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1 September 1993

Ms. Lisa Marino
U.S. Environmental Protection Agency
DE/MD Remedial Section (3HW42)
Region III
841 Chestnut Street
Philadelphia, PA 19107

W.O.# 01631-016-002

Dear Ms. Marino:

On behalf of Sussex County, I am submitting the enclosed Sussex County Review Comments on EPA's Baseline Risk Assessment for Sussex County Landfill No. 5 (dated 30 July 1993). This risk assessment was received by Sussex County on 02 August 1993.

Should you have any questions, please contact us.

Very truly yours,

ROY F. WESTON, INC.

Thomas A. Drew /EJT

Thomas A. Drew, P.G.
Project Manager
Geosciences Department

:mdh

Enclosure

cc: Michael Izzo, P.E. - Sussex Co.
Robert Wood, P.E. - Sussex Co.
George Weiner, Esq. - McCutchen, Doyle, Brown, and Enersen
Jamie Hackney - DNREC
Eva Timmer - WESTON
Charles Dobroski - WESTON

**SUSSEX COUNTY REVIEW COMMENTS**
**HUMAN HEALTH RISK ASSESSMENT**
**SUSSEX COUNTY LANDFILL NO. 5**

## SUMMARY OF CONCLUSIONS

**1. Page 1, 3rd and 4th Paragraphs** - The summary of conclusions only summarizes the results for the adult based on the residential wells. The risk results from the monitoring wells should also be included, as well as the results from the child. The cancer risk is presented in these paragraph, as well as in many other areas of the document, using three significant figures. However, as stated in RAGS, page 8-12, "[r]esulting cancer risk estimates should be expressed using one significant figure only." In the 3rd paragraph it is stated that a calculated risk of 1.30E-04 for the residential wells exceeds the agency's carcinogenic risk range (i.e., 1.0E-06 to 1.0E-04). However, if only one significant figure is reported, then the risk (1E-04) falls within the agency's generally acceptable risk range. The cancer risk throughout the document should be changed to report only one significant figure. Although RAGS does not specify whether the hazard index should also be presented as one significant figure, an example table does present the hazard index using one significant figure as well. Also, the meaning of the phrase "increased carcinogenic risk" may not be apparent to all readers. It would be preferable to use the phrase "incremental lifetime carcinogenic risk" (comment also applies to pages 33, 35, 36, 37, and 38).

These paragraphs also need to specify what type of scenarios the risk values are based on (e.g., hypothetical future use, current use). Also, the use of the words "residential wells" in the 4th paragraph is misleading, since the current residential scenario was based on data from one residential well. Approximately 13 residential wells were sampled, of which only one well contained VOCs. Risk calculations based on data from this one well should not be broadly presented as applicable to all residents in the area. This needs to be clarified here as well as in other areas of the document (e.g., pg. 5).

**2. Page 1, 4th Paragraph** - It is stated that hazard indices of 4.39 and 4.68 "indicate that adverse health effects may be expected for residential use of this water." This is a misleading statement that can lead the reader to believe that adverse health effects are likely if a hazard index of one is exceeded. In order to prevent this misinterpretation of the hazard index, the language should be changed to indicate that if a hazard index of one is exceeded this simply means that there may be a concern for potential health effects.

## ORGANIZATION OF THE RISK ASSESSMENT

**3. Page 3, 3rd Paragraph** - It is stated in this paragraph that "[c]oncentrations of site-related contaminants at exposure points are compared with Applicable or Relevant and Appropriate Requirements (ARARs). Since ARARs are not available for all contaminants in all media, quantitative risk estimates are also developed..." However, the NCP states that "[t]he identification of ARARs is not the purpose of the baseline risk assessment... The

identification of ARARs is a separate part of the RI, because many ARARs are not directly risk related." Thus, these statements should be revised. In addition, comparison to ARARs should be removed from the risk assessment.

## SELECTION OF THE CHEMICALS OF CONCERN

**4. Page 4** - All acronymns used in the report, such as TIC and SAS should be defined.

## FATE AND TRANSPORT

**5. Page 5, 6th line from the bottom of page** - Change "effect" to "affect".

**6. Page 5, 4th and 5th lines from the bottom of page** - One of the fate and transport mechanisms listed for site-related chemicals is the transport of contaminants "downstream in water or on suspended sediments..." This is not consistent with the RI, which notes that groundwater does not discharge to surface water in the RI/FS study area. Thus, discussions of fate and transport of site-related chemicals in surface waters should be removed from the risk assessment.

