Tennessee Valley Authority, 1101 Market Street, LP 5A, Chattanooga, Tennessee 37402-2801

August 1, 2008

10 CFR 52.79

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

In the Matter of) Docket No. 52-014 and 52-015
Tennessee Valley Authority)

BELLEFONTE COMBINED LICENSE APPLICATION – RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION – GASEOUS WASTE MANAGEMENT SYSTEMS

Reference: Letter from Ravindra Joshi (NRC) to Andrea Sterdis (TVA), Request for Additional Information Letter No. 033 Related to SRP Section 11.03 for the Bellefonte Units 3 and 4 Combined License Application, dated June 6, 2008

This letter provides the Tennessee Valley Authority's (TVA) response to the Nuclear Regulatory Commission's (NRC) request for additional information (RAI) items included in the reference letter.

A response to each NRC request in the subject letter is addressed in the enclosure which identifies any associated changes to be made in a future revision of the BLN application. Please note that the RAI incorrectly referred to SRP Section 11.03 title as Liquid Waste Management Systems. This response corrects the subject as the Gaseous Waste Management Systems.

If you should have any questions, please contact Tom Spink at 1101 Market Street, LP5A, Chattanooga, Tennessee 37402-2801, by telephone at (423) 751-7062, or via email at tespink@tva.gov.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 1ST day of Aug, 2008.

Jack A. Bailey
Vice President, Nuclear Generation Development

Enclosure
cc: See Page 2

D085
NRO

cc: (Enclosures)
J. P. Berger, EDF
E. Cummins, Westinghouse
S. P. Frantz, Morgan Lewis
M.W. Gettler, FP&L
R.C. Grumbir, NuStart
P. S. Hastings, NuStart
P. Hinnenkamp, Entergy
R. G. Joshi, NRC/HQ
M.C. Kray, NuStart
D. Lindgren, Westinghouse
G. D. Miller, PG&N
M.C. Nolan, Duke Energy
N. T. Simms, Duke Energy
G. A. Zinke, NuStart

cc: (w/o Enclosure)
B. C. Anderson, NRC/HQ
M.M. Comar,NRC/HQ
B. Hughes,NRC/HQ
R. H. Kitchen, PGN
A .M. Monroe, SCE&G
C. R. Pierce, SNC
R. Reister, DOE/PM
L. Reyes, NRC/RII
T. Simms, NRC/HQ
J. M. Sebrosky, NRC/HQ

Enclosure
TVA letter dated August 1, 2008
RAI Responses

Responses to NRC Request for Additional Information letter No. 033 dated June 6, 2008
(5 pages, including this list)

Subject: Gaseous Waste Management Systems in the Final Safety Analysis Report

RAI Number	Date of TVA Response
11.03-01	This letter – see following pages
11.03-02	This letter – see following pages

Associated Additional Attachments / Enclosures	Pages Included
Attachment 11.03-01A	4 pages
Attachment 11.03-01B	11 pages
Attachment 11.03-02A	5 pages
Attachment 11.03-02B	4 pages

Enclosure
TVA letter dated August 1, 2008
RAI Responses

NRC Letter Dated: June 6, 2008

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 11.03-01

FSAR Sections 11.3.3.4.2 and 11.3.5.1 (including BLN COL Item 11.3-1) reference draft NEI Template 07-11 as the basis of the cost-benefit analysis for justifying, in part, the design of the Gaseous Waste Management System (GWMS). The NEI template proposed a bounding envelope of population doses associated with gaseous effluent releases, which, if met, would demonstrate compliance with ALARA cost-benefit requirements of Section II.D of Appendix I to Part 50. However, NEI Template 07-11 was withdrawn from further consideration by NEI. Accordingly, please explain how the applicant intends to develop a plant and site-specific cost-benefit analysis demonstrating compliance with Section II.D of Appendix I to Part 50 with respect to the GWMS, and provide sufficient information for the staff to evaluate the bases and assumptions used in the analysis against the applicable NRC regulations and guidance.

BLN RAI ID: 0422

BLN RESPONSE:

A plant specific cost-benefit analysis has been developed demonstrating compliance with Section II.D of Appendix I to Part 50 with respect to the GWMS. This cost-benefit analysis replaces use of NEI 07-11; thus, reference to NEI 07-11 will be removed from the FSAR. The total annual costs of the gaseous radwaste system augments listed in Regulatory Guide 1.110, Revision 0, were developed using the methodology and parameters provided in the regulatory guide. Conservative values were chosen for parameters not specified in the regulatory guide. The following variable parameters were used:

- Capital Recovery Factor (CRF) – This factor is taken from Table A-6 of Regulatory Guide 1.110 and reflects the cost of money for capital expenditures. A cost-of-money value of 7% per year is assumed in this analysis, consistent with the "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission" (NUREG/BR-0058). A CRF of 0.0806 was obtained from Table A-6.
- Indirect Cost Factor (ICF) – This factor takes into account whether the radwaste system is unitized or shared (in the case of a multi-unit site) and is taken from Table A-5 of Regulatory Guide 1.110. It is assumed that the radwaste system for this analysis is a unitized system at a 2-unit site, which equals an ICF of 1.625.
- Labor Cost Correction Factor (LCCF) – This factor takes into account the differences in relative labor costs between geographical regions and is taken from Table A-4 of Regulatory Guide 1.110. A LCCF of 1.0 (the lowest value) is assumed in this analysis.

The lowest-cost option for gaseous radwaste treatment system augments is the Steam Generator Flash Tank Vent to Main Condenser at $6,320 per year, which yields a threshold value of 6.32 person-rem ($6,320/$1,000) total body or thyroid dose from gaseous effluents.

The population doses, 3.0 person-rem whole body and 6.3 person-rem thyroid, are given in revised Table 11.3-205 (Attachment 11.03-01B). As discussed above, the lowest cost gaseous radwaste system augment is $6,320. Assuming 100% efficiency of this augment, the minimum possible cost per person-rem is determined by dividing the cost of the augment by the population dose. This is $2,107 per person-rem total body ($6,320/3.0 person-rem) and $1,003 per person-rem thyroid ($6,320/6.3 person-rem). These costs per person-rem reduction exceed the $1,000 per person-rem criterion prescribed in Appendix I to 10 CFR Part 50 and are therefore not cost beneficial. Realistic efficiencies would increase the cost per person-rem further above the $1,000 criterion.

FSAR Section 11.3 is being revised to reflect changes in the determination of maximum individual doses and population doses as well as provide a response to this RAI. The revised population doses are used in the above evaluation. The revision of FSAR Section 11.3 is provided in Attachment 11.3-01A. The corresponding revisions to FSAR Tables 11.3-201 through 11.3-205 are provided in Attachment 11.3-01B. In addition, the FSAR change resulted in new FSAR Tables 11.3-206 and 11.3-207 as provided in Attachment 11.3-01B. FSAR Tables 11.3-206 provides maximum individual doses compared to 10 CFR 20.1301 limits. FSAR Table 11.3-207 provides collective gaseous doses compared to 40 CFR Part 190 limits.

