulb gets to hot, it will have a much shorter life span. To cool the bulb, the can in which it is housed allows air to flow through freely. This is wonderful for the bulb, but not for the heating or cooling efficiency of the house. Some people, recognizing

this fact, have blocked the vents or installed insulation directly over these fixtures. This has been the cause of many fires. In the past few years something else has come to light. Wood exposed to what were thought to be harmless temperatures (150 to 200 deg. F.) will over a period of 20 to 30 years, change in chemistry and ignite in this low range. The 1982 I.C.B.O. uniform building code, just adopted by the city of Seattle, states that a permanent loss of strength will occur when wood is subjected to prolonged temperatures in excess of 150 deg. F. I have personal knowledge of a fire that started in a properly installed, non-modified recessed light that had been in place for about 25 years. My recommendation to people with these fixtures is to have them removed and replaced by a safer installation.

Much to the credit of the building industry, safer and more energy efficient recessed fixtures have been developed, though there is some question as to their compatability with the new code. If there is a need or desire to keep a recessed fixture, I always suggest the use of fluorescent bulbs. When used with a diffusing plastic lens, they provide more uniform and efficient general lighting than the cans did anyway.

Finally, plumbing penetrations are common to most houaes and allow air infiltration into wall cavities. While the electrical outlet gaskets help, the problem is best handled at the source. A little caulk ,while installing floor and/or ceiling insulation, will go a long way toward much lower energy consumption.

WATER VAPOR - THE POLLUTION THAT GETS NO RESPECT

Most people have the mistaken idea that air temperature alone is what governs comfort. Comfort is determined by three main factors: air temperature, mean radiant temperature, and relative humidity (R.H.). Studies by A.S.H.R.A.E. indicate that as R.H. approaches high or low extremes, the range of air temperature considered comfortable narrows. This means heating and cooling controls systems are constantly adjusted in a vain attempt to maintain comfort. This translates into less efficient, and thus, more costly operation.

The old idea that the moister the air, the warmer it feels is true only to a limited extent. If air is extremely moist, then slightly warm air will feel muggy and slightly cool air will feel clammy. If the air is particularly dry, then discomfort and respritory problems will occur. It has been my experience that indoor air should, during the winter months, have a R.H. in the range of 50 to 60%.

If a home is well caulked and weatherstripped, and all combustion appliances are properly vented, the occupants will have little trouble in maintaining this moisture level. The lore of the wood stove says that they produce dry heat. The truth is, fireplaces that take their combustion air from within the home will cauae infiltration of large amounts of cold dry air driving the R.H. down. A wood burning appliance installed in accordance with this report will not have that effect. Adding humidity, if needed, is much easier and less costly than dehumidification. Unlike air temperature, that tends to vary greatly throughout a structure, humidity tends to be very uniform. It is somewhat analogous to the level of a swimming pool. No matter where you add or take away water from the pool, the level of the pool is equally effected over the entire surface. Therefore, putting a pot of water

on to boil in the kitchen will raise the R.H. in the entire house, assuming you have not turned on the ventilation fan.

During the summer months a lower R.H. is needed for comfort and health. The human body needs to give off heat. This rate of heat loss depends on the age of, and amount of work being done by, the occupant. When air temperatures start to exceed 85 deg. F., the major mechanism for heat loss is through persperation. This persperation must evaporate to do its job. If the R.H. is high, the rate of evaporative cooling is low. This relsults in discomfort at best and heat stroke at worst. It has been my experience that R.H. should be kept at 30 to 40% if possible.

In some climates this would be impossible without dehumidifiers during extreme conditions. Even under extreme conditions, the tight home has the advantage. Ventilation of the structure can occur during the most favorable time, usually early in the morning before the sun rises. Then during the worst part of the day, the home can be closed to a minimal venting mode and retain the dryer, cooler air for comfort. This would save money on the installation and operation of dehumidification equipment or grossly oversized cooling systems.

Comfort is important, but there are other considerations when dieal ing with excessive humidity. Dry rot is an insidious destroyer of property. I have visited homes with major dry rot damage caused by the owner blocking vents with material packaged and sold for just that purpose. This unconscionable retailing practice must stop.

I have had owners tell me they open the vents in the summer, only blocking theem in the winter. The winter is when all the damage occurs due to higher moisture content of the ground and the greater temperature differential between the interior and exterior air. This, in fact, mimics the survival

technique used in the desert to trap water vapor under a plastic sheet.

The attic vents must also remain open due to the migration of water vapor from the living space. In the tight construction of the "super insulated house" this migration will be minimal, but in the average retrofit dealt with in the B.P.A. program, a good ventilation system is the only way to prevent dry rot from growing in the rafters. There are also records of strong allergic reactions to the mold and mildew associated with dry rotting conditions.

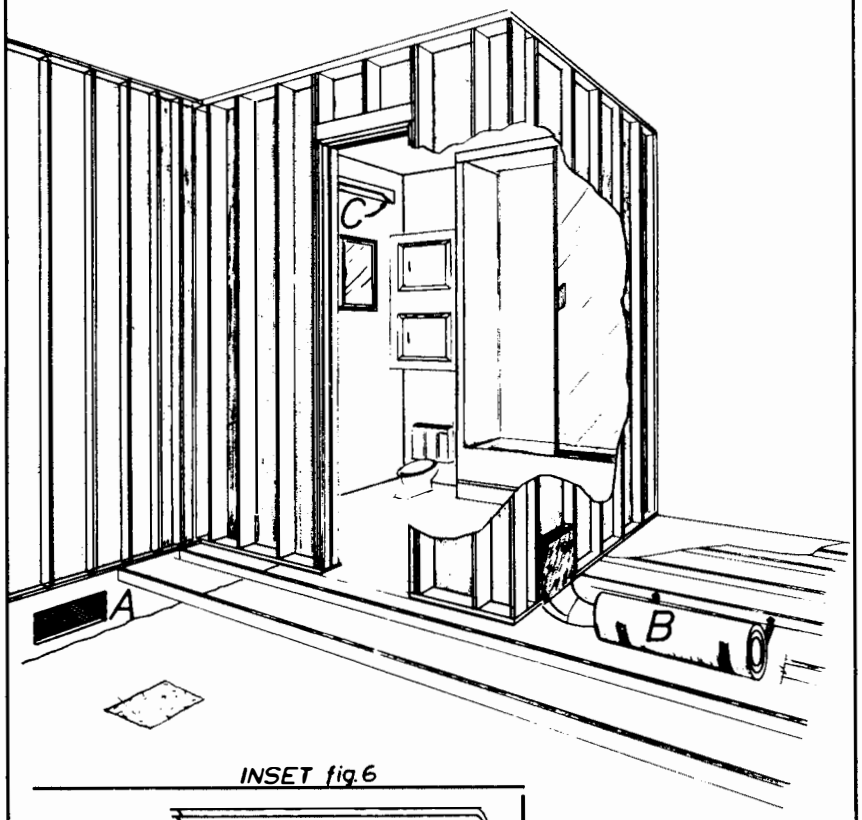
With proper humidity control, condenstaion on windows should be no more than a slight fogging. If storm windows or double glazing is added, the problem should all but disappear. It can only be concluded that humidity has a direct and distinct effect on the health and well being of the occupants and the structure itself.

