PUBLIC COMMENTS: On NRC Environmental Review of Relicensing of The Prairie Island Nuclear Generating Plant (PING); and Xcels Environmental Report (ER) – Operating License Renewal Stage PING (NMC), Units 1 and 2, Docket No. 50-282 and 50-306, License Nos. DPR-42 and DPR-60.

DG-1149

To: Rulemaking, Directives and Editing Branch,
Office of Administraton, U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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Dear Sir,

I am using the CEQ EIS guidelines to frame my comments. My oral comments can be found in the evening transcript for the Red Wing public hearings. The outline of my comments is as follows:

I. Affected Environments
II. Interdisciplinary Approach
III. Connected Actions and Cumulative Effects
IV. Baselines
V. Recommended Alternatives
VI. Mitigation and Monitoring
VII. Additional Citations

Thank you for your attention to my comments to the scope of environmental review.

Kristen Eide-Tollefson

Sec. 1502.15 Affected environment. The environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in a statement shall be commensurate with the importance of the impact, with less important material summarized, consolidated, or simply referenced. Agencies shall avoid useless bulk in statements and shall concentrate effort and attention on important issues. Verbose descriptions of the affected environment are themselves no measure of the adequacy of an environmental impact statement.

I. Affected Environment. Defining the scope of the affected environment is the foundation of the EIS. The defining of the affected environment either adequate captures, or inadequately constrains considerations in the EIS. This act of defining and describing, impacts interested and affected communities and persons. It is important to interested and potentially affected communities and persons, to be included in the scope and to have their economic, social and natural resource bases identified. See also **IV. BASELINES.**

The scope of the description of the affected environment should not be constrained by the requirement for succinctness in the description itself. Succinctness of description refers to length, not to content.

Prairie Island: The description of the affected environment should adequately describe the social, environmental, economic and health situation of the Prairie Island Indian Community. Xcel's ER is inadequate in this description.
Neighboring Communities/Counties: The scope should also adequately describe the social, environmental, economic and health characteristics of the affected counties listed in Xcel's ER under 2.6.

Xcel's discussion of the Area Economic Base under 2.6 in its ER is entirely inadequate to describe the affected social, economic and natural environments of the directly affected river communities in the listed counties.

2.9 adequately describes planning concerns for Goodhue County. The county is increasingly looking to the special characteristics of its natural resource base to define its identity and guide future planning. Many of these resources are sensitive and require special consideration and planning treatment. The entire river valley ledge is highly susceptible to groundwater contamination. Surface water protections are increasingly important as well, as noted in 2.8.

50 Mile impact zone: In addition, the NRC EIS should also either describe or say why it does not consider communities/counties within the 50 mile potential impact radius of the plant. Communities are very aware of this radius.

Hiawatha Valley: The EIS should particularly concern itself with the affected environment -- the environmental, social, economic and natural resource bases -- that are common to the river communities, across and downriver from Prairie Island. The ecologies and economies of the river valley communities are deeply

interconnected - both between the shores and along the Great River Road which runs along both sides of the river, Wisconsin (Hwy 35) and Minnesota (Hwy 61).

Area Economy: The area's economy is based in large part on tourism, recreational fishing and other water resource attractions. These economies are year round, and are affected by water quality, ice qualities and other features of the river/lake ecology. The scope of affected environments should extend to the southern end of Lake Pepin at least.

Some of the important common features of the Hiawatha Valley can be found in materials on:

- Hiawatha Valley Partnership
  www.nextstep.state.mn.us/res_detail.cfm?id=2380 - 14k
- The Great River Road, http://www.mnmississippiriver.com/
- The Mississsippi River Commission
  http://www.mvd.usace.army.mil/mrc/index.php,
- Mississippi River Regional Planning Commission -http://www.mrrpc.com/;
- Minnesota Mississippi River Parkway Commission
  www.mn**mississippiriver**.com Carol.Zoff@dot.state.mn.us; and the
- Mississippi Valley Partners business literature.
  http://www.city-image.com/index.php?page=Mississippi-Valley-Partners

Natural resource and waters information, is available from the Department of Natural Resources (Lake City office), and other commenting agencies.