FSAR Table 11.3-204 is being revised to provide comparison with 10 CFR Part 50 Appendix I. The values provided in the revised Table 11.3-204 consider actual off-site land use census data (e.g., locations of residences and gardens), as provided in response to NRC Environmental Report information requests.

The associated application revisions include items that are both PLANT-SPECIFIC and items that are expected to be STANDARD for the S-COLAs as shown in the Application Revisions section below. The portion of this response which describes the methodology and parameters used to develop the total annual costs of the radwaste system augments is expected to be STANDARD for the S-COLAs. The remaining portions including the content in the revised tables provided in Attachment 11.03-01B are PLANT-SPECIFIC.

ASSOCIATED BLN COL APPLICATION REVISIONS:

COLA Part 2, FSAR Chapter 11, Section 11.3 and associated tables are revised as shown in Attachments 11.03-01A and 11.03-01B. (The changes include new sections and/or tables as needed).

ATTACHMENTS/ENCLOSURES:

Attachment 11.03-01A, COLA Part 2, FSAR Section 11.3

Attachment 11.03-01B, COLA Part 2, FSAR Section 11.3 Tables 11.3-201 through 11.3-207

NRC Letter Dated: June 6, 2008

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 11.03-02

Please provide detailed information to enable the staff to validate and verify the estimated doses in FSAR section 11.3.3.4 with respect to the dose objectives of Appendix I to 10 CFR Part 50 and the dose limits in 10 CFR 20.1301(e); please revise the FSAR to include this information, or justify its exclusion. The information should include the following:

- A complete description of how the applicant derived all the values listed in Table 11.3-201, including all assumptions made
- Citations to any reference material used (for documents not publicly available please provide a copy for staff's use)
- Detailed breakdown of individual doses by pathway and organ
- Detailed breakdown of population doses by pathway and organ

BLN RAI ID: 0520

BLN RESPONSE:

Regulatory Guide 1.206, Revision 0, and Standard Review Plan 11.3, Revision 3, require the parameters used to determine estimated doses from the gaseous effluent system to be provided in the FSAR, but neither requires the FSAR to provide a detailed basis for each parameter. In lieu of providing this detail in the FSAR, the requested material is provided in the annotated table provided in Attachment 11.3-02A. The annotated table included in this response provides additional information on how the values in FSAR Table 11.3-201 were derived. This annotated Table is not part of the FSAR and is not included in the revisions to the COLA.

The methodology used to develop the projected population presented in revised FSAR Table 11.3-202 (Attachment 11.03-1B) is also provided, because Table 11.3-202 is referenced by Table 11.3-201. The annotated table provides the input parameters, the values used in the analysis, and the basis for each value. A reference is provided for each value with supporting discussion about how the value was determined if it is not found directly from the reference.

Citations to the reference material are provided. The referenced material is publicly available.

FSAR Section 11.3 is being revised to reflect changes in the determination of maximum individual doses and population doses. The revision considers actual off-site land use census data (e.g., locations of residences and gardens), as provided in response to NRC Environmental Report information requests.

The attached tables reflect those changes that will be provided as part of Revision 1 to the FSAR.

As part of the revision to FSAR Section 11.3, a detailed breakdown of individual doses by pathway and organ is provided in the revised Table 11.3-203.

As part of the revision to FSAR Section 11.3, a detailed breakdown of population doses by pathway and organ is provided in the revised Table 11.3-205.

The associated application revisions include both PLANT-SPECIFIC items and items expected to be STANDARD for the S-COLAs as shown in the Application Revisions section below.

ASSOCIATED BLN COL APPLICATION REVISIONS:

COLA Part 2, FSAR Chapter 11, Tables 11.3-203 and 11.3-205 will be replaced with those in Attachment 11.3-01B; these tables provide the individual and population doses by pathway and organ.

ATTACHMENTS/ENCLOSURES:

Attachment 11.03-02A, FSAR Table 11.3-201 (annotated), GASPAR II Input; providing input parameter, value, and assumptions and bases used to establish the value

Attachment 11.03-02B, Meteorological data from XOQDOQ-generated file

ATTACHMENT 11.03-01A
TVA letter dated August 1, 2008
RAI Responses

ATTACHMENT 11.03-01A

FSAR Section 11.3

(The revised text replaces existing FSAR text in its entirety.)

11.3 GASEOUS WASTE MANAGEMENT SYSTEM

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

11.3.3.4 Estimated Doses

Add the following information at the end of DCD Subsection 11.3.3.4.

BLN COL 11.3-1
BLN COL 11.5-3 The calculated gaseous doses for the maximum exposed individual are compared to the regulatory limits from Appendix I of 10 CFR Part 50 and 10 CFR Part 20.1301 for acceptance. Tables 11.3-204 and 11.3-206 display this comparison and demonstrate that the calculated gaseous doses for the maximally exposed individual are less than the regulatory limits. The doses to individuals due to routine gaseous effluents are given in Table 11.3-207 for comparison to the regulatory limits set forth in 40 CFR Part 190. The contributing pathways are external exposure to airborne activity in the plume, external exposure to deposited activity on the ground, inhalation of airborne activity in the plume, and ingestion of contaminated agricultural products including meat, milk, and vegetables (including grains).

Dose and dose rate to man were calculated using the GASPAR II computer code. This code is based on the methodology presented in Regulatory Guide 1.109. Factors common to both estimated individual dose rates and estimated population dose are addressed in this subsection. Unique data are discussed in the respective subsections. Activity pathways considered are plume, ground deposition, inhalation, and ingestion of vegetables, meat, and milk (both cow and goat).

Agricultural products are estimated from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service. GASPAR II evenly distributes the food production over the entire 50 mi. when given a total production for calculating dose.

Population distribution within the 50-mi. radius is presented in FSAR Tables 2.1-203 and 2.1-204.

11.3.3.4.1 Estimated Individual Doses

Dose rates to individuals are calculated for airborne decay and deposition, inhalation, and ingestion of milk (cow and goat), meat and vegetables. Dose from plume and ground deposition are calculated as affecting all age groups equally.

Table 11.3-201 contains GASPAR II input data for dose rate calculations. Information regarding the locations for the nearest man, milk animal, garden, and school is located in Section 2.3.