MITIGATION BY ACTION OF WATER VAPOR. To solve a problem we must first identify it. The two major areas of concern are the kitchen and the bathroom. The kitchen is descussed in the section on natural gas stoves. Therefore, to avoid redundancy, I will turn to humidity control for the bathroom. (see Fig. 6)

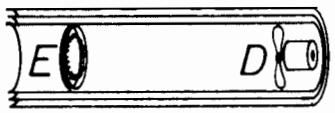
The first requirement for dealing with water vapor is to trap it. This is very effectively done by the installation of weatherstripping on the bathroom door. Interior passage doors are notoriously leaky. Next, the room should be disconnected from any central H.V.A.C. system. The occupancy rate of a bathroom does not justify the maintenance of a constant temperature. Do not think me cruel, I like a comfortable bathroom. To this end I install a separate heating system. It can be turned on in one of two ways, by a preset timer, or by the occupant upon entering the room. The bathroom must be provided with its own separate air supply. In my own house this was very

A CRAWL SPACE VENT
B INTAKE BLOWER SYSTEM
C NEAR CEILING VENT WINDOW
D BLOWER FAN
E HEATING ELEMENT

FIG. 6
INSIDE-OUT HOUSE



INSET fig. 6



easy. The forced air furnace runs ductwork through the vented crawl space. I removed the bathroom branch and closed it off at the trunk. I installed a section of triple wall chimney pipe to the register. In this pipe I installed a small heating element and a blower fan. This takes air from the crawl space and blows it into the room. If the air happens to be uncomfortably cool the heating element can be turned on. When the switch that turns on the fan is used, it over rides the speed control on the fan to insure an adequate flow of air over the element for safe operation. The heating element also has an over heat protection thermostat.

For added heat in the bathroom, a double set of heat lamps are in the ceiling. The air blower/heater is controlled by a 60 minute spring timer. This way the system can be left on to work after the person has left, and not accidentally run all day.

The air being blown into the room displaces moisture laden air through a short, but wide window near the ceiling (see item C Fig. 6). The windows shape will not allow access to intruders, so it can be left open any time. Most bathroom fans have a capacity or 40 to 80 c.f.m. This is insufficient to the task. I recommend a blower capable of 200 to 500 c.f.m. This size of blower tends to be loud. That is why I install a speed control. While the room is occupied, the fan can be run slow and quiet. When the person leaves, the fan can be turned up and left to finish the job.

So there it is, a bathroom with it's own H.V.A.C. system, separated from the rest of the house by a weatherstripped door. It is successful in stopping the migration of large volumes of moisture vapor into the rest of the house. I call the concept the "Inside-Out House".

The question some times comes up as to why I pressurize the bathroom rather than use an exhaust fan. First of all, I could not safely preheat the

incoming air. If the door were left adjar, I could not be sure of proper flow rates for the element. Also, if you have, or are planning, a composting toilet, you do not want to reverse the natural ventilation that occurs in that type of fixture.

There is, in many homes, another major source of moisture. It is the automatic clothes dryer. Many people buy those totally usless plastic boxes that divert the warm exhaust air from the dryer back into the house. This air has a large amount of moisture and aside from creating the moisture problems addressed earlier, it also makes the dryer work longer. That is because the moisture it just got rid of is now being drawn right back into itself. Clothes should not be dried within the heated structure. A good place for the dryer is the garage or an unheated vented basement. The dryer, like the fireplace, needs a large amount of air to run properly.

The sale of dryer exhaust diverters is another piece of missinformed retailing that must cease. The deletion of water vapor as an important pollutant in chapter 3 is a grave error. It is a problem that must be addressed in any house tightening program.

CONCLUSIONS

4

In my estimation there is no reason for the continued exclusion from the weatherization program of approximately 70% of the electrically heated homes in the B.P.A. region. The concerns raised by the E.I.S. can in every case be dealt with by cost effective mitigation by action.

Plumbing and electrical penetrations should be more completely and thouroughly dealt with. These penetrations are substantial and I feel represent some of the reason for the rather conservative estimation of the potential energy savings available.

Water vapor is such an obvious indoor air quality issue I still find it difficult to beleive that it was over looked. In my experience as a designer, consultant, and auditor, moisture damage has been a common thread in the problems to be solved in the properly weatherized home.

The B.P.A. has an excellent opportunity to not only save large amounts of energy, but to maintain and even improve the indoor air quality of most homes. I urge the B.P.A. to move ahead quickly and aggressively with a program that will provide both jobs and energy through the proven means of conservation.

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NORTHERN PLAINS RESOURCE COUNCIL

Field Office
Box 858
Helena, MT 59624
(406) 443-4965

Main Office
419 Stapleton Building
Billings, MT 59101
(406) 248-1154

Field Office
Box 886
Glendive, MT 59330
(406) 365-2525

November 14, 1983

Anthony R. Morrell
Environmental Manager BPA
P.O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

RE: Expanded Weatherization Program Draft EIS

There is definitely a need for a final revised EIS. This one fulfilled our worst fears about Bonneville's commitment to the Regional Plan. BPA has repeatedly stated it agrees with the plan, but continues to raise roadblock after roadblock to its implementation.

All agree that Indoor Air Quality is an issue which needs to be examined and effectively dealt with; however, the whole tone of BPA's analysis is the dangers of weatherization. The impacts can be taken care of effectively at a reasonable cost. It does absolutely no good to scare the public about this problem.

1 The EIS plainly does not treat resourses evenhandly. It is far too optimistic when it comes to thermal resource costs and environmental problems, and then assumes the worst case situation for conservation measures.

2 The final EIS should model ranges of homes with the various air quality problems and avoid choosing a typical house. There is no average or typical house; some will have problems quite diverse from the norm and require diverse mitigation measures, they should not be treated as the norm.

The improper and increased use of wood stoves cannot be ignored. It is one of the clearest reactions to rising energy prices and becoming a severe problem.

3 Finally, air exchanges used with weatherization can cost-effectively reduce health risks and should be used where necessary. Without a quality and aggressive conservation program the Northwest will have to resort to a thermal course it cannot afford -- financially, environmentally, socially or healthwise.

Thank you for your consideration of these comments; we look forward to an improved final EIS which treats resources fairly.

Sincerely,

Tim Stearns

Tim Stearns
NPRC staff

68

Nov. 14, 1983
Harry L. Brunsdon
901 So Wright
Tacoma, Wn. 98408

Mr Anthony Morrell
B.P.A.
P.O. Box 3621 - SJ
Portland, Ore. 97208

Dear MrMorrell :

In the past I have be active in the Washington State Energy Committee for the Senate and the Chamber of Commerce for the City of Tacoma Energy Committee.

1 I would support the expansion of the present BPA weatherization program. In the long run, the more we conserve the better off we shall be. If air pollution poses a problem it can be handled by heat exchangers or other means.

Sincerely,

Harry L Brunsdon

Washington State Senate

Energy and Utilities Committee

4th Floor, Senate Office Building • Olympia, Washington 98504 QW-41 • (206) 753-9107

Senator Al Williams, *Chairman*
Senator Margaret Hurley, *Vice Chairwoman*
Senator Max Benitz
Senator W.H. "Bill" Fuller
Senator H.A. "Barney" Goltz
Senator Dick Hemstad
Senator Mike McManus
Senator Ray Moore
Senator J.T. Quigg

November 10, 1983

Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

The draft environmental impact statement (EIS) on the Bonneville Power Administration (BPA) proposal to expand its present Residential Weatherization Program describes some of the negative health effects of concentrating indoor air pollutants. The concentration occurs as a result of decreasing natural infiltration. It would seem on the surface that two worthwhile goals -- energy conservation and good health -- are in conflict. This is not the case.

The negative effects of indoor air pollutants arise solely because outdoor, unheated air is not allowed to leak into the residence. Fortunately, a cost-effective means exists to replenish fresh air without simply exhausting heated air: the air-to-air heat exchanger.

It is my understanding that in separate analyses the Northwest Power Planning Council (NPPC) staff and the National Resources Defense Council staff have found air-to-air heat exchangers to be cost-effective in residences when installing tightening measures. The installation of heat exchangers is a mitigating measure that does not require research, assures a regular air exchange and, when included in the cost of acquiring conservation, has been shown to meet the NPPC's cost-effectiveness criteria of less than 4 cents/kwh.

1 There are many assumptions, numbers and conclusions contained in the draft EIS that one can challenge. However, I think the salient point is that too little is known about indoor air pollutants and associated health effects to stop tightening homes. An acceptable mitigation measure exists (air-to-air heat exchangers) and undoubtedly others will be found.