## FATE AND TRANSPORT OF CONTAMINANTS OF CONCERN

**7. Page 6, 1st Paragraph** - This paragraph mentions the volatilization of benzene from surface water to ambient air. However, the RI states that groundwater does not discharge to surface water in the RI/FS study area. Thus, the discussion of volatilization of benzene from surface water is not applicable at this site, and should be removed.

**8. Page 6, 3rd and 4th Paragraphs** - Discussion on fate processes for 1,2-dichloropropane and trichloroethylene includes references to surface water and soils. As stated in comment no. 7, discussion of fate processes in surface waters is not applicable at this site. It is also important to note that the landfill cover is comprised of native soil that was excavated during landfill trenching operations, stockpiled, and then placed over the waste material. Thus, the discussion of fate processes in soils is also not of major concern at this site. The discussion of fate processes of chemicals should focus on groundwater, since that is the media of concern at this site.

## EXPOSURE POINT CONCENTRATIONS

**9. Page 9, 1st Sentence** - Here, as in other areas of the document (pg.12, 3rd and 4th paragraphs; pg. 37, last paragraph), it is stated that monitoring wells may be used for drinking purposes. However, the monitoring well scenario, under current and future use, should not be considered for a number of reasons. A groundwater management zone program has been in place at the site since August 1988, and is enforced by DNREC. Under this program, it would not be possible to obtain the necessary permits to use monitoring wells for drinking water purposes, and it would not be possible to install any new

wells in the no well zone, which encompasses the site and residents downgradient of the site. Also, under a Memorandum of Understanding (MOU), which is a binding agreement between Sussex County and DNREC, an alternate water supply system would be installed to serve the existing residential wells downgradient of the site. This would preclude the future use of residential wells immediately downgradient of the site.

**10. Page 9, 1st Full Paragraph** - The first sentence states that "[i]n cases where the non-detect values for selected contaminants identified in Monitoring Well LD-1 were the maximum contaminant concentrations detected for contaminants found in the LD-1, LS7R, LS-16 monitoring well cluster, one-half of those non-detect values were determined to be the maximum contaminant concentration value to be used for risk assessment purposes." This sentence should be restated so that non-detect values are not referred to as "the maximum contaminant concentrations detected". Also, instead of using non-detects as exposure points in some instances, the maximum detected concentrations should be used. The use of non-detects in calculating risk adds a great deal of uncertainty to the risk assessment, particularly in the monitoring well scenario, where the majority of risk is contributed by a non-detect value. As stated in comment no. 35, vinyl chloride contributes the majority (83-88%) of the cancer risk calculated based on the monitoring well data. As presented on pages 13 and 14, vinyl chloride was detected in monitoring well LS-7R at 0.6 ppb, was not detected in LS-16 (detection limit = 0.3 ppb), and was not detected in LD-1 (detection limit = 4 ppb). Based on this information the exposure point concentration used in this assessment for vinyl chloride was 2 ppb, or 1/2 of the detection limit for LD-1. Thus, the risk values are based on a number that is over three times greater than concentrations actually detected in the monitoring wells.

It is stated at the end of this paragraph that "[t]he contaminants are not being detected due to the elevated detection limits of Monitoring Well LD-1". This statement makes the assumption that contaminants are in groundwater at the LD-1 location, but were not detected due to the high detection limits. There is insufficient basis to support this statement. The statement should be restated to read something like "It is possible that some of the contaminants of concern may be present at LD-1 but were not detected due to the higher detection limits at this location."

**11. Page 9, Site Conceptual Model** - The site conceptual model should not be listed under the subheading "Exposure Point Concentrations". It should either be moved towards the front of the document or under "Exposure Assessment". The site conceptual model needs to discuss the proposed exposure scenarios more clearly. For example, the statement that "[t]he residents are then exposed to the contaminated groundwater..." may lead a reader to believe that there are residents at the site currently exposed to contaminants in groundwater. However, there is only one residential well in which low levels of VOCs have been detected. This residence has had an alternative water supply available for some time, and the well has been fitted with a treatment system. It also needs to be stated that both an adult and child will be evaluated.

