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SUBJECT: Comments on First External Review Draft by the USEPA SAB INC

TO: Integrated Nitrogen Committee

FROM: Dan B. Jaynes, Soil Scientist /s/

Below are selected comments I have regarding the INC's first draft. I hope that the comments are helpful in making for a stronger final report.

General Comments:

The draft is an excellent summary of the national Nr budgets and the consequences of Nr enrichment of air, water, and land resources. The national Nr budget is presented several times and in several different ways and it is not always clear how these various budgets relate to each other as various sources and sinks are alternately combined or split out. Multiple presentations of the Nr budget make the draft repetitious. This has probably resulted from the document being written by various teams, but these inconsistencies and repetitions need to be corrected before the final document.

Many of the Findings and Recommendations within the body of the report are not substantiated by the text in the section preceding their listing. They may not be wrong or misleading; they just don't follow logically from the discussion in the preceding text. This would be a much stronger and influential document if the Findings and Recommendations are drawn directly from pertinent cited research.

Many of the solutions proposed are poorly documented. The use of EE N fertilizers is a prime example as they are presented as having a great potential to reduce Nr losses, but no research is presented showing their efficacy or practicality in the production of the major commodity crops, where the vast majority of N fertilizer is used and lost. And in fact, there exists little data showing their efficacy in producing good crop yields while reducing losses of Nr. Improved tile drainage systems are also cited as possible solutions (C1-7 l43) and while I agree with this assessment, nowhere in the draft do you explain what is meant by improved drainage systems or research cited where they have been proven effective.

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A glossary of terms and acronyms needs to be included. For example the definition for NOx and NOy is never given. Likewise jargon such as “ammonia slip” need to be defined. Acronyms such as PBL are used and never defined.

Specific Comments:

C1-6. Either combine or more clearly delineate the differences between OR 1-2 and OR 1-3. Currently, there appears to be much overlap between these two recommendations and I’m not clear how they differ or why they can’t be combined into one.

C1-8. Recommendation R1-3. The other three recommendations include a “through” statement that at least gives some indication as to how the committee believes the goal can be attained. No such statement is included for this recommendation – perhaps because the committee is unsure if/how it can be accomplished in a realistic manner. Also, little justification is given in the text to support the 20% reduction value (or for the 20% reduction value in R1-2). Setting these reductions as goals may be worthwhile, but a realistic accounting of the risks, costs, and mechanisms for attaining these reductions needs to be provided.

C3-8. Recommendation R3-1. Can the panel estimate what the magnitude of savings would be for control of off highway sources within the U.S.? If substantial, I’m surprised that control of this source of Nr combined with ramping down further emissions from highway and industry sources is not a priority for the panel as Nr production from these sources is completely a waste product. I came away from the November panel meeting thinking that control of this source would be emphasized, but its not isn’t listed on p. C1-7 with the other 4 highlighted Recommendations.

C3-13 Finding F3-3. It is impossible to determine that farmers don’t follow BMPs by just using USDA statistics as these only report average use rates etc. and it is not possible to pick out the farmers over applying. Also it is unclear what the panel means by BMPs for N, as many farmers currently follow state extension guidelines for N use, but these may not be the best methods known for optimizing NUE – only the most cost effective or practical.

C3-13 Recommendation R3-3. While these may or may not be viable recommendations, none are supported by the narrative immediately preceding this recommendation. How would NRDs (#1) improve N use or are you assuming a regulatory function for these? Subsidizing EE fertilizer products (#2) will certainly be needed if they are to be widely used, but first these products must be shown effective and the management schemes developed for the major commodity crops. The science isn’t currently there yet. Improving education and extension is desirable (#4) and on-

farm networks can be effective, but remember that most farmers get their fertilizer information from coops, crop consultants, and fertilizer dealers and not from University Extension. How does the panel recommend the enlistment of these groups in improving N recommendations?

C3-16. Recommendation R3-4. Overall, these recommendations are not substantiated by the text immediately preceding them. Also, (1) NUE as defined in this report "grain yield per unit N applied" is quite easily determined at least on average using NASS statistics. What is not easily determined is "grain yield per unit total N" that includes mining of soil N, manure, fixed N from legumes, etc. (2) No citations are given regarding the use of "smart" N fertilizers on the main commodity crops, probably because there are few to none showing both yield returns and water and air quality benefits. While there may be a potential for these products (if subsidized) research clearly showing their benefits is required first. (3) I agree with this statement and there is research currently being conducted in this area. That is why I'm surprised that your main Recommendation R1-3 states "crop output (can) be increased while reducing … by … 20% … applied artificial Nr" as there are still numerous research and infrastructure barriers to be overcome.

C3-17, l30. N2O losses may be < 1% of N applied in many fields, but in the higher soil organic soils of the Midwest corn belt these losses can approach 7% and occur in both the corn year (when N is applied) and in the soybean year (when N is not applied). See Parkin and Kaspar, JEQ 35:1496-1506.

C3-20 l1. While there was a jump in corn acres in the U.S. in 2007, 2008 data show that at least half this gain in acres has been taken back out of corn. Also corn prices have moderated extensively, so statement on price increases in previous sentences is also obsolete. Perhaps it would be better to point out how corn for ethanol and corn prices will be intimately tied to world wide oil prices now and in the future.