1 At this time, I recommend that BPA acquire cost-effective conservation as directed by the NPPC's Regional Power Plan. The proposed action in the draft EIS, coupled with the installation of air-to-air heat exchangers, falls within the Plan. It conserves energy. It is cost-effective. It preserves good health. The failure to acquire this resource is a failure to implement the Regional Power Plan and to provide consumers with an adequate, reliable, economical and efficient electrical energy supply.

Sincerely,

Al Williams, Chairman
Senate Energy and Utilities Committee

AW:mj4-2

JOHN SPELLMAN
Governor

STATE OF WASHINGTON
WASHINGTON STATE ENERGY OFFICE
400 E. Union, 1st Floor, ER-11 • Olympia, Washington 98504 • (206) 754-0700

November 14, 1983

Mr. Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P. O. Box 3621 - SJ
Portland, OR 97208

Re: BPA Expanded Residential Weatherization Program Draft EIS

Dear Mr. Morrell:

Bonneville's efforts to understand and quantify indoor air pollution and its potential health effects are commendable. The potential health effects from indoor air pollution are a legitimate concern for people who are exposed to the sources of indoor air pollution described in the DEIS. The DEIS devotes considerable space to identifying existing conditions (sources) and attempting to quantify these conditions in terms of health effects. As such, the DEIS is a pioneering effort. However, the "action" triggering NEPA is BPA's decision on whether or not to expand the existing weatherization program to include certain "house tightening" measures. Thus, the EIS, if it is to be an aid in decision making, should focus on the

1 environmental and health impacts that may result from: 1) substituting thermal generation for conservation, including consumer responses to higher electric rates (no action); and 2) expanding the existing weatherization program either immediately or under a delayed schedule. The DEIS fails to adequately address the first of these alternatives--No Action Alternative.

2 (See specific comments below on the No Action Alternative.) Without this information, no reasonable judgement regarding the relative significance of the proposed action versus continuation of the status quo is possible.

3 A second area of concern is the lack of emphasis in distinguishing between the health effects that may arise under 1) existing conditions, with or without the existing BPA weatherization program; and 2) an expanded BPA weatherization program. The final EIS should distinguish these effects, so the relative significance of each can be weighed in making a decision on the program.

This does not mean that air quality impacts under existing conditions should be ignored. In fact, the DEIS supports the need to inform the public of the potential health effects that emanate from certain sources of indoor air pollution that may be found within any given home. The need to educate and inform exists whether or not homeowners decide to "tighten" their homes under a BPA program or independently of a BPA or utility sponsored

program. Whether this is a BPA responsibility, a utility responsibility, or a broader governmental responsibility is really beyond the scope of the DEIS.

4 However, it is clearly BPA's duty to inform people of possible health impacts resulting from a delayed or immediate expansion of the weatherization (house tightening) program. By doing so, homeowners receive needed information to weigh in deciding whether or not to participate in BPA's expanded program.

5 In essence, the EIS should not suggest that house tightening measures cause cancer or respiratory diseases, it is the sources of indoor air pollution that may cause these health effects. Certain house tightening measures may increase the occupant's risk of experiencing these health impacts if the sources of pollution are not or cannot be eliminated or if house tightening measures are installed without adequate mitigation.

6 A third area of concern pertains to the discussion of mitigation in the DEIS. The DEIS considers seven mitigations-by-exclusion and three mitigations-by-action. Mitigation-by-action appears to be a very sound alternative that should be discussed further in the FEIS. It appears irresponsible to perform house tightening measures without compensating measures to ensure that existing indoor air quality is maintained, or at least not allowed to deteriorate below certain conservative standards. The cost-effectiveness of the mitigation-by-action alternatives needs to be further developed in the FEIS. (See specific comments below on Mitigation by Action.)

Specific Comments:

No Action Alternative:

The "no action alternative" should be revised to consider the following comments:

The Air Quality section states that 74.4 annual megawatts of additional electric energy would be needed without the proposed action. The additional emissions from coal or nuclear generation of this energy are given in Table 2.4. The Land Use section discusses the additional acreage committed to generate 74.4 MWA in the absence of the proposed action. This impact, along with the increased emissions information of Table 2.4, are the only apparent reference to impacts from the 74.4 MWA additional generation. However, the impact of these emissions on ambient air quality are not discussed. Nor was there any discussion of the occupation-related health impacts associated with the thermal generation alternatives.

Additionally, many consumers will install "house tightening" measures on their own in response to higher electric rates. Substitution of higher cost thermal resources for conservation will further increase rates and consumer-installed house tightening. These impacts should be quantified in the FEIS; they were not in the DEIS.

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Fish and Wildlife, Socioeconomic and Institutional Effects, Water Quality, and Health Effects sections do not appear to consider any impact from the additional 74.4 annual megawatts generation. These sections should discuss impacts of the 74.4 MWA thermal generation.

Mitigation-by-Action:

Discussion of the mitigation-by-action should be expanded and variations on the technique should be explored.

- Consideration should be given to house tightening measures in conjunction with mechanical ventilation without a heat exchanger. In certain circumstances this might be cost effective when an air-to-air heat exchanger would not be. One example would be a home whose only apparent air quality offender is an occasionally-operated wood stove. Ventilation could be accomplished by a fan, without heat recovery, operated only during wood stove operation.

- Consideration should be given to devices which remove air contaminants without ventilation. These could include paper and fabric filtration devices, charcoal filter devices, electrostatic precipitators, and dehumidifiers.

- Consideration should be given to optimal location, scheduling, and control of mitigation measures. Most devices for controlling air quality have a substantial operating cost. Even air-to-air heat exchangers fail to recover up to 50 percent of the heat energy in exhaust air and require fan energy to operate. Accordingly, the DEIS should direct much more attention to location of such devices and scheduling and control of the devices' operation.

  Even within a single house, there are extreme variations in air quality. Although infiltration is nominally expressed as a constant rate, houses do not leak at a constant rate. They may leak excessively when someone leaves a window open, when children are running in and out, and during windy weather. Air in the same houses may become quite stagnant when none of the above conditions occur.

  Leakage is not the only time varying indoor air quality factor. Emission rate can be extremely time variable as well as location variable. For example, BaP can be emitted in large pulses when a wood stove is stoked or a smoker lights up. Humidity and aerosols may be emitted in large pulses in confined locations when someone uses the shower or aerosol spray products in the bathroom or during cooking and dishwashing activities in the kitchen. It follows logically that effectiveness of air cleaning or exhausting devices is highly dependent upon register location and operating schedule.

The following paragraphs describe methods of air quality device control which have been tried or which appear to have potential. BPA should investigate and report on these and others in the FEIS.

The ultimate control device would be a detector which could sense all potentially significant indoor pollutants and outdoor conditions, be programmed with an occupancy schedule, and process the information to cycle or modulate air quality control devices. Such an ultimate controller would undoubtedly be too costly, but simplifications thereof should be studied. These could include dehumidistats; time clocks; outdoor anemometers; thermal sensors near showers, stove flues, or range hoods; special stats (i.e., detectors) to switch on upon rise of certain known critical contaminants, etc.; or certain combinations of the above.

The FEIS should discuss location of inlets and outlets for ventilating and air cleaning devices. Prudent location can accomplish spot removal of emissions from known emitters with greatly reduced flow volumes. Similarly, prudent location can also ensure thorough flushing of dispersed contaminants.

New or existing bathroom and kitchen exhaust fans are well located for removal of many pollutants concentrated near their source. Perhaps outside makeup air can be admitted into existing furnace ducting or at a through-the-wall location remote from exhaust locations. It may be prudent to admit outdoor air near freestanding wood stoves or through unheated interior spaces (if volatile or toxic household chemical products are not stored there). Excessive or nonoptimal ventilation, during windy weather, can probably be minimized by one-way dampers in outside makeup air inlets. These matters of circulation should be studied and discussed in the FEIS treatment of mitigation.