## EXPOSURE ASSESSMENT

**12. Page 10, Groundwater** - It is stated here that the Agency's default exposure assumptions are used in the exposure assessment. A sentence needs to be added explaining that these assumptions are presented on pages 15 to 17. After reviewing the exposure asssumptions as listed on these pages, it appears that some of these assumptions are not default values, such as the 2 L/day water ingestion rate for children, the inhalation rates of 30 $m^3$/day for adults and 20 $m^3$/day for children, a shower exposure duration of 20 minutes, and a total body surface are of 10,470 $cm^2$ for 1 to 6 year old children. (We assume you're evaluating a 1-6 year old child. However, this was never stated in the document, and needs to be clarified). For further discussion on these assumptions see comment nos. 20, 21, and 22.

**13. Page 10, Residential Wells, 1st Paragraph** - It need to be stated here that there is currently only one residence where VOCs have been detected. The estimation of risk based on exposure to VOCs in residential wells is based on data from this one well.

**14. Page 10, Residential Wells, 2nd Paragraph** - It is stated here that "residential well GW-2 is being used as the point of residential exposure since it represents the center of the residential well contaminant plume". It would be more appropriate to state that GW-2 is the only well to encounter groundwater contaminants downgradient of the landfill.

**15. Page 10, Residential Wells, 2nd Paragraph** - Stating that "maximum risk" is occuring at location GW-2, implies that exposures are occurring elsewhere, which is not the case. Please modify this statement.

**16. Page 11, 2nd Paragraph, 1st Sentence** - This statement is incorrect. Benzene and vinyl chloride were not detected at 4 ppb in both rounds of groundwater sampling. Please modify.

**17. Page 11, Last Paragraph** - Why is the monitoring well data considered as part of a current use scenario? Nobody is currently using water at this location. For such a use to occur, residential development of the area would already have had to take place, which is clearly not the case. Thus, considering these well data under a current use scenario is not appropriate. In addition, potential future use is precluded by actions taken by DNREC and Sussex County. Under a Memorandum of Understanding (MOU) with DNREC, Sussex County previously established groundwater management zones around the landfill to control and restrict future groundwater usage, and the installation of a central water supply system is scheduled for next year. This MOU program is currently being implemented by DNREC and Sussex County. Subsequent to the steps outlined above, notices were added to the deeds for all property in the groundwater management zones, confirming the existence of the MOU and its related restrictions on groundwater usage. Furthermore, Sussex County has amended its deed to the landfill site to preclude any future development of the site for residential or commercial purposes. Collectively the above mentioned actions undertaken by Sussex County and DNREC obviate future groundwater use in the area around the

Laurel Landfill. Also, the first sentence in this paragraph discusses "on-site receptors", when there are none (also on pg 12, 1st paragraph).

**18. Page 12, 1st Paragraph, Last Sentence** - Wording needs to be changed to reflect possible exposure, and potential plume migration.

**19. Page 14, 2nd Paragraph, 3rd Sentence** - This sentence implies that there are groundwater receptors at the site, when there are none. Also, see comment no. 9 regarding the shortcomings on the monitoring well scenario.

**20. Page 15** - A 2 liter water ingestion rate is based on data for adults and should not be applied to child. A child water ingestion rate that has been accepted by EPA in many past risk assessments is 1 liter/day. Please provide references for all of the exposure assumptions presented here.

**21. Page 16** - The units of IR are presented as $m^3$/hr in the equation, but as $m^3$/day in the variable values. Also, the units for ET are presented as hours/day in the equation, but as minutes in the variable. Please correct these inconsistencies, and provide references for all of the exposure assumptions presented here. The inhalation rates used for adults and children, as presented in the text (30 $m^3$/day and 20 $m^3$/day, respectively), are not EPA default values as stated in the document. According to EPA's Human Health Evaluation Manual, Supplemental Guidance (OSWER Directive 9285.6-03, March, 1991) a total daily inhalation rate of 20 $m^3$/day should be used for adults. A child inhalation rate would be expected to be even lower than the adult rate. Based on an evaluation of the spreadsheets, it appears that inhalation rates of 20 $m^3$/day and 15 $m^3$/day were used for adults and children, respectively, in the actual calculations of dose. Please correct the discrepancy between the text and the calculations.