Sec. 1502.6 Interdisciplinary preparation Environmental impact statements shall be prepared using an inter- disciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts (section 102(2)(A) of the Act)…

II. Interdisciplinary approach. Evaluation of the interdependence of the local river community economies and ecologies -- the natural and "human environments" -- requires a fully interdisciplinary approach (see also connected actions and cumulative effects). The affected river communities should be extended, at least, to the southern border of Lake Pepin, which is directly impacted by PI.

Special characteristics of PIIC: Analysis must in particular include the effects of the continued operation of the plant and expansion of the ISFSI upon the special characteristics of the of the Native American community at Prairie Island. This includes effects upon spiritual traditions, traditional diet, medicines, psychological well being and other categories, as defined by the Prairie Island Indian Community.

Sec. 1508.8 Effects. "Effects" include (a) Direct effects, which are caused by the action and occur at the same time and place. (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.

Sec. 1508.14 Human environment. "Human environment" shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. (See the definition of "effects" (Sec. 1508.8).) This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment

Sec. 1508.25 Scope: connected, cumulative and similar actions. Scope consists of the range of actions, alternatives, and impacts to be considered in an environmental impact statement. The scope of an individual statement may depend on its relationships to other statements (Secs.1502.20 and 1508.28). To determine the scope of environmental impact statements, agencies shall 3 types of actions, 3 types of alternatives, and 3 types of impacts. They include:

- **(a)** **(a) Actions** (other than unconnected single actions) **which may be connected actions,** which means that they are closely related and therefore should be discussed in the same impact statement. **Actions are connected if they: (i) Automatically trigger other actions which may require environmental impact statements. (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously. (iii) Are interdependent parts of a larger action and depend on the larger action for their justification.**
- **(b)** **Cumulative actions,** which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.
- **(c)** **Similar actions**, which when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequencies together, such as common timing or geography. An agency may wish to analyze these actions in the same impact statement. It should do so when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement
- **(d)** **(b) Alternatives**, which include: i. No action alternative. ii. Other reasonable courses of actions. iii. Mitigation measures (not in the proposed action).
- **(e)** **(c) Impacts, which may be: (1) Direct; (2) indirect; (3) cumulative.**

Sec. 1508.7 Cumulative impact. "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

III. Connected Actions and Cumulative Effects: There are at least 4 pending actions which constitute connected actions and have cumulative effects upon these interdependent systems. These are identified below, and should be analyzed accordingly. We will need to depend upon the expertise of others to clarify the relationship of these actions to the 3 types of actions, impacts and alternatives listed in 1508.25, and addressed in the handbooks. The following chart gives an example: www.seeda.co.uk/RES_for_the_South_East_2006-2016/docs/AnnexF-031106.doc -

The scope of these particular comments should not limit definition and analysis of cumulative impacts, nor the definition and scope of the connected actions. They are merely a starting point which the affected and interested local governments should expand upon. Please confirm that there will be an opportunity in the comment process for these affected communities to address cumulative effects and connected, cumulative and/or similar actions as defined in Sec. 1508.25. Please clarify how that will work.

A. Connected, Cumulative or Similar Actions affected by the PING application.

Environmental review under NEPA requires that the potential impacts of related actions present or future, and their **cumulative effects**, be described and analyzed. These actions need not be permitted by the same agency. The following actions,

specifically, are connected to the relicensing of Prairie Island and will be reviewed by both state and federal governments.

Our argument is that the timing of these reviews and the "departmentalization" of the actions is harmful, and blocks adequate EIS analysis of these federal actions, and undermines adequacy of the SER for relicensing. The connected, cumulative and/or similar actions listed below need to be evaluated as connected/cumulative or similar actions and their cumulative effects upon the affected environments must be evaluated. All are dependent upon and interconnected with the NRC relicensing review and permit:

1. UPRATE – Certificate of Need Extended Power Uprate – PUC Docket E002/Cn-08-509. Without the extended license there will be no uprate. The license renewal safety review and aging reactor review MUST consider the cumulative effects of the uprate temperatures and pressures upon: a) the safety of the aging reactor, over time, and b) the cumulative environmental and socio-economic effects of increased temperatures on the ecology of the lake; c) new fuel types; d) additional emissions (if any) and timing and frequency of those emissions; e) other concerns raised by other parties, particularly the Prairie Island Indian Community (PIIC).