Table 11.3-203 summarizes the doses to the maximum exposed individual for each pathway and age group. These doses are per unit doses for either Unit 3 or Unit 4. The doses due to immersion in the plume are calculated at the point of maximum exposure outside of the site boundary, 1.74 mi. south of the plant. Doses from all other pathways are conservatively calculated at the maximum receptor, a garden 1.13 mi. southwest of the plant. The total doses shown in Table 11.3-203 conservatively include the doses from the goat milk pathway instead of the cow milk pathway. The evaluation assumed that the maximally exposed individual drinks their entire assumed milk consumption from a goat living at the worst-case receptor. This is conservative because there is not a large number of milk goats within 5 mi. of the Bellefonte site and goat milk produces higher doses than cow milk. The doses shown in Table 11.3-203 for the cow milk pathway are included for information only. The doses are below the 10 CFR Part 50, Appendix I design objectives of 5 mrem/yr to total body, and 15 mrem/yr to any organ, including skin.

11.3.3.4.2 Estimated Population Dose

The population dose analysis performed to determine offsite dose from gaseous effluents is based upon the AP1000 generic site parameters included in DCD Chapter 11 and Tables 11.3-1, 11.3-2 and 11.3-4 and population data in Table 11.3-202. The population dose is shown in Table 11.3-205. The population dose summary in Table 11.3-205 results in a total effective dose equivalent (TEDE) of 3.19 person-rem. The TEDE was calculated by adding 3% of the thyroid dose to the total body dose. This methodology is recommended by the NRC in Regulatory Guide 1.183 for comparing dose results expressed in terms of total body and thyroid with results expressed in terms of TEDE.

11.3.3.4.3 Gaseous Radwaste Cost-Benefit Analysis Methodology

STD COL 11.3-1 The guidance for performing cost-benefit analysis for the gaseous radwaste system is similar to that used and described for the liquid radwaste system in Section 11.2. The gaseous radwaste treatment system augments annual costs were determined and the lowest annual cost considered a threshold value. The lowest-cost option for gaseous radwaste treatment system augments is the Steam Generator Flash Tank Vent to Main Condenser at $6,320 per year, which yields a threshold value of 6.32 person-rem total body or thyroid from gaseous effluents.

For AP1000 sites with population dose estimates less than 6.32 person-rem total body or thyroid dose from gaseous effluents, no further cost-benefit analysis is needed to demonstrate compliance with 10 CFR 50, Appendix I, Section II.D.

11.3.3.4.4 Gaseous Radwaste Cost-Benefit Analysis

BLN COL 11.3-1 The population doses are given in Table 11.3-205. The lowest cost gaseous radwaste system augment is $6,320. Assuming 100 percent efficiency of this augment, the minimum possible cost per person-rem is determined by dividing the cost of the augment by the population dose. This is $2,107 per person-rem total body ($6,320/3.0 person-rem) and $1,003 per person-rem thyroid ($6,320/6.3 person-rem thyroid). These costs per person-rem reduction exceed the $1,000 per person-rem criterion prescribed in Appendix I to 10 CFR Part 50 and are therefore not cost beneficial. Realistic efficiencies would increase the cost per person-rem further above the $1,000 criterion.

11.3.3.6 Quality Assurance

STD SUP 11.3-1 Add the following to the end of DCD Subsection 11.3.3.6:

Since the impact of radwaste systems on safety is limited, the extent of control required by Appendix B to 10 CFR Part 50 is similarly limited. Thus, a supplemental quality assurance program applicable to design, construction, installation, and testing provisions of the gaseous radwaste system is established by procedures that comply with the guidance presented in Regulatory Guide 1.143.

11.3.5 COMBINED LICENSE INFORMATION

11.3.5.1 Cost Benefit Analysis of Population Doses

STD COL 11.3-1 This COL Item is addressed in Subsection 11.3.3.4.3.

BLN COL 11.3-1 This COL Item is addressed in Subsections 11.3.3.4, 11.3.3.4.1, and 11.3.3.4.2, and 11.3.3.4.3.

BLN COL 11.5-3 This COL Item is addressed in Subsection 11.3.3.4.

ATTACHMENT 11.03-01B
TVA letter dated August 1, 2008
RAI Responses

ATTACHMENT 11.03-01B

FSAR Table 11.3-201
Through
Table 11.3-207

(The revised Tables 11.3-201 through 11.3-205 replace existing FSAR Tables in their entirety, Tables 11.3-206 and 11.3-207 are new and will be added to FSAR)

BLN COL 11.3-1
BLN COL 11.5-3

TABLE 11.3-201
GASPAR II INPUT(1)

Input Parameter	Value
Number of Source Terms	1
Read Met data from XOQDOQ-generated file	Selected
Distance from site to NE Corner of the US (mi.)	1,262
Source Term	DCD Table 11.3-3
Population Data	Table 11.3-202
Fraction of the year leafy vegetables are grown	0.42
Fraction of the year milk cows are on pasture	0.67
Fraction of max individual's vegetable intake from own garden	0.76
Fraction of milk-cow feed intake from pasture while on pasture	1
Fraction of the year goats are on pasture	0.75
Fraction of goat feed intake from pasture while on pasture	1
Fraction of the year beef cattle are on pasture	0.67
Fraction of beef-cattle feed intake from pasture while on pasture	1
Total Production Rate for the 50-mile area	
-Vegetables (kg/yr)	144,009,482
-Milk (L/yr)	61,128,558
-Meat (kg/yr)	20,644,713

1) Input parameters not specified use default GASPAR II values.

TABLE 11.3-202
2027 PROJECTED POPULATION INPUT FOR POPULATION DOSE COMPUTATIONS

BLN COL 11.3-1
BLN COL 11.5-3

	Distance (mi)									
Direction	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	5	58	77	52	21	266	574	4,765	9,177	6,981
NNE	0	47	117	173	183	825	6,419	7,783	8,151	11,697
NE	0	30	33	17	28	254	6,887	9,524	29,319	91,976
ENE	0	3	9	16	26	214	5,902	16,297	79,290	250,397
E	0	5	25	77	175	1,463	4,264	8,575	13,575	17,399
ESE	0	5	20	97	302	1,566	5,218	12,458	18,212	13,543
SE	0	4	11	20	34	1,301	10,948	10,537	8,973	19,181
SSE	0	4	9	19	44	866	11,572	12,556	10,824	15,461
S	0	1	4	29	103	2,103	6,340	9,632	19,713	47,054
SSW	0	0	10	191	723	861	3,529	19,894	38,054	34,127
SW	0	3	51	160	337	5,524	5,964	12,583	21,301	29,876
WSW	0	24	94	293	737	13,759	2,920	9,515	16,780	16,889
W	5	51	135	207	198	707	2,088	40,264	111,023	187,497
WNW	20	75	157	242	284	447	1,397	8,045	20,143	34,014
NW	13	56	58	32	27	198	1,056	3,273	7,893	15,181
NNW	12	58	57	22	12	257	368	6,910	20,169	37,006
Totals	55	424	867	1,647	3,234	30,611	75,446	192,611	432,597	828,279