The methodologies used to calculate the "Ca" term (i.e., indoor air VOC concentration) should be presented here or in an appendix. It is stated in the text that the Foster and Chrostowski model was used to calculate "Ca". However, after an examination of the spreadsheets, which were later supplied to us, it appears that the methods of Foster and Chrostowski were only followed in part, and that the equations were modified and assumptions were changed. It appears that the changes result in a much more conservative estimate of exposure and risk. For example, the "Ca" term as presented in the Foster and Chrostowski paper is expressed as a differential equation which accounts for the rate of change of the indoor pollutant concentration with time. The equation accounts for a buildup of chemical in the shower stall over time, as well as an air exchange rate. This method is quite different than that used in the risk assessment. The "Ca" term as calculated in the report represents an instantaneous mixing of the contaminants from the entire volume of water used during the twenty minute shower (100 liters), instead of a gradual buildup of chemicals in the air. No air exchange is assumed. It is then assumed that a receptor breathes this maximum air concentration for twenty minutes. This method does not represent a realistic showering scenario, and it is unclear why the departure was made from

Foster and Chrostowski's mehods. Foster and Chrostowski's methods were also departed from when calculating the "Cd" term (i.e., concentration leaving the water) for the child. In calculating the "Cd" term for the child, it appears as though the assumption is made that a child is bathing rather than showering. The equation incorporates a bath water depth term, as well as bath duration, water concentration, and the mass tranfer coefficient. This equation is not presented in the Foster and Chrostowski paper, which only evaluates showering. In addition, the text of the report does not clearly state that it is assumed that children are bathing rather than showering. Rather, the text states that "children may come into contact with these contaminants through...the inhalation of volatile organic constituents of contaminated groundwater during showering and bathing.." (page 12). Also, when calculating an air concentration based on bathing for children, the equation assumes a "shower stall" volume of 2940 liters. However, a shower stall volume is most likely smaller than the volume of air surrounding a bathtub. This assumption most likely overestimates the air concentration for children. Also, in estimating inhalation exposure doses for both the child and adult, an exposure time of 20 minutes per shower/bath was used. This compares to a shower duration of 10 to 15 minutes as presented in the Foster and Chrostowski paper, as a lower and upper bound scenario, respectively.

**22. Page 17** - Please provide references for all of the exposure assumptions presented here. The body surface area assumed for a 1-6 year old child (10,470 $cm^2$) seems a little high. According to EPA's dermal guidance document (EPA/600/8-91/011B, January 1992) the average 50th percentile total body surface area for 2 to 6 year old male children is 7314 $cm^2$. This is EPA's most recent guidance on dermal guidance, and should take precedence over other sources.

## TOXICITY ASSESSMENT

**23. General** - A lot of information is presented on toxicity of the contaminants of concern in this section that does not apply to this particular site. For example, on the top of page 21, is a statement on the major source of pollution of chlorobenzenes in Lake Ontario. Please remove irrelevant information in these toxicity profiles. It may be more appropriate to move the bulk of the material in the toxicity assessment into an appendix.

Also, the toxicity assessment discusses the basis of a few of the health criteria, but does not include such a discussion for many of the health criteria used. For some of the criteria only a very limited discussion is presented, and really does not allow the reader to fully evaluate the confidence in these values. It is important to discuss the basis of all RfDs and CSFs used. For example, there was no discussion on the basis of the benzene inhalation RfD in this report. It is important to discuss the provisional nature of this RfD, particularly since there is a great deal of uncertainty associated with this value, and benzene through the inhalation route is driving the hazard index at the site. This provisional RfD has since been changed by ECAO, and the new number is 1.4E-04 mg/kg-day (based on an RfC of 5E-04 $mg/m^3$). Some of the major uncertainties with the benzene RfD/RfC (old and new), include the wide gap between the NOEL used to derive the RfC, and observed adverse