Scenarios: These assessments should be done for various water level scenarios on the ecology of the lake, and consider potential cumulative effects of warming temperatures (global climate change), with heat and emission factors from the uprate. Climate change effects, including temperature and water, are likely within the period of relicensing. This analysis should expand upon water demand, quality and shortage concerns for the area in addressing these scenarios.

2. Site Permit Extended Power Uprate – PUC Docket Eoo2/GS-08-690. Without relicensing, there would be no site permit process. And it is the location of the uprate, at the PI facility, that creates the context for the connected actions and their cumulative effects upon the affected environments.

3. Additional Dry Cask Storage Certificate of Need PUC Docket E002/CN-08-510. Additional dry cask storage is needed to accommodate waste from relicensed reactors. There is no federal plan for this waste. It is therefore, reasonably speaking, beyond the reach of the confidence decision, regardless of its wording. Even if NRC judges, as it must, the adequacy of the confidence ruling, this does not eliminate the need to address the effects, as connected/cumulative/similar actions in the EIS.

There are a number of related actions that reach beyond the current license and relicensing period that involve decommissioning, long term storage of wastes at the reactor site, and an unspecified set of scenarios including federal actions (take title; regional interim storage etc) that impact the affected communities and local governments. While we have no illusions that we will significantly change the way in which NRC has delt with this issue in the past, there are specific impacts that we

would like addressed in the EIS that have to do with future funding, land use, and responsibility for at reactor site waste management. These socio-economic factors directly affect local governments, and it is not reasonable that they should not be addressed at the point of relicensing. Others may have other requests.

Commitment of Resources: Local governments have ultimate responsibility for the safety and well being of their communities. They must define and defend their interests, as it relates to any actions or non-actions affecting their economic, social and natural environments. The lack of resolution of the storage issue, in the context of NRC extension of uprate, license and cask storage permits, creates significant burdens for these local governments, including but not limited to PIIC. These impacts include lobbying, time, money and expertise needed to provide adequate local oversight of the issues and respond to utility, state and federal initiatives.

Local Government impacts: Most importantly, where these local governments are unable or unwilling to commit resources to provide for the representation and defense of these interests, the intention of NEPA for public involvement, and a number of other NRC, state and federal principles – is undermined.

Funding scenarios: Like NRC, the ability of local governments to 'do their job' depends upon funding. Should NRC's or DOE's funding continue to be reduced, or should fail – or their ability to perform adequately to their mandate be undermined by funding shortages, the primary burdens for protecting the safety and well being of the affected communities falls to their local government. It is in the context of the cumulative effects of current, and future actual and potential failures of funding (this includes Yucca Mountain) for the NRC/DOE mandates related to waste management, that the unresolved waste issue must be addressed in the EIS. See: www.naruc.org/Resolutions/Nuclear%20Waste%20Disposal.pdf

Xcel's responsibility: While Xcel, under the federal waste contract, is responsible for the waste until the federal government takes it, Xcel has provided for no mechanisms to ensure the responsible management, monitoring, or funding of indefinite storage; nor has Xcel done contingency planning in the event of federal funding shortages or failure. In fact, Xcel has continued to claim in related dockets that the waste storage is temporary and that their responsibility is subordinate to that of the federal government, despite the clear terms of the contract title. Neither PUC, nor NRC, nor DOE has addressed this gap in responsibility. And none of the 'responsible' entities has provided a reasonable set of factors, funding or timeline for the facility and cask replacement recommended by DOE, at each 50 to 100 years.