BLN COL 11.3-1

BLN COL 11.5-3

TABLE 11.3-203 (Sheet 1 of 4)
ANNUAL DOSE TO A MAXIMALLY EXPOSED INDIVIDUAL FROM GASEOUS EFFLUENTS (PER UNIT)

	Dose (mrem/yr)							
Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Adult Age Group								
Plume	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.72E-01	9.57E-01
Ground	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.93E-02
Vegetable	6.17E-02	6.34E-02	3.60E-01	6.18E-02	5.77E-02	8.66E-01	5.15E-02	5.06E-02
Meat	1.93E-02	2.39E-02	8.80E-02	1.94E-02	1.89E-02	4.87E-02	1.85E-02	1.84E-02
Cow Milk(1)	2.83E-02	2.34E-02	1.06E-01	3.11E-02	2.85E-02	8.76E-01	2.24E-02	2.17E-02
Goat Milk	4.26E-02	2.69E-02	1.24E-01	4.96E-02	3.81E-02	1.17E+00	2.72E-02	2.48E-02
Inhalation	9.04E-03	9.15E-03	1.42E-03	9.25E-03	9.41E-03	8.50E-02	1.18E-02	8.77E-03
Total	3.33E-01	3.23E-01	7.73E-01	3.40E-01	3.24E-01	2.37E+00	3.23E-01	1.11E+00

4

BLN COL 11.3-1

BLN COL 11.5-3

TABLE 11.3-203 (Sheet 2 of 4)
ANNUAL DOSE TO A MAXIMALLY EXPOSED INDIVIDUAL FROM GASEOUS EFFLUENTS (PER UNIT)

	Dose (mrem/yr)							
Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Teenage Age Group								
Plume	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.72E-01	9.57E-01
Ground	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.93E-02
Vegetable	9.35E-02	9.55E-02	5.63E-01	9.86E-02	9.20E-02	1.19E+00	8.27E-02	8.10E-02
Meat	1.57E-02	1.83E-02	7.40E-02	1.60E-02	1.56E-02	3.71E-02	1.53E-02	1.52E-02
Cow Milk(1)	4.58E-02	4.05E-02	1.94E-01	5.48E-02	5.04E-02	1.39E+00	3.98E-02	3.84E-02
Goat Milk	6.11E-02	4.52E-02	2.24E-01	8.58E-02	6.57E-02	1.86E+00	4.72E-02	4.25E-02
Inhalation	9.15E-03	9.24E-03	1.73E-03	9.50E-03	9.73E-03	1.06E-01	1.34E-02	8.85E-03
Total	3.79E-01	3.68E-01	1.06E+00	4.10E-01	3.83E-01	3.39E+00	3.73E-01	1.15E+00

BLN COL 11.3-1

BLN COL 11.5-3

TABLE 11.3-203 (Sheet 3 of 4)
ANNUAL DOSE TO A MAXIMALLY EXPOSED INDIVIDUAL FROM GASEOUS EFFLUENTS (PER UNIT)

	Dose (mrem/yr)							
Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Child Age Group								
Plume	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.72E-01	9.57E-01
Ground	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.93E-02
Vegetable	2.07E-01	1.99E-01	1.30E+00	2.18E-01	2.07E-01	2.33E+00	1.91E-01	1.89E-01
Meat	2.86E-02	2.98E-02	1.39E-01	2.91E-02	2.86E-02	6.12E-02	2.82E-02	2.81E-02
Cow Milk(1)	9.96E-02	9.25E-02	4.72E-01	1.19E-01	1.11E-01	2.78E+00	9.31E-02	9.09E-02
Goat Milk	1.16E-01	9.96E-02	5.39E-01	1.70E-01	1.35E-01	3.71E+00	1.04E-01	9.74E-02
Inhalation	8.10E-03	7.99E-03	2.09E-03	8.45E-03	8.64E-03	1.24E-01	1.16E-02	7.81E-03
Total	5.60E-01	5.36E-01	2.18E+00	6.26E-01	5.79E-01	6.43E+00	5.49E-01	1.33E+00

BLN COL 11.3-1

BLN COL 11.5-3

TABLE 11.3-203 (Sheet 4 of 4)
ANNUAL DOSE TO A MAXIMALLY EXPOSED INDIVIDUAL FROM GASEOUS EFFLUENTS (PER UNIT)

	Dose (mrem/yr)							
Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Infant Age Group								
Plume	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.72E-01	9.57E-01
Ground	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.93E-02
Vegetable	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Meat	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cow Milk(1)	1.99E-01	1.88E-01	9.00E-01	2.44E-01	2.20E-01	6.71E+00	1.90E-01	1.86E-01
Goat Milk	2.19E-01	1.98E-01	9.98E-01	3.41E-01	2.59E-01	8.96E+00	2.09E-01	1.96E-01
Inhalation	4.68E-03	4.56E-03	1.05E-03	5.05E-03	5.03E-03	1.11E-01	7.10E-03	4.49E-03
Total	4.24E-01	4.03E-01	1.20E+00	5.46E-01	4.64E-01	9.27E+00	4.30E-01	1.21E+00

1) The doses shown for the cow milk pathway are included for information only. They are not included in the total doses, because the evaluation assumed that the maximally exposed individual drinks their entire assumed milk consumption from a goat living at the worst-case receptor. See Subsection 11.3.3.4 for further discussion.

BLN COL 11.3-1
BLN COL 11.5-3

TABLE 11.3-204
CALCULATED MAXIMUM INDIVIDUAL DOSES COMPARED TO 10 CFR PART 50 APPENDIX I LIMITS

Description	Limit	Calculated Values
Noble Gases (1)		
Gamma Dose (mrad)	10	2.65E-01
Beta Dose (mrad)	20	1.39E+00
Total Body Dose (mrem)	5	1.58E-01
Skin Dose (mrem)	15	9.57E-01
Radioiodines and Particulates		
Total Body Dose (mrem)	-	4.02E-01
Max to Any Organ (mrem)(2)	15	9.11E+00

1) Doses due to noble gases in the released plume are calculated at the location of maximum dose at or beyond the site boundary (location of highest X/Q and D/Q values). This location is 1.74 miles south of the plant (Reference 3.10)

2) The maximum dose to any organ is the dose to the thyroid of an infant. This dose is calculated at the receptor location with the highest X/Q values, which is a garden 1.13 miles southwest of the plant.