effects in humans and animals. Adverse effects are first observed in humans at exposure concentrations (30 ppm) approximately 670 times higher than the NOEL (0.045 ppm) used to derive the RfC. In addition, effects in animals are first observed at exposure concentrations (5 ppm) approximately 110 times higher than the NOEL. Currently there is insufficient information to determine the actual benzene concentration at which effects would first begin to occur. There is also insufficient information with which to lessen the gap between the NOEL and currently observed effect levels. Uncertainty in the benzene RfC is compounded by the application of an uncertainty factor (300, based on the old value; and 100, based on the new) in deriving the RfC. Where uncertainty exists, EPA errs on the side of conservatism by adjusting the RfC lower, through the application of a series of uncertainty factors. Also, confidence in the principal study on which the RfC was based (Collins study), as well as the benzene database is "medium". Additional examples of uncertainties in the health criteria are provided in comment nos. 26, 27, and 29.

Also, what is the purpose of presenting ARARs in the "criteria" summary tables for each chemical? (See comment no. 3)

**24. Page 20, Summary of Benzene Criteria** - If the new provisional ECAO RfD for benzene is used, this table needs to be revised to incorporate the new RfD, and indicate under "source" that this value is derived by ECAO.

**25. Page 22, Summary of 1,4-Dichlorobenzene Criteria** - Define "DWSHA", and provide a complete reference.

**26. Page 27, Summary of TCE Criteria** - Change "SfD" to "RfD". It needs to be noted in the table that the oral RfD used for TCE is based on a derivation by ECAO. In the text, the basis of the oral RfD and the Inhalation SF, both of which are provisional numbers developed by ECAO, needs to be discussed. In addition, the oral slope factor used for TCE has since been withdrawn by EPA from IRIS. The basis and limitations of using a withdrawn slope factor need to be discussed.

**27. Page 29, Summary of Vinyl Chloride Criteria** - The oral and inhalation SF are presented in HEAST but have been withdrawn from IRIS. HEAST mention that these values are interim, and that they do not incorporate considerable information that is now available on vinyl chloride. This should be noted in the text.

**28. Page 29, Last Paragraph** - This paragraph should be moved to the next page, under the heading "F. Beryllium".

**29. Page 30, Last Paragraph; and Page 31** - An inhalation unit risk is presented for beryllium, but is never used in this assessment since beryllium was not evaluated through the shower pathway. Please remove any information relating to the inhalation of beryllium. An oral slope factor for beryllium is used in calculating risk in this assessment, but is not presented here. The basis, confidence, and source of the oral slope factor for beryllium

needs to be presented here. Also, in the discussion of the oral RfD, it needs to be stated that EPA's overall confidence in this value is "low" (IRIS, 1993).

## RISK CHARACTERIZATION

**30. Page 33, 3rd and 4th Paragraphs** - The cancer risk is presented in these paragraph, as well as in many other areas of the document, using three significant figures. However, as stated in RAGS, page 8-12, "[r]esulting cancer risk estimates should be expressed using one significant figure only." In the 3rd paragraph it is stated that a calculated risk of 1.30E-04 for the residential wells exceeds the agency's acceptable risk range of 1.0E-06 to 1.0E-04. However, if only one significant figure is reported, then the risk (1E-04) falls within the agency's generally acceptable risk range. The cancer risk throughout the document should be changed to report only one significant figure. Although RAGS does not specify whether the hazard index should also be presented as one significant figure, an example table does present the hazard index using one significant figure as well.

**31. Page 33, 4th Paragraph** - In the last two sentences in this paragraph, reference is made to "cancer risk calculated for children". However, the cancer risk is not for a child, but for an individual over a lifetime due to exposure as a child. The language should be changed to reflect this here as well as in other areas of the document.

**32. Page 33, Last Paragraph** - The language here, as well as in other areas of the risk characterization state that "[i]f a hazard index exceeds 1.0E+00, adverse health effects may be expected to occur." On page 36 the assessment goes so far as to say that a hazard index of 10.4 calculated for the showering pathway indicates that "this route of exposure would be expected to elicit adverse noncarcinogenic health effects". In addition, on page 38 the assessment states that "adverse noncarcinogenic effect[s] would be expected for both adults and children" based on hazard indices of 9.73, and 10.4, respectively. These statements are misleading, if not incorrect, in implying that adverse health effects would occur or are expected if a hazard index of one is exceeded. In order to prevent this misinterpretation of the hazard index, the language should be changed on pages 34-38 to indicate that if a hazard index of one is exceeded this simply means that there may be a concern for potential health effects.