No-Action: Because there is no federal plan for waste from relicensed reactors, there is no timeline for removal, no specified place for the waste to go, and no known facilities/cask replacement timeline, the cumulative effects of indefinite storage should be assessed.

Deterioration factor impacts line up for PI: The engineering studies for the Yucca Mountain D/EIS use 3 factors to evaluate the vulnerability of the designated regions to the effects of the no action (indefinite at reactor site storage) alternatives: proximity to populations, amount of precipitation, and the freeze thaw cycle, which are the primary factors in cask and facility deterioration rates. All three of these factors are present at Prairie Island.

Impact on commitment of resources, land use: The waste from the original license period is scheduled (in the YM queue) to be gone @2045. At this point the casks with waste from the initial license period/ISFSI will be between 40 and 50 years old. According to the Yucca Mountain DEIS timeline, this is also the point at which breakdown of containment could begin. The pool will be @ 70 years old.

With the casks gone, the site could be restored as early as @2045. If the plant is relicensed, then the site cannot be restored. Because it is so close to the business and residential environments of PIIC, the condition of the site will affect the quality of the environment in which they are doing business and residing. Indefinite storage creates an unacceptable level of unknowns and will not only deprive the Community of a restored environment, but will require expenditures related to due diligence and necessary vigilance in overseeing and responding to conditions at the storage site. These burdens threaten the quality of life and economic vitality of present and future generations.

NEPA requirements: While NRC Rules allows these actions to be analyzed in a vacuum, NEPA and CEQ rules (arguably) do not. These actions can have significant, ongoing and cumulative effects upon the economies and ecologies, security and health of the area; and particularly upon future generations.

IV. BASELINES [7. **Define a baseline condition for the resources, ecosystems, and human communities.**]. The following baselines (at least) need to be established for the assessment of cumulative impacts, and to allow for meaningful monitoring of the affected environment into the future. These comments should in no way limit the work of EIS analysts, or the types and numbers of baselines to be established. Baselines need to be identified and represented in an accessible way; the data and analysis should be understandable to community members and local officials.

A. Groundwater baseline: Minnesota statute provides parameters for groundwater protection, that require a baseline to be established.

116C.76 NUCLEAR WASTE DEPOSITORY RELEASE INTO GROUNDWATER.

Subdivision 1. Radionuclide release levels. Radioactive waste management facilities for spent nuclear fuel or high-level radioactive wastes must be designed to provide a reasonable expectation that the undisturbed performance of the radioactive waste management facility will not cause the radionuclide concentrations, averaged over any year, in groundwater to exceed:

(1) five picocuries per liter of radium-226 and radium-228;
2) 15 picocuries per liter of alpha-emitting radionuclides including radium-226 and radium-228, but excluding radon; or
(3) the combined concentrations of radionuclides that emit either beta or gamma radiation that would produce an annual dose equivalent to the total body of any internal organ greater than four millirems per year if an individual consumed two liters per day of drinking water from the groundwater.
Subd. 2. Disposal restricted. The location or construction of a radioactive waste management facility for high-level radioactive waste is prohibited where the average annual radionuclide concentrations in groundwater before construction of the facility exceed the limits in
subdivision 1.
Subd. 3. Protection against radionuclide release. Radioactive waste management facilities must be selected, located, and designed to keep any allowable radionuclide releases to the groundwater as low as reasonably achievable.
History: 1986 c 425 s 11

Epri: "Groundwater Protection Guidelines for Nuclear Power Plants, 2008." www.epriweb.com/public/000000000001016099.pdf

B. Historic cancer rates for Goodhue, Dakota, Peirce, and Wabasha Counties through 2006. We have been unable to access these statistics.

C. Thermal conditions south of PI to the southern border of Lake Pepin.

D. Fish populations south of PI to the southern border of Lake Pepin

In addition, the following information would be useful to local communities in understanding the 'baseline' trajectory and flux of emissions/releases over time. Without historic information, current information can be unduly alarming, and difficult to evaluate:

1. Air emission releases (See CURE comments), historic, through 2007
2. Thermal discharges, historic through 2007
3. Effluent discharges – type, timing and frequency, historic through 2007
4. Tritium discharges, historic through 2007.