BLN COL 11.3-1
BLN COL 11.5-3

TABLE 11.3-205
POPULATION DOSES

(person-rem)

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	1.04E+00	1.04E+00	1.04E+00	1.04E+00	1.04E+00	1.04E+00	1.23E+00	1.22E+01
Ground	1.35E-01	1.35E-01	1.35E-01	1.35E-01	1.35E-01	1.35E-01	1.35E-01	1.58E-01
Inhalation	3.56E-01	3.58E-01	5.10E-02	3.62E-01	3.64E-01	2.55E+00	4.64E-01	3.48E-01
Vegetable	1.02E+00	1.02E+00	4.77E+00	1.02E+00	1.01E+00	1.03E+00	1.00E+00	1.00E+00
Cow Milk	2.82E-01	2.77E-01	1.27E+00	2.89E-01	284E-01	1.34E+00	2.77E-01	2.75E-01
Meat	1.64E-01	1.69E-01	7.72E-01	1.65E-01	1.64E-01	1.98E-01	1.64E-01	1.63E-01
Total	3.00E+00	3.00E+00	8.03E+00	3.01E+00	3.00E+00	6.30E+00	3.27E+00	1.41E+01

BLN COL 11.3-1

BLN COL 11.5-3

TABLE 11.3-206
MAXIMUM INDIVIDUAL DOSES FROM BOTH UNITS DUE TO ROUTINE GASEOUS EFFLUENTS COMPARED TO 10 CFR 20.1301 LIMITS

Description	Limit	Calculated Values
TEDE (mrem)	100	1.50E+00
Maximum Dose per Hour (mrem/hr)	2	1.72E-04

BLN COL 11.3-1
BLN COL 11.5-3

TABLE 11.3-207
COLLECTIVE GASEOUS DOSES COMPARED TO 40 CFR PART 190 LIMITS

Description	Limit	Calculated Values for Both Units
Total Body Dose Equivalent (mrem)	25	1.12E+00
Thyroid Dose (mrem)	75	1.85E+01
Max to Any Other Organ (mrem)(1)	25	4.36E+00

1) Note that the maximum dose to any organ other than the thyroid is the dose to the bone of a child.

ATTACHMENT 11.03-02A
TVA letter dated August 1, 2008
RAI Responses

ATTACHMENT 11.03-02A

FSAR TABLE 11.3-201 (ANNOTATED)
GASPAR II

(The annotated tables are provided for information only. They are not part of the FSAR)

ATTACHMENT 11.03-02A
TVA letter dated August 1, 2008
RAI Responses

FSAR Table 11.3-201 (annotated)
GASPAR II INPUT[1]

Input Parameter	Value	Basis
Number of Source Terms	1	GASPAR Job Control Option
Read Met data from XOQDOQ-generated file	Selected	GASPAR Job Control Option. Listing of the XOQDOQ file is provided in Attachment 11.03-02B.
Distance from site to NE Corner of the US (mi.)	1,262	Note 2
Source Term	DCD Table 11.3-3	DCD Table 11.3-3
Population Data	FSAR Table 11.3-202	Note 3
Fraction of the year leafy vegetables are grown	0.42	Note 4
Fraction of the year milk cows are on pasture	0.67	Note 4
Fraction of max individual's vegetable intake from own garden	0.76	GASPAR default per NUREG/CR-4653, Table 2.3.
Fraction of milk-cow feed intake from pasture while on pasture	1	Conservative assumption, because it maximizes the feed from potentially contaminated pasture. GASPAR default per NUREG/CR-4653, Table 2.3.
Fraction of the year goats are on pasture	0.75	Note 4
Fraction of goat feed intake from pasture while on pasture	1	Conservative assumption, because it maximizes the feed from potentially contaminated pasture. GASPAR default per NUREG/CR-4653, Table 2.3.
Fraction of the year beef cattle are on pasture	0.67	Note 4
Fraction of beef-cattle feed intake from pasture while on pasture	1	Conservative assumption, because it maximizes the feed from potentially contaminated pasture. GASPAR default per NUREG/CR-4653, Table 2.3.
Total Production Rate for the 50-mile area		
• Vegetables (kg./yr.)	144,009,482	Note 5
• Milk (L./yr.)	61,128,558	Note 6
• Meat (kg./yr.)	20,644,713	Note 7

ATTACHMENT 11.03-02A
TVA letter dated August 1, 2008
RAI Responses

Notes

1. Input parameters not specified use default GASPAR II values as provided in NUREG/CR-4653, GASPAR II Technical Reference and User Guide.
2. Distance from site to NE Corner of the US determined using Google Earth. Note, this parameter is used by GASPAR to calculate the NEPA population doses and does not affect the doses calculated to demonstrate compliance with Appendix I of 10 CFR Part 50 or 10 CFR Part 20.
3. NUREG-1555 requires a population projected out to five years from the time of the licensing action. The population used for this calculation is projected out to 2027 to conservatively bound the 5-year criteria. The transient and permanent populations are also included for conservatism, because this results in a higher projected population and therefore a higher population dose. The population distribution for each of the 22½-degree radial sectors centered on the 16 cardinal compass directions for radial distances of 1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 miles is calculated based on FSAR Tables 2.1-203, 2.1-204, and 2.1-208, which gives the projected populations in sectors of 0, 2, 4, 6, 8, 10, 16, 40, 60, and 80 km. To adjust the population distribution to the radial sectors given in miles, the population distributions are assumed to be uniform throughout the given sectors in kilometers. Then the population distributions for the radial segments in miles are adjusted based on the ratio of land area of that radial segment that falls within the different radial segments in kilometers to the total land area in each relevant radial segment in kilometers. A sample calculation is given below.

   Land Area within a 0 – 2 km. Radius = 4.85 $mi.^2$

   2027 Projected Population within a 0 – 2 km. radius in the North Sector = 7 people

   Land Area within a 0 – 1 mi. Radius = 3.14 $mi.^2$

   2027 Projected Population within a 0 – 1 mi radius in the North Sector = 7 (3.14/4.85) = 5 people

   The 2027 projected population within a 1 – 2 mi radius in the north sector consists of the remaining 2 people from the 0 – 2 km radial sector as well as a portion of the people in the 2 – 4 km radial distance in the north sector. This portion is based on the ratio of the land area in a 1 – 2 mi radius that lies within a 2 – 4 km radius and the land area within a 2 – 4 km radius of the plant. This ratio is calculated below.

   Land Area within a 2 – 4 km. Radius = 14.56 $mi.^2$

   Land Area within a 1 – 2 mi. Radius = 9.42 $mi.^2$

   Ratio = [9.42 – (4.85 - 3.14)]/ 14.56 = 0.53

   FSAR Table 11.3-202 was generated using this methodology. The total population within 50 miles of the Bellefonte site projected to the year 2027 is 1,565,771 people.
4. The length of the vegetable growing season and the amount of time cows and goats spend grazing on pasture are estimated using Figure 2.2 of NUREG/CR-4653 and the methodology therein. The results are a growing season for vegetables of five months, milk and beef cows are on pasture for eight months, and goats are on pasture for nine months. The average absolute humidity during the growing season is calculated by GASPAR II if a relative humidity and temperature are input. The growing season was considered to be May through October, which is a month longer than the five month vegetable growing season determined above. This is conservative because including May or October decreases the average relative humidity and average temperature, which results in higher doses. The average relative humidity in Huntsville, AL for May though October from 2001 – 2005 [FSAR Table 2.3-205] was used to determine the average relative humidity over the growing season near the site, which was calculated to be 75.6%. The average temperature in Scottsboro, AL for May though October from 1971 – 2000 [FSAR Table 2.3-263] was used to determine the average temperature over the growing season near the site, which was calculated to be 71.7 °F.
5. Section 1 of NUREG/CR-4653 states that GASPAR is capable of evaluating the doses due to ingestion of contaminated vegetables (including grains). Therefore, grains, vegetables, and orchards are conservatively included in the calculation of the annual vegetable production within 50 miles of the site. According to corn utilization statistics for the U.S. [United States Department of Agriculture,

5. (cont.)