**33. Page 33, Last Paragraph and Page 34, 2nd Paragraph** - If the new provisional ECAO benzene RfD is used, the hazard indices for the adult based on the residential well data will change from 4.39 to approximately 1.8. The results of the child noncarcinogenic risk should also be presented here.

**34. Page 34, Last Paragraph** - The risk for beryllium is reported as exceeding the Agency's carcinogenic risk range of 1.0E-06 to 1.0E-04. However, if only one significant digit is reported (1E-04) the risk falls within the range.

**35. Page 35, Monitoring Well Results, 1st and 2nd Paragraphs** - See comment no. 9 regarding the shortcomings of the monitoring well scenario. Also, it is important to note that the majority of cancer risk (83-88%) calculated based on monitoring well data is based on a non-detect value for vinyl chloride. This introduces an unacceptable degree of uncertainty in these risk estimates.

**36. Page 35, Last Paragraph and Page 36, 1st Paragraph** - If the new provisional ECAO benzene RfD is used, the hazard indices for the adult and child based on monitoring well data will change from 9.74 and 10.4, to approximately 3.9 and 4.2, respectively.

SUMMARY OF RISKS

**37. General** - Comment nos. 30 - 34 discussed under "Risk Characterization" also apply here.

**38. Page 37, 3rd and 5th Paragraphs; and Page 38, 1st and 2nd Paragraphs** - The risk for beryllium is added to the estimated site-related risk. However, it is not appropriate to add these risks. As stated in RAGS, page 5-18, "[i]f background risk might be a concern, it should be calculated separately from site-related risk." This comment also applies to page 38, last sentence of the 1st paragraph.

**39. Page 37, 7th Paragraph** - Reiterate that data is from one well.

**40. Page 37, Last Paragraph** - Reference is made to "on-site adults and children", when there are currently no on-site residents.

UNCERTAINTY

**41. General** - Overall, the uncertainty analysis should be expanded to discuss many of the uncertainties as brought up in our comments.

**42. Page 38, Last sentence** - Change "... if this water were to be used for drinking" to "...if water of this quality were to be used for drinking".

**43. Page 39, 1st Paragraph, Last sentence** - Change "...overestimates or future..." to "...overestimates of future...".

**44. Page 38/39, Exposure Characterization** - This section needs to include a discussion of the uncertainty associated with using exposure point concentrations based on non-detects (i.e. 1/2 the detection limit) (see comment no. 10). Also, the method used to calculate the air concentration while showering was an unrealistic approach, and therefore introduces an unaccepatable degree of uncertainty in these exposure estimates (see comment no. 21).

**45. Page 39, Toxicity characterization** - There needs to be more of a discussion of the uncertainty in some of the health criteria used, particularly for those chemicals in which confidence in the criteria is low or medium (e.g., benzene, beryllium). See comment nos. 23, 26, 27, and 29 under "Toxicity Assessment".

**46. Page 40, Residential and Monitoring Wells, 3rd Paragraph** - This is the type of information that also has to be stated upfront in the report in order to prevent reader confusion.

**47. Page 40, Second to Last Paragraph** - Change "effected" to "affected". Also, the last sentence in this paragraph states that "if additional residential development were to occur at the site, risk to site residents may be underestimated." However, the risk would not change if residential development were to occur, since the risk assessment evaluated a RME scenario in which individuals were drinking water from the center of the plume. An increase in the number of residents in this area does not correspond to an increase in individual risk.

## APPENDIX

**48.** In some of the appendix tables for the residential well scenario, an exposure concentration of 1 ug/L is listed for 1,2-dichloropropane. This does not correspond to 2 ug/L as stated in the text and as listed in some of the other appendix tables.

**49.** Please provide page numbers.

## REFERENCES

**50.** References for similar authors/agencies (e.g., EPA) should be listed in order of date, and similar dates further denoted by letters (e.g., 1990a, 1990b, 1990c). Without this information it is not always possible to determine which particular source was used.

**51.** Please provide page numbers.