Table 1-5. Steps in cumulative effects analysis (CEA)
to be addressed in each component of environmental impact assessment (EIA)

Scoping

1. **Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.**

2. Establish the geographic scope for the analysis.

3. Establish the time frame for the analysis.

4. Identify other actions affecting the resources, ecosystems, and human communities of concern.

Describing the Affected Environment

5. **Characterize the resources, ecosystems, and human communities**

Environment **identified in scoping in terms of their response to change and capacity to withstand stresses.**

6, Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds,

7. Define a baseline condition for the resources, ecosystems, and human communities.

Determining the Environmental
8. **Identify the important cause-and-effect relationships between human**
Consequences **activities and resources, ecosystems, and human communities.**

9. Determine the mognitude and significance of cumulative effects.

10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.

11. Monitor the cumulative effects of the selected alternative and adapt management.
http://orf.od.nih.gov/Environmental+Protection/NEPA/EnvironmentalAssessments.htm

V. Recommended Alternatives:

1. Replacement Option: Combined technologies, specifically wind paired with existing/refurbished gas facilities, should be the primary baseload alternative evaluated by Xcel. Xcel's gas fleet is aging. Its assessment of refurbishment should maximize opportunities for gas/wind combinations, optimizing flexible use of these facilities and avoiding the costs and climate impacts of new gas plants.

2. Conversion option: An energy and R&D park at Prairie Island, would be a conversion option for the PI site and plant. It would utilize existing equipment, add modular generation and take advantage of the transmission at PI. Hydrogen could be generated during off peak hours and PI could become a hydrogen fueling and experimental station, among other R&D projects. This would bring an alternative selection of high paing 'green' jobs into the area, develop new capacities and provide opportunities to capture funding opportunities as new federal energy initiatives unfold.

1502.22 - Incomplete or unavailable information.

When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

(a) If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.

(b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement: (1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the

purposes of this section, reasonably foreseeable includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.

(c) The amended regulation will be applicable to all environmental impact statements for which a Notice of Intent (40 CFR 1508.22) is published in the Federal Register on or after May 27, 1986. For environmental impact statements in progress, agencies may choose to comply with the requirements of either the original or amended regulation.

While the "foreseeable future" is difficult to define with nuclear waste, the scope of incomplete and missing information regarding the fate of waste from relicensed reactors is significant. There is no rational plan, no maintenace or facility replacement schedule for relicensed reactors at Monticello or Prairie Island. There is no contingency planning; no scenario development. The missing information is not only factual, but procedural. This situation should be described, and elaborated, under this section of the EIS.

VI. 1508.20 Mitigation and Monitoring: Mitigation includes:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.
(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
(e) Compensating for the impact by replacing or providing substitute resources or environments.

From the perspective of a planning commission member in a downriver community that is part of the affected environment of the PING, the most useful kind of mitigation to consider in conjunction with relicensing the plant, is an exploration of long term joint stakeholder mechanisms would allow affected communities and local governments to participate meaningfully in the ongoing decisions involving PING. Several references are included below.

"Stepwise approach to decision-making for long term radioactive waste". www.nea.fr/html/rwm/reports/2004/nea4429-stepwise.pdf

"Uncertainty, innovation, and dynamic sustainable development (applied to nuclear waste)" Lenore Newman School of Environment and Sustainability, Victoria, B.C., Canada V9B 5Y2(e-mail: lenore.newman@royalroads.ca) http://ejournal.nbii.org/archives/vol1iss2/0501-001.newman.html

VII. Citations: The following set of citations from CEQ rules is included for the benefit of other public commentators. For NRC, the inclusion of these sections creates a framework of our expectations regarding the importance and scope of connected/cumulative effects analysis (CEA). We have used primarily CEQ references since this is the standard that NRC uses:

Table 1-2 Principles of Cumulative Effects Analysis

http://ceq.hss.doe.gov/nepa/ccenepa/sec1.pdf

Cumulative Impacts are caused by the aggregate of past, present, and reasonably foreseeable future actions.
The effects of a proposed action on a given resource, ecosystem, and human community include the present and future effects added to the effects that have taken place in the past. Such cumulative effects must also be added to effects (past, present, and future) caused by all other actions that affect the same resource.