- Consideration should be given to alternate technologies for mitigating indoor air quality problems. It may be advantageous to exhaust stale house air through a utility space containing a heat pump water heater. This could allow some heat recovery from the stale air before it exits the house. Heat pump water heaters which allow direct exhausting of house air, through their evaporator coils, are available in Sweden. The FEIS should explore the cost of adapting domestic units for this operating mode. This would likely require better aerosol filtration and lower CFM/higher temperature differential operation. Also a larger than usual tank size might be required to ensure adequate thermal storage to accommodate time mismatch between ventilation needs and hot water needs. Still, this might be more cost-effective than an air-to-air heat exchanger in some applications because recovery of free or waste heat can occur year round.

Mr. Anthony R. Morrell
November 14, 1983
Page Five

In summary, I again commend BPA for its efforts to understand and quantify indoor air pollution and its potential health effects. However, a thorough understanding of the issue may be a long time in coming. Moreover, there will probably never be consensus on how much health risk is tolerable. Given these realities it is important to emphasize the need to educate on sources of indoor air pollution and to provide information on the potential increased health risk of house tightening without mitigation. BPA should, therefore, thoroughly evaluate and expand in the FEIS the discussion of mitigation-by-action. There may be cheaper and/or more energy conserving ways to maintain or increase indoor air quality than by installing air-to-air heat exchangers. For whatever devices are used, substantial improvements in effectiveness and operating cost may be realized if location and control options are thoroughly studied.

Sincerely,

Richard H. Watson
Director

EMcG/sat
D-L5-28

AMERICAN PLYWOOD ASSOCIATION

November 16, 1983

Mr. Anthony R. Morrell
Environmental Engineer
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

Subject: Comments on the Draft Environmental Impact Statement, "The Expanded Residential Weatherization Program."

The American Plywood Association (APA) is a trade association representing 61 member companies who collectively operate 148 manufacturing plants that produce about 85% of the Structural-Use Panels manufactured in the United States. These Structural-Use Panels include softwood plywood, oriented strand board (OSB), waferboard and structural particleboard. In 1982, 16.4 billion sq. ft. of these products were produced in the United States.

Our Association has recently had the opportunity to review the August, 1983 Draft Environmental Impact Statement (EIS) titled "The Expanded Residential Weatherization Program." We have also reviewed the "Issue Backgrounder" which was prepared in connection with the EIS. These publications appear to be very comprehensive and generally well done. However, we noticed several statements in connection with formaldehyde emissions from plywood and particleboard that could be very misleading; and we would, therefore, urge consideration of the following comments on these publications.

1 Our concern with the draft EIS is that it uses the terms "plywood" and "particleboard" in a very broad generic sense, and it fails to distinguish between panel products manufactured with urea formaldehyde adhesives and those manufactured with phenol formaldehyde (phenolic) adhesives. This distinction is very critical, since the amount of formaldehyde emitted from a wood panel product is highly dependent upon the adhesive type used. Formaldehyde-related problems with wood products have been associated with products that utilize urea formaldehyde, not with those that utilize phenol formaldehyde adhesives.

Urea formaldehyde adhesives are used for most decorative hardwood plywood wall paneling and for certain types of particleboards. Urea formaldehyde adhesives are not highly water resistant and are normally used in products that are to be used indoors where high moisture levels are not normally present.

Products glued with phenol formaldehyde adhesives, on the other hand, include structural panel products such as softwood plywood, oriented strandboard (OSB), waferboard, and structural particleboards. Because phenolic adhesives are extremely durable and waterproof, many of these products can be used for exterior applications. Phenolic adhesives do not break down during service to release formaldehyde vapors. Since phenol formaldehyde is the only type of

7011 So. 19th St. / P.O. Box 11700 / Tacoma, Washington 98411 / 206 565-6600
TLX 32 7430

formaldehyde-containing adhesive used by manufacturing facilities represented by the APA, my comments will be directed toward products manufactured with these adhesives.

The enclosed brochure, titled "Formaldehyde and Wood Products," provides some general information concerning hardwood plywood and particleboards made with urea formaldehyde adhesives. For more detailed information concerning these products, I would suggest you contact:

1. Hardwood Plywood Manufacturers Association
   P.O. Box 2789
   Reston, Virginia 22090
   Phone: 703-435-2900

2. National Particleboard Association
   2306 Perkins Place
   Silver Spring, Maryland 20910
   Phone: 301-587-2204

2 Formaldehyde emissions from panels glued with phenolic resin adhesives are extremely low, and to my knowledge, the use of these types of panels has not caused any problems. As far as we are aware, formaldehyde emissions from phenolic panel products made by APA member mills are below levels which have been established by all state or federal laws or guidelines. The technical reasons for the low formaldehyde emissions associated with phenolic adhesives are summarized in the enclosed report by Dr. Richard Blomquist, entitled "Formaldehyde Emissions Are No Problem With Wood Products Bonded With Phenolic Resins." Dr. Blomquist is a chemist, retired from the U.S. Forest Products Laboratory.

The statements in the draft EIS which are of concern to us appear on pages ii, 3.1, 3.3, and in Table 3.1 on page 3.2. The generic use of the terms "plywood" and "particleboard" on these pages incorrectly implicates phenolic panel products in the formaldehyde problem. We believe that this is inappropriate, and we would strongly urge BPA to revise the text to indicate that formaldehyde emissions have not been considered a problem with wood panel products glued with phenolic adhesives.

The "Issue Backgrounder," on pages 10 and 11, attempts to address the fact that formaldehyde emissions from certain plywood panels are lower than from others. However, the statements which are made are not correct and could be very confusing to the public. The problem evidently arises from a misunderstanding of the meaning of the terms "interior" and "exterior."

On page 10 is a photograph of a stack of softwood plywood panels, showing an APA stamp for an Exterior grade. The caption reads: "Exterior grade plywood gives off less formaldehyde than interior grades." This caption is incorrect, because of the peculiar meaning of the terms "interior" and "exterior" in the softwood plywood industry.

A softwood plywood panel can be classified as Interior either because it contains an adhesive which is not fully waterproof or because it contains lower-grade (D-grade) veneers. Most Interior plywood is made with an exterior (waterproof phenol formaldehyde) adhesive and is graded as Interior simply because it contains some D-grade veneer. Only a very small amount of softwood

plywood is classified as Interior solely because it is manufactured with protein-based adhesives, which are not fully waterproof. (Urea formaldehyde adhesives are not used in softwood plywood manufacture.)

In light of the above considerations, virtually all softwood plywood, whether classified as Interior or Exterior, is bonded with phenol formaldehyde adhesives and, therefore, should not cause any formaldehyde-related problems. The confusion caused by the caption on page 10 could be rectified by stating that "The use of structural panels bonded with phenolic adhesives, such as softwood plywood, should not cause formaldehyde-related problems."

The statement in paragraph 4 on page 11 of the "Issue Backgrounder," stating that Exterior plywood can be used for paneling, is also not quite appropriate, in light of the above discussion. From the standpoint of formaldehyde emissions, both Interior and Exterior softwood plywood could be used for paneling. However, the most important problem with the statement is that most paneling is hardwood plywood, not softwood plywood, since the hardwoods (oak, maple, walnut, e.g.) are more attractive as paneling than are the softwoods (fir, pine, hemlock, e.g.). I do not believe that exterior hardwood plywood paneling is readily available. I would suggest that the Hardwood Plywood Manufacturers Association be contacted for information on the availability of paneling which has little or no formaldehyde emitting potential.

I hope that these comments are helpful. We will be happy to provide additional information, including test data on actual formaldehyde emissions from phenolic products, if it would be of help to BPA in developing the final EIS.

The APA greatly appreciates the opportunity to comment on the draft EIS.