Economic Research Service, "Feed Grains Database" (available online at http://www.ers.usda.gov/data/feedgrains/)], of all corn used in 2002, 58.6% was used for feed and residual, 10.5% was used in alcohol for fuel, and 0.2% was used for seed. Conservatively ignoring any amount of corn that may leave the 50 mile radius for processing or consumption, 30.7% of the corn produced is assumed to be consumed within 50 miles of the Bellefonte site. For all other crops considered, it is conservatively assumed that everything produced within 50 miles of the site is also consumed by humans within 50 miles of the site.

The acreage of crops harvested in each county within the 50-mile radius is documented in the 2002 Agricultural Census, which can be accessed from the United States Department of Agriculture (USDA) website [http://www.nass.usda.gov]. The harvest in each county was adjusted based on the area ratios of counties that lay within a 50-mile radius of the Bellefonte site. The acreage harvested for each crop is multiplied by the United States average yield of each crop, which is available via the USDA website [http://www.nass.usda.gov]. The yields for grains are provided for three categories that represent farms where the entire crop is irrigated, only part of the crop is irrigated, and none of the crop is irrigated. For each grain, the average yield was chosen based on whether most of the acreage of that crop was completely irrigated, partially irrigated, or not irrigated. For instances where the acreage was spread out among the three categories, the average yield for a partially irrigated farm was used. The average yield for vegetables is determined based on the production values for the 34 major vegetables produced in each state for 2003 according to USDA records [http://www.nass.usda.gov]. Data from 2003 was used because this data was unavailable for 2002. The average yield per acre for orchards is assumed to be equal to that of each state's major orchard fruit crop.

According to data from the 2002 Agricultural Census, which can be accessed via the USDA website [United States Department of Agriculture, National Agricultural Statistics Service (available online at http://www.nass.usda.gov)], Alabama and Georgia have more acres of peaches than any other fruit that grows in orchards. For both states, there are more acres of pecans than peaches. However, it is conservative to assume that all of the acreage identified as being used for orchards in these states is used to harvest peaches because the average yield for peaches is much higher than for pecans. The 2002 average yield per acre for peaches in the state of Georgia was 3.75 tons/acre based on the 2007 Annual Statistical Bulletin – Georgia Agricultural Facts, which can be accessed via the USDA website [http://www.nass.usda.gov]. The average yield for peaches in the state of Alabama was unavailable. Therefore, the yield from Georgia was used.

According to data from the 2002 Agricultural Census, which can be accessed via the USDA website [http://www.nass.usda.gov], Tennessee has more acres of apples than any other fruit or nut that grows in orchards. Therefore, it is reasonable to assume that most of the acreage identified as being used for orchards in the state of Tennessee is used to harvest apples. The average yield per acre for apples in Tennessee was 12,400 lbs. per acre in 1993, which was significantly higher than for any other year between 1984 and 1993 [Tennessee Agricultural Statistics Service, "Tennessee Commercial Apple & Peach Tree Inventory", 1993]. The yield for 1993 was also higher than the yields for 2005 and 2006, which were 9,440 and 11,100 lbs./acre, respectively. The yields of apples for 2005 and 2006 are from the Tennessee Agriculture 2007: Department Report and Statistical Summary, which can be accessed via the USDA website [http://www.nass.usda.gov].

For Alabama and Georgia, the average yield of peaches is used and for Tennessee the average yield of apples is used. Some of the average crop yields are based on bushels. For these crops, the average weight per bushel based on University of Missouri Agricultural Publication G4020, "Tables for Weights and Measurement: Crops", [William J. Murphy, Published by University of Missouri Extension, October 1993 (available online at http://extension.missouri.edu/xplor/agguides/crops/g04020.htm)] is used to calculate a total weight for each crop.

6. The inventory of milk cows in each county within the 50-mile radius is documented in the 2002 Agricultural Census. If data from the 2002 census was unavailable, data from the most recent Agricultural Census dating back to 1987 was used instead. The inventory in each county was adjusted based on the area ratios of counties that lay within a 50-mile radius of the Bellefonte site. Any goat milk produced within 50 miles of the plant was not included in the calculation of the population dose because the number of milk goats within the area is insignificant compared to the number of milk cows. The necessary data from the Agricultural Census for each county was found in the County Summary Highlights, which can be accessed from the United States Department of Agriculture (USDA) website [http://www.nass.usda.gov].

   The total number of milk cows within 50 miles of the Bellefonte site is multiplied by the 2002 average milk produced per cow in the relevant state [United States Department of Agriculture, National Agricultural Statistics Service (available online at http://www.nass.usda.gov)]. To convert pounds of milk to liters of milk, a density of 1,030 kg./m.3 for whole milk is used [Glenn Elert, "The Physics Hypertextbook – Density", 1998 – 2008 (available online at http://hypertextbook.com/physics/matter/density/)]. Using the density of whole milk is conservative because it has a lower density than skim milk. A lower density results in a greater volume of milk.
7. The inventory of beef cows in each county within the 50-mile radius is documented in the 2002 Agricultural Census. If data from the 2002 census was unavailable, data from the most recent Agricultural Census dating back to 1987 was used instead. The inventory in each county was adjusted based on the area ratios of counties that lay within a 50-mile radius of the Bellefonte site. The necessary data from the Agricultural Census for each county was found in the County Summary Highlights for each state, which can be accessed from the United States Department of Agriculture (USDA) website [http://www.nass.usda.gov].
   A conservative slaughter rate of 50% is used for beef cows based on Figure 4 of David P. Anderson, James G. Robb, and James Mintert, "Managing for Today's Cattle Market and Beyond - The Cattle Cycle", 1996 (available online at http://ag.arizona.edu/AREC/wemc/cattlemarket/CatlCycl.pdf). Because Alabama does not have a federal slaughter inspection program, nearly all of the commercial red meat from Alabama is sold and sent out of state to be slaughtered under federal inspection. Based on the 2007 Alabama Annual Statistics Bulletin, which can be accessed via the USDA website [http://www.nass.usda.gov]. There were 423,000 head of cattle sold in 2002. Only 2,000 head of cattle were for farm slaughter, and only 7,000 head of cattle were commercially slaughtered in Alabama in 2002 [http://www.nass.usda.gov]. Based on these values, approximately 98% of commercial cattle from Alabama is shipped out of state to be slaughtered. For conservatism, it is assumed that 35% of the cattle from Alabama within 50 miles of the Bellefonte site are slaughtered and consumed within the 50 mile radius. It is conservatively assumed that 50% of the cows in Georgia and Tennessee within 50 miles of the Bellefonte site are slaughtered and consumed within 50 miles of the site. This results in a total number of slaughtered beef cows within 50 miles of the Bellefonte site of 59,505. This number is multiplied by the 2002 average dressed weight of 765 lbs./head, which is based on USDA livestock slaughter data [http://www.nass.usda.gov].