2. Cumulative effects are the totai effect,Inciuding both direct and indirect effects,on a given resource, ecosystem, and human community of ail actions taken, no mat?er who (federai, nonfederal, or private) has taken the actions.
Individual effects from disparate activities may add up or interact to cause additional effects not apparent when looking at the individual effects one at a time. The additional effects contributed by actions unrelated to the proposec action must be included in the analysis of cumulative effects.

3. Cumulative effects need ta be analyzed in terms of the specific resource, ecosystem, and human community being affected.
Environmental effects are often evaluated from the perspective of the proposed action. Analyzing cumulative effects requires focusing on the resource, ecosystem, and human community that may be affected and developing an adequate understanding of how the resources are susceptible to effects.

4. It IS not practical to analyze the cumulative effects of an action on the universe; the ilst of environmental effects must focus on those that are truly meaningful.
For cumulative effects analysis to help the decisionmaker and inform interested parties, it must be limited through scoping to effects that can be evaluated meaningfully. The boundaries for evaluating cumulative effects should be expanded to the point at which the resource is no longer affected significantly or the effects are no longer of interest to affected parties,

5. Cumulative effects on a given resaurce, ecosystem, and human community are rarely aligned with poiitical or administrative boundaries.**.**
Resources typically are demarcated according to agency responsibilities, county lines, grozing allotments, or other administrative boundaries. Because natural and sociocultural resources are not usually so aligned, each political entity actually manages only a piece of the affected resource or ecosystem. Cumulative effects analysis on natural systems must use natural ecological boundaries and analysis af human communities must use actual sociocultural boundaries to ensure including all effects,

6. Cumulative effects may resuit from the accumulation of simliar effects or the synergistic interaction of different effects.
Repeated actions may cause effects to build up through simple addition (more and more of the same type of effect), and the same or different actions may produce effects that interact to produce cumulative effects greater than the sum of the effects.

7. Cumulative effects may last for many years beyond the life of the action that caused the effects.
Some actions cause damage lasting far longer than the life of the action itself (e.g., acid mine drainage, radioactive waste contamination, species extinctions). Cumulative effects analysis needs to apply the best science and forecasting techniques to assess potential catastrophic consequences in the future.

B. Each affected resource, ecosystem, and human community must be analyzed in terms of he capacity to accommodate additional effects, based on its own time and space parameters.
Analysts tend to think in terms of how the resource, ecosystem, and human community will be modified given the action's development needs. The mast effective cumulative effects analysis focuses on what is needed to ensure long-term productivity or sustainability of the resource.

Table 1-4 Types of Cumulative Effects

In simplest terms, cumulative effects may synergistic-where the net adverse cumulative arise from single or multiple actions and may effect is greater than the sum of the individual result in additive or interactive effects. Interac- effects. This combination of two kinds of tive effects may be either countervailing— actions with two kinds of processes leads to four where the net adverse cumulative effect is Iess basic types of cumulative effects (Table 1-3; see than the sum of the individual effects-r Peterson et al. 1987 for a similar typology).

Type 1 — Additive - Repeated "additive" effects from a single proposed proiect.
Example: Construction of a new road through a national park, resulting in continual draining of road salt onto nearby vegetation.

Type 2 – Interactive - Stressors from a single source that interact with receiving biota to have an "interactive"

(nonlinear) net effect.
Example: Organic compounds, including PCBS, that biomagnify up food chains and exert disproportionate toxicity on raptors and large mammals.

Type 3 – Additive - Effects arising from multiple sources (proiects, point sources, or general effects associated with development) that affect environmental resources additively.
Example: Agricultural irrigation, domestic consumption, and industrial cooling activities that all contribute to drawing down a groundwater aquifer.