Sincerely,

John Emery

JOHN A. EMERY, Ph.D.
Project Manager
Environmental Affairs

JAE:ji

Encls.

cc: T. R. Flint

Formaldehyde Emissions Are No Problem With Wood Products Bonded With Phenolic Resins

By R. F. Blomquist

August 6, 1981

INTRODUCTION

There has been a great deal of national publicity lately about the irritating effects some people suffer due to formaldehyde emissions from certain products, particularly in newly-constructed mobile homes and smaller buildings. Since formaldehyde is used in the manufacture of phenolic resins, the question may arise as to whether there is a problem in panels bonded with phenolics such as softwood plywood and exterior-type particleboard. This report will show why the formaldehyde emissions problem is not caused by such products.

Softwood plywood for exterior exposure has been made with phenolic resin adhesives for nearly 40 years. The proportion of plywood made with these adhesives has increased very significantly in recent years, however, due to a decline in the use of less durable interior-type glues.

In the past, interior-type softwood plywood panels were typically made with other types of adhesives, including soybean and blood proteins. In more recent years, special modified phenolic resin adhesives have been used. In these adhesives, bark, blood protein, agricultural residues and other materials are added to the phenolic resin, primarily to reduce glueline costs and still provide the necessary levels of permanence required for protected and interior applications. Consequently, virtually all softwood plywood is now manufactured with some type of phenolic resin adhesive. Moreover, certain structural particleboards, waferboards and other panel products are increasingly being bonded with phenolic adhesives.

The most complete current summary of the formaldehyde problem in wood products is that of Nestler (1), who reviewed world-wide chemical literature through January 1977. This document contains extensive literature citations on formaldehyde emission problems.

Time did not permit the writer to review all the original articles cited, but a private conversation with Nestler indicated that only his citations A21, A26, and C31b had any mention of studies with phenolic resins. These were all apparently laboratory studies, and they made no specific mention of any problems with formaldehyde emissions from panels in use. Additional background is cited by Gillespie (2) and Kelly (3).

In the absence of any demonstrated or reported formaldehyde emission problems with particleboard or plywood made with phenolic resin adhesives, this report will be concerned primarily with the technical factors involved with the phenol-formaldehyde resins as adhesives and binders. The report will also consider how these factors relate to predicting formaldehyde emissions, or absence thereof, with phenolic-resin bonded products such as softwood plywood.

Phenol-Formaldehyde Resins as Binders and Adhesives

These resins are prepared by condensing phenol, a yellowish solid (commonly called carbolic acid), with formaldehyde (a gas in water solution), using relatively low mole ratios of formaldehyde to phenol under heating and refluxing conditions.

The formaldehyde combines chemically with the phenol to form intermediate methylol groups on the phenol molecule in the ortho and para positions. These methylol groups are largely chemically converted to methylene bridges by heat in the subsequent curing reaction. Thus, the original formaldehyde loses all identity as such, and is rigidly combined chemically with the phenol to form stable polymeric structures.

The typical phenolic plywood adhesives must be cured with heat and pressure under rather highly alkaline conditions, with curing temperatures being typically 265 to 300°F. Further chemical condensation during curing occurs to produce a very durable, insoluble and heat-resistant polymeric structure which resists chemical degradation very well and can be decomposed only by heating under strong acid or alkaline conditions.

There is little free formaldehyde in the original resin dispersion and the higher cure temperatures used tend to volatilize any residual free formaldehyde. In addition, heating formaldehyde in the presence of the strong alkaline catalysts used would tend to convert any free formaldehyde into methyl alcohol and formic acid (as sodium formate) by auto oxidation-reduction referred to as the Cannizzaro reaction.

This combination of low free formaldehyde in the resin, the high temperatures and long cure periods, and the Cannizzaro reaction all tend to result in extremely low amounts of residual formaldehyde in the bonded product. These factors would tend to explain the lack of any reported problem with formaldehyde emissions from phenolic resins in wood products.

The high resistance of phenolic resins to deterioration under a variety of severe service conditions is, of course, a principal reason why these resins are used so widely in making Exterior-type softwood plywood and structural particleboard. The durability of phenolics also explains why they are used for plastic moldings, as adhesives for severe service as in bonding brake linings for vehicles, and for various components for aerospace vehicles. Being highly durable, these resins do not break down to release formaldehyde. Some other less durable resins are also made with formaldehyde and they can break down and release some of this chemical under certain conditions. The phenolics, however, are not to be confused with such resins.

CONCLUSIONS

There are no confirmed reports of formaldehyde emission problems with phenolic resin-bonded wood panel products, and a formaldehyde emission problem with these resins is not anticipated for the following reasons:

1. The demonstrated high stability and durability of the phenolic resins.
2. The low mole ratio of formaldehyde to phenol in the phenolic resins.
3. The high cure temperatures and long cure periods used in hot pressing the phenolic resin-bonded wood products.
4. The potential destruction of any free formaldehyde under alkaline curing conditions used with the phenolic resins (Cannizzaro reaction).

Under the circumstances cited above, one would not expect any significant formaldehyde emission problems with phenolic resin-bonded wood panel products.

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3. 1977, Kelly, M. W., *Critical Literature Review of Relationships Between Processing Parameters and Physical Properties of Particleboard*, U.S. Forest Service General Technical Report FPL-10.

Printed by the American Plywood Association
P.O. Box 11700
Tac ma, Washington 98411

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IDAHO STATE HISTORICAL SOCIETY
610 NORTH JULIA DAVIS DRIVE BOISE. 83702

November 17, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

RE: Draft EIS - The Expanded Residential Weatherization Program

Dear Mr. Morrell:

We recently have received the draft environmental impact statement for the Bonneville Power Administration's proposed Expanded Residential Weatherization Program. Upon reviewing the information in the draft EIS we have determined that the nature of the project is such that it will have no effect on National Register properties or other significant archaeological or historical sites.

Sincerely,

Thomas J. Green
State Archaeologist
State Historic Preservation Office

TJG/bhd

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Your Seattle City Light

Joseph P. Recchi, Superintendent
Charles Royer, Mayor

November 10, 1983

Mr. Peter Johnson, Administrator
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Johnson:

My staff has reviewed the Draft Environmental Impact Statement (EIS) on Bonneville Power Administration's (BPA) proposed Expanded Residential Weatherization Program. Indoor air quality has emerged in recent years as a subject of clear concern. Numerous studies and reports, this EIS among them, have documented the issues. Seattle City Light joins those recognizing the need to address these concerns. We commend BPA for its effort in this regard.

1 It is also clear that some energy conservation measures will increase indoor air pollution problems if strong pollution sources are already present in the residence. It does not follow, however, that the best method of dealing with indoor air problems is to link them with home weatherization. Strategies which are under the control of homeowners rather than BPA or utilities are preferable. For example, the elimination or control of pollution sources is almost certainly a more effective strategy than foregoing or preventing weatherization in most cases. Source control may often be more effective and less costly than mechanical ventilation. It is our position that programs based on informed homeowner choice and mitigation measures geared to
2 specific situations are most likely to accomplish both the goals of energy conservation and of indoor air quality.

Our detailed comments make the following general points:

o 3 BPA has in the past assumed responsibility, to the detriment of obtaining conservation, for choices properly made by homeowners provided with adequate information. Mitigation-by-exclusion strategies deny the homeowner the chance to make an informed choice.

o 4 BPA should apply the same level of scrutiny and evaluation of health effects to thermal generation which will be required if the expanded weatherization resource is not obtained as it applies to the expanded weatherization resource.

o 5 The methodology and data on health effects raise more questions than they answer.

o 6 The presentation of mitigation is incomplete. Further, mitigations are presented in a way which does not allow a comparison of their cost-effectiveness in relationship to energy and health.

o 7 BPA's presentation of the issues to the public does not promote objective analysis, but fosters the misconception that residential weatherization will only be obtained at the expense of human health.