ATTACHMENT 11.03-02B
TVA letter dated August 1, 2008
RAI Responses

ATTACHMENT 11.03-02B

METEOROLOGICAL DATA
From XOQDOQ

GASPAR II XOQDOQ-Generated Input File

```
PLANT VENT, NO DECAY,  UNDEPLETED
    S 1.056E-06 1.332E-06 1.333E-06 6.662E-07 4.121E-07 1.826E-07 6.594E-08
 3.280E-08 2.098E-08 1.509E-08
  SSW 1.450E-06 8.774E-07 5.329E-07 5.589E-07 7.153E-07 3.271E-07 1.178E-07
 5.835E-08 3.720E-08 2.669E-08
   SW 1.397E-06 8.392E-07 5.124E-07 3.455E-07 2.686E-07 2.988E-07 1.489E-07
 7.486E-08 4.818E-08 3.481E-08
  WSW 3.294E-07 2.310E-07 1.584E-07 1.136E-07 8.690E-08 1.564E-07 8.764E-08
 4.491E-08 2.926E-08 2.133E-08
    W 1.007E-07 7.084E-08 5.419E-08 4.352E-08 3.610E-08 9.208E-08 5.360E-08
 2.761E-08 1.804E-08 1.318E-08
  WNW 1.350E-07 8.471E-08 5.522E-08 1.357E-07 2.334E-07 1.062E-07 4.007E-08
 2.063E-08 1.348E-08 9.844E-09
   NW 2.773E-07 1.291E-07 7.180E-08 2.214E-07 2.919E-07 1.330E-07 5.030E-08
 2.595E-08 1.697E-08 1.241E-08
  NNW 3.892E-07 1.998E-07 1.170E-07 3.109E-07 3.885E-07 1.760E-07 6.596E-08
 3.378E-08 2.199E-08 1.602E-08
    N 6.472E-07 3.221E-07 1.914E-07 1.359E-07 1.050E-07 1.190E-07 1.032E-07
 5.273E-08 3.427E-08 2.494E-08
  NNE 1.386E-06 6.541E-07 3.826E-07 2.677E-07 2.047E-07 2.482E-07 2.249E-07
 1.156E-07 7.541E-08 5.503E-08
   NE 1.032E-06 5.166E-07 6.461E-07 1.090E-06 7.812E-07 3.529E-07 1.316E-07
 6.711E-08 4.358E-08 3.169E-08
  ENE 6.170E-07 8.662E-07 9.746E-07 4.915E-07 3.065E-07 1.378E-07 5.101E-08
 2.589E-08 1.677E-08 1.217E-08
    E 4.578E-07 7.253E-07 6.430E-07 3.217E-07 1.994E-07 8.876E-08 3.231E-08
 1.619E-08 1.040E-08 7.505E-09
  ESE 3.678E-07 7.600E-07 4.522E-07 2.270E-07 1.411E-07 6.312E-08 2.321E-08
 1.174E-08 7.589E-09 5.504E-09
   SE 4.016E-07 8.496E-07 4.974E-07 2.478E-07 1.530E-07 6.760E-08 2.428E-08
 1.203E-08 7.676E-09 5.512E-09
  SSE 6.317E-07 1.380E-06 8.313E-07 4.175E-07 2.596E-07 1.162E-07 4.270E-08
 2.157E-08 1.394E-08 1.010E-08
PLANT VENT, 2.260 DAY DECAY,  UNDEPLETED
    S 1.054E-06 1.307E-06 1.293E-06 6.372E-07 3.889E-07 1.662E-07 5.438E-08
 2.366E-08 1.333E-08 8.492E-09
  SSW 1.446E-06 8.702E-07 5.239E-07 5.377E-07 6.749E-07 2.977E-07 9.725E-08
 4.230E-08 2.385E-08 1.523E-08
   SW 1.393E-06 8.326E-07 5.041E-07 3.366E-07 2.587E-07 2.677E-07 1.205E-07
 5.247E-08 2.947E-08 1.872E-08
  WSW 3.283E-07 2.285E-07 1.550E-07 1.098E-07 8.294E-08 1.367E-07 6.886E-08
 2.997E-08 1.672E-08 1.051E-08
    W 1.004E-07 7.001E-08 5.277E-08 4.168E-08 3.399E-08 7.842E-08 4.045E-08
 1.720E-08 9.353E-09 5.724E-09
  WNW 1.346E-07 8.400E-08 5.420E-08 1.272E-07 2.150E-07 9.305E-08 3.069E-08
 1.317E-08 7.223E-09 4.462E-09
   NW 2.767E-07 1.283E-07 7.066E-08 2.076E-07 2.684E-07 1.162E-07 3.831E-08
 1.641E-08 8.979E-09 5.533E-09
  NNW 3.884E-07 1.983E-07 1.149E-07 2.922E-07 3.581E-07 1.545E-07 5.066E-08
```