Type 4- Interactive - Effects arising fram multiple sources that affect environmental resources in an interactive (i.e., countervailing or synergistic) fashion.
Example: Discharges of nutrients and heated water to a river that combine to cause an algal bloom and subsequent loss of dissolved oxygen that is greater than the additive effects of each pollutant.

Criteria. In determining whether a proposed action will or will not "significantly affect the quality of the human environment," OPDIVs/STAFFDIVs should evaluate the expected environmental consequences of a proposed action by means of the following steps, utilizing the guidance provided in 40 CFR 1508.27:

Step One -- Identify those things that will happen as a result of the proposed action. An action normally produces a number of consequences. For example, a grant to construct a hospital may terminate human services; will involve destruction and construction; will provide a service. Actions may be connected, cumulative, or similar (see 40 CFR 1508.25(a)).

Step Two -- Identify the "human environments" that the proposed action will affect. In accordance with 40 CFR 1508.27, the significance of an action must be analyzed in several contexts, such as society as a whole (human, national), the affected region, the affected interests, and the locality. The significance of an action will vary with the setting of the proposed action. Environments may include terrestrial, aquatic, subterranean, and aerial environments, such as islands, cities, rivers or parts thereof.

Step Three -- Identify the kinds of effects that the proposed action will cause on these "human environments." A change occurs when a proposed action causes the "human environment" to be different in the future than it would have been, absent the proposed action. These changes involve the introduction of various "resources" (including those often characterized as waste).

Example: A decrease in the amount of soil entering a stream; the introduction of a new chemical compound to natural environments.

In addition to organisms, substances, and compounds, the term "resources" include energy (in various forms), elements, structures, and systems (such as a trash collection service in a city). Present environmental impacts and reasonably foreseeable future environmental impacts must be considered.

In identifying changes caused by the proposed action, OPDIVs/STAFFDIVs should identify the magnitude of the changes likely to be caused within smaller and larger "human environments" affected (e.g., part of a city, the whole city, the metropolitan area).

The impacts resulting from the proposed action may be direct, indirect, or cumulative (see 40 CFR 1508.25(c)).

Step Four -- Identify whether these changes are significant. The following points should be considered in conjunction with 40 CFR 1508.8 (effects), 40 CFR 1508.14 (human environment), and 40 CFR 1508.27 ("significantly") in making a decision concerning significance:

- A change in the characterization of an environment is significant (e.g., from terrestrial to aquatic.
- The establishment of a species in or removal of a species from an environment may be significant
- The more dependent an environment becomes on external resources, the larger the magnitude of change (and the more likely it is to be significant);
- The larger the environment under consideration, the lower the amount of change needed before the change may be significant.

The CEQ regulations in 40 CFR 1508.27 describe a number of factors that should be considered in evaluating severity (intensity) of an impact. OPDIVs/STAFFDIVs should consider the cumulative effect of the proposed action. An action may

be individually insignificant but cumulatively significant when the action is related to other actions. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

Sec. 1508.27 Significantly. "Significantly" as used in NEPA requires considerations of both context and intensity:

(a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

- Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
- The degree to which the proposed action affects public health or safety.
- Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
- The degree to which the effects on the quality of the human environment are likely to be highly controversial.
- The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
- The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
- Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Respectfully submitted,
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About the commentator: Eide-Tollefson served on the MN Environmental Quality Board Citizen's Site Advisory Committee for the Goodhue Storage Facility exercise in 1995. After the Florence Township sites were eliminated from consideration, she continued to work as a citizen advocate in state regulatory and legislative arenas., submitting numerous comments on integrated resource planning, and other nuclear and energy resource proposals.

In 2006 she graduated from the Humphrey Institute MPA program with a concentration in "Public Engagement in Energy Policy, Planning and Infrastructure Development". She has served on Environmental and legislative stakeholder and advisory committees and from 1999-2003, was active in the Nuclear Waste Strategy Coalition. She is currently a planning commissioner for Florence Township, Goodhue County. She is, however, not an environmental lawyer or professional and must depend upon the expertise of NRC professionals in evaluating and acting upon her comments and recommendations.