1. UTILITY RESPONSIBILITY. BPA's approach in the EIS overstates the problem of indoor air pollution as it relates to utilities' responsibilities and the acquisition of expanded residential weatherization as a conservation resource.

a. 8 Implicit in the EIS, and apparently unquestioned, is the assumption that BPA (or the utility), rather than the homeowner, is responsible for both assessing the health risk for each home and making the decision whether to tighten the house. (The decision against tightening keeps existing indoor pollutant levels unchanged.) City Light's position has been that the utility's responsibility lies in notifying the customer about possible increases in concentration of pre-existing pollutants, with the potential for increasing health problems as a consequence of the homeowner's decision to acquire house tightening measures offered by City Light.

9 We feel the EIS should have focused on the changes in indoor air quality which can be attributed to house tightening. Such an orientation would have led to the needed analysis of how tightening affects air exchange in the house, whether health is significantly affected by the resultant air exchange rates and what mitigation can be applied to the impacts.

b. 10 The EIS offers a one-page treatment of a notification strategy under "Other Mitigation", describing a program in which homeowners would be provided information on "possible detrimental effects of operating a wood stove inside a tightened house and possible detrimental effects of smoking inside a tightened house" (p. 2.47). Notification as discussed in the EIS relates to a sensational but very small part of the health effects being linked to indoor air pollution -- smoking and cancer. Such information is greatly

10 deficient in disclosing what it is purported to disclose, the range of indoor air pollutant health effects. What is more, the section is devoid of the information homeowners should factor into their own decisions about exposure to indoor pollutants, the kinds of increases in pollutant concentration attributable to house tightening, and the effects of ventilation measures. City Light has provided BPA details about our policy and program, in which we provide information to homeowners and allow them to decide for themselves about house tightening. Unfortunately, the EIS nowhere acknowledges this, and brushes aside disclosure to customers as a program which cannot be evaluated and whose effects are unknown although probably beneficial (p. 2.48).

c. 11 Notification is one measure on the spectrum of BPA involvement. A more coherent description of program options is needed. Beyond disclosure, BPA could explore case-by-case approaches, with identification and response more tailored to specific problems. The monitoring measures in Mitigations 1 and 3 are a start in this direction. We feel that a case-by-case approach should be fully analyzed before moving to broad exclusions as program choices. In order to decide when it might be practical to move from a disclosure-only strategy to a case-by-case approach, one must have available a good description of the cost and adequacy of monitoring methods.

2. STANDARD OF ANALYSIS. The approach taken in this EIS leads us to wonder why this level of scrutiny is being applied to acquiring this conservation resource. A different standard of analysis of health effects seems to be applied to non-conservation resources. The EIS does not equally detail the effects from acquiring the thermal generating resources which will be needed if conservation resources are unavailable.

a. 12 An adequate comparison of health effects among options should estimate the degree to which negative health effects will occur with the No Action option (BPA's existing program with substantial categories excluded from weatherization programs), especially if weatherization is pursued independently by homeowners uninformed of the impacts of their actions and unassisted by mitigation efforts. It is expected that some homeowners will tighten their homes on their own (p. 2.12). There is no mention that health risks will increase as a result unless these homeowners take their own steps to mitigate health effects. There is no attention to whether the No Action alternative would contribute to

increased rates promoting price-induced tightening measures, with potential health risks.

b. The description of health risks of the No Action alternative includes estimates of injuries and accidents from construction of coal-fired or nuclear thermal plants (the alternative resources) but not the health effects from plant emissions or from water or land contaminated by their wastes. 12 If health effects are to be examined in such detail, then trade-offs between acquisition of this conservation resource and acquisition of a coal or nuclear resource would best be understood by comparing all disease risks from chronic exposure to indoor air pollutants with all disease risks from chronic exposure to coal-fired plants emissions or to radioactivity from handling and storing nuclear materials.

3. COMPARISON OF HEALTH EFFECTS AMONG ALTERNATIVES. The EIS fails to analyze house tightening health effects in a fashion which is complete and conducive to comparing the alternative proposals. The cancer increases attributable to house tightening are so small that their significance is not established, particularly in light of the statement that estimating cancers based on some substance levels is not accepted by the entire scientific community (p. 2.10). 13 Such detailed presentation of cancers exaggerates that risk and obscures the significance of "non-cancer" health effects. Yet for some pollutants, such as formaldehyde, the major health problem is something other than cancer.

a. Because of contaminants, wood stoves and portable space heaters (kerosene) are indicated as bases for exclusion from weatherization. No mention is made of the degree to which tightening a home reduces or minimizes the use of these heat sources, presumably with an attendant reduction in pollutant emissions. Further reductions attainable with mechanical ventilation should also be considered, given the statistical levels dealt with in this study.

b. To properly assess health effects from indoor air pollution, one would need to take into account the distinct and the synergistic effects related to outdoor air quality and to non-residential indoor air exposures (indoor air can be a problem in work places and other buildings besides homes where people spend a good deal of time).

4. EXAMINATION OF AIR CHANGES PER HOUR. The direct impact of house tightening is a decrease in the number of air changes per hour

(ACH) of natural ventilation. While houses cannot reliably be designated "safe" or "unsafe" based on levels of natural ventilation because the pollution levels are more important, it might be useful to a homeowner to know if the house would be relatively tight or relatively leaky after weatherization, and whether natural ventilation would be expected to go down 10% or 80%.

The homeowner would want to know the "baseline" ACH for her/his house and the change in ACH as it relates to specific pollutants, in order to be able to assess energy conservation savings versus health risks. 14 A more "case-specific" approach appears appropriate here; while no universal "safe" ACH level can be established, ACH in relation to specific pollutants/health effects could be evaluated.

What is more, if air exchange rates can be restored by mechanical ventilation, mitigation measures should address this. To frame the discussion in terms of pollutant levels without evaluating a variety of means to remove sources or reduce those levels is to steer toward exclusion criteria such as those already constraining BPA's weatherization program.

Treatment of air exchange rates and effects is very general in the Appendices. As averages or examples are used elsewhere for purposes of analysis, average or example ACH rates would be appropriate in this discussion. If ACH is difficult to measure in individual homes, then it would be helpful for the EIS to discuss current technology and how utilities can utilize this information for specific cases.

Nowhere in the EIS is there discussion of the health effects from not educating homeowners about ACH or changes in pollutant levels in different homes or from varying sources. Thus the purchaser of a very tight house, unaware that its ACH is in its lowest ranges, might smoke, install a woodstove or kerosene heater, install carpeting or furniture which contains formaldehyde, etc., without realizing the risks from continuing activities which might have been innocuous in a house with significantly greater ACH.

5. CRITERIA FOR AND TREATMENT OF MITIGATION. The EIS is set up in such a way that it is virtually impossible to determine the most 15 cost-effective and appropriate measures to both protect health and reach conservation goals.

a. By framing the issue as it has--that is, enumerating cancers related to pollutants rather than impacts from changes in air

exchange rates in tightened houses with or without mitigation--the EIS presents the health problems as virtually unsolvable under the Proposed Action (no exclusions from the weatherization program).

The Proposed Action without mitigation would ignore health effects. The exclusion categories offered as mitigation continue BPA's policy of excluding large numbers of customers, significantly hindering energy conservation efforts. The exclusion categories are based on assumptions about pollutant sources, rather than on demonstrated problems in particular homes. A case-by-case strategy is not really discussed. Neither ignoring the health question, nor continuing to exclude the seven categories of customers is a suitable approach, in our view.

b. As depicted in the EIS, it would seem that indoor air quality problems can be handled by mechanical ventilation. But the content and format of the EIS fall far short of thoroughly examining mitigation-by-action possibilities, talking only about air-to-air heat exchangers (AAHX), and not even doing that completely. From the presentation, readers are left to conclude that mechanical ventilation other than by AAHX is not feasible, while using AAHX is extremely costly.