C3-20 Finding F3-6. Again, this conclusion is inaccurate given current developments in the biofuel, corn, and fertilizer markets. The fertilizer cost ($0.61/lbs NH3) to grain price ($3.54/bu) ratio is currently in favor of reduced N inputs, but all of these markets are volatile.

C3-22 Recommendation R3-7. I'd change the wording to "ammonia/ammonium ***should*** be monitored nationwide" given their importance and uncertainty.

C3-28 l31. Much of the N deposited in pastures and rangelands is taken up by the grasses growing there so that it is inaccurate to say that this N "was not recovered for further use".

C3-29. Finding F3-8. Farm level improvements may be helpful, but this finding would

carry more weight if the preceding section gave examples of technologies that have been shown to be effective and an estimate of the additional costs involved.

C3-30 l23. Should reference the research cited illustrating N leaching in turf.

C3-47 Finding F3-10. I did not see any evidence to increasing NH3 emissions presented in the previous section and question this finding for accuracy.

C3-48 l20. A more accurate phrase would be “provide nutrients” instead of “provide fertilizer”.

C3-51 Fig. 3-13. I don’t understand the N storage component of these systems. As this is a continuous annual budget, new storage in soils implies an ever increasing soil organic matter content or a decreasing soil C:N ratio. Neither has much credence in the literature. It is probably best to assume a long term steady state in soil organic matter and thus no new net storage in your budget. Also the inputs and outputs do not balance in the different compartments e.g. inputs into Agricultural are 19.6 while outputs are 20.8. I suspect that the 2.0 Tg N Transfer term should be balanced by a decrease in the Products term.

C3-57 Table 3-15. Do not confuse no-till with conservation tillage. No-till and reduced tillage are forms of conservation tillage but the converse is not true. Baker et al, 2007 based on the study by West and Post, 2002 looked specifically at no-till not all conservation tillage. Also, I would question the panel’s conclusion that any N is being newly stored in agricultural lands, i.e. that soil C stocks are increasing. This needs to be better substantiated in the text.

C3-60 Section 3.3.3.1. It is confusing how you interchange the use of watershed and catchment in this section. Please use catchment consistently when referring to the 16 catchments, e.g. caption for Fig 3-14 should read in part “using weighted averages for all 16 catchments)” not watersheds.

C3-62 Tables 3-19 and 3-20. I find the numbers in these tables confusing, especially when compared to those used in the Nr cascade (p C3-64) or Figure 4-2. Different break downs of the components are used and categories are mixed making it difficult to impossible to compare the different representations of Nr. Other features are also confusing, in Table 3-19 if 4.4 Tg N comes from crop residues and 4.7 Tg comes from SOC does this imply that SOC is decreasing over the long term? Likewise in Table 3-20 if 4.7 Tg N goes from soil to crop where is the return N to the soil so that SOC does not decrease dramatically over the short term? Finally, the values in the tables do not agree with the value given in lines 1-12 on p. C3-63 (e.g. 5.9 Tg atmospheric deposition on p. C3-63 but 5.4 Tg in table). I’d urge care and greater uniformity in the portrayal of the N budgets among all sections of the report.

C3-67. Interesting that Booth and Campbell recommend that the most productive agricultural land, the land that is most intensively cropped, should be the land targeted for land retirement. This appears to be counter to your “intensification” argument made earlier.

C3-67 l43. Conservation has little direct effect on increasing crop yields. Only in the long term can one argue that conservation tillage, by saving topsoil, would impact yields and this benefit has been poorly if at all substantiated by field observations.

C3-68 l18. I agree that the goal is greater synchrony between N application and N need by the crop. We already know for example that side dressing N in response to a soils test or perhaps in response to a sensed N deficiency in lieu of fall N application can improve N use and decrease N losses. But the challenge is addressing the numerous institutional and logistic roadblocks to farmer adoption of these practices. Farmers apply N in the fall for many reasons (lower N prices, favorable soil conditions, opportunity time). These will have to be overcome to move farmers away from this practice. Institutional roadblocks also exist, such as the requirement by fertilizer dealers for farmers to preorder N fertilizer, making adaptive N application impossible or inability of coops to provide N for all farmers in the spring. Only a concerted, well coordinated, sustained effort can move the entire industry to a more effective N application regime. The question is how can EPA and other federal and state agencies help this effort?

C3-68 l25. I assume you mean “decreases in yield” rather than “increases”. NUE is not what the farmer is looking at but rather maximum return to investment. The greatest NUE comes from the first unit of N applied and decreases thereafter, but this is not the point of maximum profit. Reducing N applied always increases NUE for a nutrient that follows a diminishing returns response function.

C3-69 Finding F3-13 and Recommendation R3-19. No mention of biofuels and especially use of biofuel coproducts was made in preceding section so I do not know what this finding and recommendation is based on.

C3-74. #5. Rates of ammonia emissions need to be quantified, but so too do the rates of ammonia uptake by crops and forests. Much of the ammonia emitted from soil is rapidly taken up by crops and does not travel far from its origin.

C4-11 l 20. As noted above the 10% increase in crop acreage for corn is out of date. Perhaps a more general statement about the volatility of corn for biofuels and its linkage to global oil markets would be more appropriate.