2.167E-08 1.188E-08 7.346E-09
N 6.458E-07 3.197E-07 1.879E-07 1.316E-07 1.003E-07 1.038E-07 8.036E-08
3.463E-08 1.916E-08 1.195E-08
NNE 1.383E-06 6.493E-07 3.759E-07 2.599E-07 1.961E-07 2.162E-07 1.747E-07
7.572E-08 4.203E-08 2.630E-08
NE 1.030E-06 5.126E-07 6.259E-07 1.035E-06 7.291E-07 3.160E-07 1.053E-07
4.622E-08 2.605E-08 1.657E-08
ENE 6.157E-07 8.457E-07 9.398E-07 4.666E-07 2.864E-07 1.236E-07 4.090E-08
1.786E-08 1.004E-08 6.369E-09
E 4.567E-07 7.104E-07 6.215E-07 3.063E-07 1.871E-07 8.011E-08 2.622E-08
1.138E-08 6.381E-09 4.048E-09
ESE 3.671E-07 7.436E-07 4.369E-07 2.160E-07 1.322E-07 5.682E-08 1.871E-08
8.150E-09 4.575E-09 2.900E-09
SE 4.007E-07 8.352E-07 4.841E-07 2.383E-07 1.455E-07 6.232E-08 2.058E-08
9.103E-09 5.215E-09 3.380E-09
SSE 6.304E-07 1.350E-06 8.022E-07 3.967E-07 2.429E-07 1.043E-07 3.428E-08
1.488E-08 8.322E-09 5.260E-09
PLANT VENT, 8.000 DAY DECAY, DEPLETED
S 9.861E-07 1.285E-06 1.271E-06 6.122E-07 3.673E-07 1.532E-07 4.862E-08
2.103E-08 1.201E-08 7.807E-09
SSW 1.357E-06 8.397E-07 5.114E-07 5.386E-07 6.844E-07 2.960E-07 9.444E-08
4.109E-08 2.356E-08 1.539E-08
SW 1.304E-06 8.022E-07 4.917E-07 3.303E-07 2.560E-07 2.727E-07 1.228E-07
5.417E-08 3.132E-08 2.057E-08
WSW 3.092E-07 2.224E-07 1.531E-07 1.094E-07 8.332E-08 1.438E-07 7.303E-08
3.273E-08 1.908E-08 1.260E-08
W 9.437E-08 6.812E-08 5.240E-08 4.200E-08 3.472E-08 8.430E-08 4.432E-08
1.982E-08 1.151E-08 7.558E-09
WNW 1.268E-07 8.126E-08 5.310E-08 1.310E-07 2.228E-07 9.537E-08 3.154E-08
1.406E-08 8.151E-09 5.348E-09
NW 2.565E-07 1.212E-07 6.768E-08 2.135E-07 2.777E-07 1.190E-07 3.940E-08
1.757E-08 1.019E-08 6.680E-09
NNW 3.633E-07 1.894E-07 1.113E-07 3.002E-07 3.697E-07 1.576E-07 5.178E-08
2.296E-08 1.327E-08 8.686E-09
N 6.024E-07 3.045E-07 1.819E-07 1.291E-07 9.948E-08 1.100E-07 8.826E-08
3.945E-08 2.295E-08 1.513E-08
NNE 1.279E-06 6.144E-07 3.627E-07 2.541E-07 1.940E-07 2.296E-07 1.926E-07
8.659E-08 5.057E-08 3.341E-08
NE 9.555E-07 4.877E-07 6.265E-07 1.052E-06 7.338E-07 3.123E-07 1.025E-07
4.555E-08 2.642E-08 1.738E-08
ENE 5.733E-07 8.384E-07 9.348E-07 4.543E-07 2.746E-07 1.161E-07 3.763E-08
1.655E-08 9.529E-09 6.230E-09
E 4.291E-07 7.017E-07 6.114E-07 2.947E-07 1.771E-07 7.415E-08 2.365E-08
1.027E-08 5.872E-09 3.820E-09
ESE 3.447E-07 7.385E-07 4.276E-07 2.068E-07 1.246E-07 5.238E-08 1.685E-08
7.370E-09 4.231E-09 2.760E-09
SE 3.744E-07 8.260E-07 4.709E-07 2.261E-07 1.355E-07 5.641E-08 1.786E-08
7.738E-09 4.431E-09 2.893E-09
SSE 5.886E-07 1.340E-06 7.856E-07 3.800E-07 2.290E-07 9.629E-08 3.095E-08
1.351E-08 7.748E-09 5.049E-09

ROUTINE RELEASE FOR BELLEFONTE COLA, INPUT TO GASPAR, 06-07 MET DATA, DEPOSITION

S 9.970E-09 3.825E-09 2.122E-09 9.536E-10 5.395E-10 2.075E-10 6.002E-11
2.379E-11 1.270E-11 7.862E-12

SSW 9.866E-09 3.037E-09 1.042E-09 7.453E-10 8.341E-10 3.373E-10 9.758E-11
3.867E-11 2.065E-11 1.278E-11

SW 9.642E-09 2.932E-09 9.924E-10 4.931E-10 2.972E-10 2.469E-10 1.018E-10
4.033E-11 2.154E-11 1.333E-11

WSW 2.069E-09 6.722E-10 2.386E-10 1.209E-10 7.207E-11 7.667E-11 3.384E-11
1.341E-11 7.162E-12 4.433E-12

W 7.157E-10 2.302E-10 8.000E-11 4.009E-11 2.380E-11 3.015E-11 1.373E-11
5.443E-12 2.907E-12 1.799E-12

WNW 1.061E-09 3.362E-10 1.170E-10 9.879E-11 1.164E-10 4.475E-11 1.295E-11
5.132E-12 2.741E-12 1.697E-12

NW 2.606E-09 7.085E-10 2.238E-10 1.684E-10 1.674E-10 6.438E-11 1.863E-11
7.382E-12 3.942E-12 2.440E-12

NNW 3.578E-09 1.001E-09 3.219E-10 2.467E-10 2.481E-10 9.542E-11 2.760E-11
1.094E-11 5.842E-12 3.616E-12

N 6.329E-09 1.717E-09 5.364E-10 2.583E-10 1.513E-10 8.657E-11 4.939E-11
1.958E-11 1.045E-11 6.470E-12

NNE 1.246E-08 3.154E-09 9.495E-10 4.512E-10 2.627E-10 1.642E-10 1.025E-10
4.063E-11 2.170E-11 1.343E-11

NE 9.713E-09 2.500E-09 8.082E-10 8.417E-10 6.263E-10 2.409E-10 6.968E-11
2.762E-11 1.475E-11 9.129E-12

ENE 6.527E-09 2.209E-09 1.223E-09 5.492E-10 3.107E-10 1.195E-10 3.457E-11
1.370E-11 7.316E-12 4.528E-12

E 4.920E-09 1.826E-09 9.409E-10 4.226E-10 2.391E-10 9.193E-11 2.660E-11
1.054E-11 5.629E-12 3.484E-12

ESE 4.260E-09 1.807E-09 7.092E-10 3.185E-10 1.802E-10 6.930E-11 2.005E-11
7.946E-12 4.243E-12 2.626E-12

SE 3.764E-09 1.919E-09 8.018E-10 3.601E-10 2.037E-10 7.834E-11 2.266E-11
8.983E-12 4.797E-12 2.969E-12

SSE 7.063E-09 3.056E-09 1.211E-09 5.439E-10 3.077E-10 1.183E-10 3.423E-11
1.357E-11 7.246E-12 4.485E-12

P	EAB	NNE	.77	1.4E-06	1.4E-06	1.3E-06	1.2E-08
P	GARDEN	SW	1.13	1.1E-06	1.1E-06	1.0E-06	4.8E-09
P	MAX POINT	S	1.74	2.8E-06	2.7E-06	2.7E-06	4.8E-09