The short shrift given to other devices for taking pollutants out of home air ("Other Mitigations Not Included", p. 2.53) is questionable. In a previous consumer publication, BPA has stated that other devices are effective to control indoor air pollutants: see "Indoor Air Quality" booklet DOE/BP-88, March 1982. What is known and unknown about various ventilation and filtering devices aeems to be not much different from what is known or unknown about heat exchangers. That the EIS explores using only heat exchangers leaves many crucial questions unanswered.

Among those questions is the appropriateness and practicality of selecting different pollutant control techniques for different pollutants. The EIS recognizes that only some and not all of the pollutants may be problems in a particular home (or type of home, such as mobile homea). The EIS should examine the practicalities and costs aspects of responding to specific problems with the device most effective (and cost-effective) for controlling the pollutant(s) involved.

c. Even if one accepts the EIS "choice" of AAHX as the sole action method to reduce indoor air pollutant levels and still

obtain the conservation resource safely, then one looks for a discussion of this chosen technology, a breakdown of costs, an explanation of installation, equipment and operation requirements. One also looks for resultant air exchange rates or effects on specific pollutants. The EIS does not carry through on this analysis, however. It does not provide in an accessible manner the data needed to interrelate health effects, mitigation measures, and cost-effectiveness in terms of energy efficiency, energy savings, and dollars per megawatt.

d. We, and no doubt other readers, have attempted to extract this data. However, questions such as overlap among categories and among health effects cloud the usefulness of our calculations. For example, it appears no mitigation-by-action measure addresses pollutants from unvented combustion appliances. Is there no alternative to do so? Is the mitigation-by-action category of radon homes coincident with the exclusion categories slab-on-grade and well-water? What is the overlap among homes with radon, homes with wood stoves and homes with formaldehyde, and how do such overlaps affect the number (and cost) of heat exchangers that would be required if the mitigation-by-action proposals were implemented? Where do apartments fit in or overlap? The category wood stove homes appears very large, (p. 2.34: 663,000 wood stove homes, p. 2.42: 951,000 total homes, 288,000 heat exchangers), and providing AAHX to them appears very expensive. How would the wood stove category's size, energy savings, and costs be affected by requiring some wood stove efficiency standards before tightening, and/or monitoring for pollutants before providing AAHX (the same strategy as proposed for radon and formaldehyde homes).

The data in the EIS suggest that in homes with wood stoves and in homes where monitoring shows significant radon or formaldehyde levels, AAHX significantly reduces these and other pollutants. Why then, is there no discussion of mitigation by AAHX for all the rest of the exclusion categories?

The average cost for installing heat exchangers is $650. How much of this cost is materials and how much labor? What characteristics about the home dictate these costs? Are there different types of heat exchangers or different labor/materials costs for mobile homes, apartments, small and large houses?

6. PREFERRED ACTION BASED ON PUBLIC RESPONSE. We are trouhled by the effect of BPA's declining to identify a Preferred Alternative, coupled with its assertions that public response will be the basis for its decisions. The manner of presentation in this case, in the EIS, and accompanying press releases, advertising, and brochures, fosters the misconception that house tightening causes cancer. Public response will thus be based on a misleading emphasis. The EIS repeatedly documents and charts links between indoor air pollutants and cancer and respiratory ailments, doing a poor job of distinguishing pre-existing air quality from the higher concentrations of pollutants in some tightened houses. It is this health risk increment and the possibilities for mitigating it which should have been better presented in both graphics and text. The single graph on this point is small and poorly labeled, overshadowed by large graphs and tables based on prior pollutant levels. As a result, the EIS contains no easily accessible showing of the trade-offs homeowners must make in deciding whether or not to tighten their homes, or how to mitigate the effects of doing so.

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We believe that the Proposed Action should include active and high quality disclosure of information to homeowners about indoor air quality. We feel that mechanical ventilation is worth pursuing as effective mitigation where house tightening leads to problematic indoor air pollutant levels.

Our comments are not intended to argue for further study or a new EIS. We encourage BPA to narrow its focus to the real issues created by the weatherization proposal, and to move toward a workable program for acquiring rather than limiting this conservation resource.

Sincerely,

Joseph P. Recchi
Superintendent

SA:dms

Rush-Hampton

Rush-Hampton Industries, Inc
P.O. Box 5500
Sanford, Florida 32772

Telephone (305) 322-5500
TWX Telex 467922
Cable RUSHAMPTON

November 21, 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

After reviewing the draft of B.P.A.'s environmental impact statement, we here at Rush-Hampton were very impressed. Indoor air pollution is the prime area of concern here and in fact, almost all of our Research and Development efforts are directed along that line.

The capabilities of Rush-Hampton's Research and Development Department are extensive. As a matter of course we are involved in the following areas:

- Industrial Microbiology
- Analytical Chemistry
- Gas absorption technology
- Separations, technology in organic chemistry

Additionally, Rush-Hampton utilizes an in-house Mechanical Testing Laboratory. This laboratory affords us the capacity to test motor performance, air flow, noise levels, and filter air flow.

Perhaps most unique is our in-field research using state-of-the art technology. The Rush-Hampton House, located in Amherst, Massachusetts, is the site of an on-going research project. This project is designed to characterize indoor air pollution as a result of energy-efficient construction. The Rush-Hampton House is a super insulated, passive solar heated home, equipped with instruments to measure and identify indoor pollutants. Those pollutants measured would include:

Mr. Anthony R. Morrell
Page Two
November 21, 1983

. Formaldehyde
. Radon
. Polynucleararomatic hydrocarbons

We believe the products manufactured by Rush-Hampton could be of real value to the B.P.A. In particular, our PM 190 HEPA unit would seem to be most beneficial.

The PM 190 makes use of a high efficiency H.E.P.A. filter as well as our own gas absorption technology. The advantage is air filtration which encompasses particulate removal as well as the removal of gaseous contaminants.

Rush-Hampton's PM 190 and other products could provide you with an acceptable alternate to heat exchangers.

1 Heat exchangers are certainly a creditable means of achieving some of the goals and meeting the spirit of your environmental impact statement. However, you will probably find that actual conditions in the field will permit the use with less extreme measures. Those measures could very well include the use of scientifically developed mechanical filtration devices. To that end we recommend our PM 190 and PM 180.

We have taken the liberty to include some support data. Please review this at your convenience.

Our factory respresentative for the Pacific Northwest is Mr. John Erbstoesser of Seattle, Washington. Mr. Erbstoesser will be glad to supply you with additional data.

Sincerely,

RUSH-HAMPTON INDUSTRIES, INC.

Norm Shearer
National Sales Manager,
Construction Division

NS/blm

Enclosure
King, J. Gordon: Air for Living. Respiratory Care, Mar-Apr 1973, Vol. 18, No. 2, pp. 160-164.
cc: Tom Dollnig
Mr. John Erbstoesser

Reference material:
"The Inside Story on Indoor Air Pollution," c1982 Rush-Hampton Industries, Inc.
"Air for Living," Respiratory Care, Mar-Apr 73, Vol 18, No. 2.
Several Fact Sheets and promotional brochures, Rush-Hampton Industries, Inc.

Dec 2, 1983

Dear Mr. Morrell,

The article that appeared in the newspaper concerning the health effects of home weatherization was of special interest to me as I have been diagnosed as having environmental allergies which cause me considerable health problems. I wholeheartedly agree that indoor air quality is being threatened.

Unfortunately I was out of town during the posted meeting and so missed the presentation. I would appreciate having any information available on this problem.

I congratulate the alertness of Bonneville Power Administration and heartily lend my interest and approval to what you are attempting to do.

Sincerely,

Mrs. Robert Daniels

DEPARTMENT OF HEALTH & HUMAN SERVICES
Public Health Service
Food and Drug Administration
Rockville MD 20857

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DEC 5 1983

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

The staff of the National Center for Devices and Radiological Health has reviewed sections of the Draft EIS on weatherization that pertain to radon (and daughters). While this review has examined the basic data and approach used in the report, a critical review and checking of computational results has not been performed. The document is rather difficult to review because aspects involving radon are scattered throughout the report.

1 The basic data and methods used to assess the risks from radon draw heavily on the work of Harley and Pasternack - 1981, and are consistent with the assessment of environmental and indoor radon in NCRP draft report SC-57 (Aug. 16, 1982). The value selected by the Draft EIS for radon in well water is a factor of 2 greater than that of Draft NCRP SC-57 for the U.S. average. For homes using well water, this source predominates and thus the value may be artificially too high.

2 The report also fails to indicate what mitigation would be undertaken if the proposed action is adopted. It would probably be appropriate
3 to undertake radon monitoring and Mitigation-By-Action No. 3 for those homes having high radon levels.

Thank you for the opportunity to comment on this Draft EIS.

Sincerely yours,

John C. Villforth
Director
National Center for Devices
and Radiological Health

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U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 443

DEC 23 1983

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
PO Box 3621-SJ
Portland, OR 97208

Re: Draft EIS--Expanded Residential Weatherization Program

Dear Mr. Morrell:

We have reviewed the Expanded Residential Weatherization Program Draft EIS. We appreciate the extension of time you have given us to provide for review by our Headquarters Offices of Air and Radiation Programs.

A copy of their detailed technical analysis is attached. Since the Office of Air Programs staff time did not allow a detailed technical analysis of the Draft EIS, we have recommended to Rusty Alton of your staff that he contact Jim Repace (FTS 382-7747) of EPA's Office of Air Programs. They can informally discuss work being done by EPA that might assist BPA in further work on this EIS and on indoor air pollution effects of the weatherization program.

Scientific Basis For Analysis

Overall, the EIS does a reasonable job covering a difficult and not fully developed area of technical analysis. BPA and others working with indoor air pollution and radiation problems might benefit from efforts to develop a more sound scientific basis to support the analysis contained in the EIS and the proposed mitigation strategies.

Mitigation Strategies

1 We recommend that BPA discuss conditional weatherization as a mitigation strategy. This strategy would establish the conditions an applicant would have to meet to participate in the weatherization program. Conditions such as selective tightening features to minimize specific risks would be established as standards and decision criteria. Approval of a home as a weatherization program participant, and the extent of participation, would be governed by the steps a home owner or resident would take to reduce or eliminate sources of indoor air pollution.

EPA has rated this Draft EIS LO-2 [LO: Lack of Objection; 2: Insufficient Information]. We appreciate the opportunity to review the report. Should you wish to discuss EPA's comments and recommendations, please contact Richard Thiel, Environmental Evaluation Branch Chief, at 442-1728 or (FTS) 399-1728. Comments on the attachment may be directed to Allan Richardson as indicated.

Sincerely,

Ernesta B. Barnes
Regional Administrator

Attachments

cc: Allan Richardson
Jim Repace

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Bonneville Power Administration
Expanded Residential Weatherization Program

Analysis of the Draft Environmental Impact Statement
PREPARED BY EPA OFFICE OF RADIATION PROGRAMS

2 1. The risk estimates for indoor exposure to radon are inadequate and project an artificially low impact on the quality of the human environment. The predictive model of Harley and Pasternack (Ha81; NCRP80) that was used in BPA's Draft EIS has previously been reviewed by EPA. (See page A.2-27 in Volume II of EPA83.) It does not provide a scientifically sound basis for evaluating risks of lung cancers induced by radiation.

The model arbitrarily incorporates a mathematical function removing lung cancers with a half-time of 20 years post exposure from the data base. This biases the estimated risks by a factor of about four. The authors of the model provide neither the reason for introducing this function nor its scientific justification. Observations of radiogenic lung cancer among the atomic bomb survivors clearly contradict Harley and Pasternack's conjecture.

The risk estimates produced by the model are a factor of five or more lower than those calculated by EPA (op. cit.), the National Academy of Sciences (NAS80), and the Atomic Energy Board of Canada (AECB82). The EIS should be revised to reflect these higher values. The risk coefficients used in general environment analyses, such as this EIS, should be based on the considered reviews of major groups cited above, rather than the speculative model proposed by Harley and Pasternack.

3 2. In Figure 2 on page x, the logarithmic scale chosen for the horizontal axis does not adequately illustrate the differences in the number of estimated cancers per year among the baseline, no action, and proposed action scenarios for each of the indoor pollutants. The additional number of cancers that are estimated to result from the no-action or proposed action programs are important to the analysis of the net benefit provided by the BPA weatherization program. Thus, the differences among the estimated number of cancers for the baseline, proposed action and no-action alternatives should be plotted for each indoor pollutant.

4 3. The section on removal/decay of indoor pollutants, page 3.6 of the EIS, should include more discussion and exposition of methods of radon control, e.g., the removal and plateout of radon progeny obtained by the use of air treatment and circulation systems. (For example, see Ru83.) These air treatment and circulation systems should also be considered as additional Mitigations-by-Action in the EIS.

5 4. The EIS should include a discussion of the effects that an increase in the concentration of particulates can have on the concentration of radon progeny. Increases both in the concentration of particulate matter and in the concentration of radon will separately lead to increases in exposure to radon progeny. This influence of the particulates is described by current models of the plateout of progeny. (For example, see Kn83.)

5. The section entitled "Lung Dosimetry Models" on page F.2 of the BPA Draft EIS states that:

> "In some treatments of modeling of risk from radon daughter exposure, a tendency has been evident to artificially lower the cumulative exposure in the environment, presumably to account for decreased breathing rates under non-working conditions (EPA80). This, in our opinion, is neither warranted nor justifiable in view of the uncertainties associated with the various rad/WLM values."

These remarks do not reflect that the epidemiological approach of evaluating risks in terms of potential cumulative exposure (in WLM) rather than in terms of lung dose (in rads) avoids the uncertainty in the rad/WLM conversion value. The potential cumulative exposure is a measure of the inhaled potential alpha energy and does not depend on the rad/WLM value. Hence, the observed relationship between potential cumulative exposure (in WLM) to radon progeny and the incidence of lung cancer is not affected by the uncertainty in the rad/WLM value.

The conversion ratio (rad/WLM) is only of interest in evaluating the actual dose delivered to cells that eventually cause lung cancer. Unfortunately, this is not feasible at this time, as we do not know the location of the cells or their depth in the bronchial mucosa (RPC 80). Thus, in order to avoid the uncertainty in the rad/WLM value, the lung cancer risk due to inhaled radon progeny is best expressed directly in terms of a person's potential cumulative exposure to radon progeny (in WLM) rather than in terms of the dose (in rads) that is assumed to be absorbed in lung tissues (RPC80).

The effect of the breathing rate on potential cumulative exposure was noted in early papers which clarified the concept of the Working Level and the Working Level Month. Evans states that:

> "In order to describe radiation exposure, the Working Level unit...should be multiplied by an average breathing rate (liter/min.), by an average fractional retention in the lung, and by the duration of the exposure." (Ev69).

6 Thus, the differences in breathing rates between workers in the mining industry and members of the general public should be accounted for in order to realistically estimate the cumulative exposure to daughter products. The fractional retention in the lung is an independent correction, and there is scientific uncertainty as to the size and the direction (greater or smaller) of the correction between miners and members of the general public. The treatment of breathing rates is further discussed in EPA78.

If you have any questions about comments prepared by the Office of Radiation Programs, please contact Allan Richardson at (FTS) 557-8927.

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REFERENCES

AECB 82 D.C.Thomas and K.G.McNeil, "Risk Estimates for the Health Effects of Alpha Radiation," A Report Prepared for the Atomic Energy Board of Canada, INFO-0081, 1982.

Ev 69 Evans, R.D., "Engineer's Guide to the Elementary Behavior of Radon Daughters," Health Physics, 17:239, 1969.

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