COMPARISON OF EMISSION MODELING AND AMBIENT AIR SAMPLING RESULTS FOR CY 1996

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Acronyms

BCP	Bethel Cumberland Presbyterian
CAP-88	Clean Air Act Assessment Package–1988
CFR	Code of Federal Regulation
EDE	effective dose equivalent
EPA	Environmental Protection Agency
HBP	Heath Ballpark
HCC	Heath Church of Christ
KOW	Kentucky Ordnance Works
LLD	lower limit of detection
mrem	millirem
NESHAP	National Emission Standards for Hazardous Air Pollutants
Np^{237}	neptunium-237
NRC	Nuclear Regulatory Commission
MDA	minimum detectable activity
PGDP	Paducah Gaseous Diffusion Plant
pCi/m^3	pico-curies per cubic meter
PSL	plant sanitary landfill
Pu^{239}	plutonium-239
SAR	Safety Analysis Report
Tc^{99}	technetium-99
Th^{230}	thorium-230
U^{238}	uranium-238
ug-U/filter	uranium per filter
USEC	United States Enrichment Corporation
VAW	Virginia Avenue West

1. INTRODUCTION

Issue 38 of the of the *Plan for Achieving Compliance With NRC Regulations at the Paducah Gaseous Diffusion Plant* (DOE/ORO-2026/R3)(hereinafter referred to as the "Compliance Plan") commits USEC to compare the EDE calculated from 1996 emissions to actual sampling data obtained from the high-volume ambient air samplers installed in 1995. As stated in the Compliance Plan, the first method of estimating the EDE is through the use of the measured concentrations of radionuclides in the air at the ambient air sampling stations. The second method is to use the estimated site emissions from the NESHAP program.

As stated in the Compliance Plan, "The primary reason for comparing the estimated EDEs (determined for the demonstration of compliance with 40 CFR 61 and 10 CFR 20 regulations) with the air sampler data is to confirm the accuracy of the methods used for estimating the EDEs." The commitment is to directly compare the EDEs calculated by each method as a way of confirming the appropriateness of the emission estimates and measurements used in demonstrating compliance with EPA regulations. While the comparison is not required by 10 CFR 20 or 40 CFR 61, and the use of ambient air sampling is not an acceptable method of demonstrating compliance with the regulations, the comparison does provide an independent check of the method of determining airborne emissions from the plant site.

2. REGULATORY REQUIREMENTS

The purpose of the NESHAP program for radionuclides is to demonstrate compliance with the requirements of 40 CFR 61, Subpart H. These regulations limit the radiological dose due to air emissions of radionuclides resulting from plant operations (hereafter referred to as the "plant dose") to the most exposed member of the public to 10 mrem/year. Subpart H requires the site demonstrate compliance with this limit on an annual basis and establishes the methodology to be used in the demonstration.

NRC regulations in 10 CFR 20 limit the plant dose to 100 mrem/year from all sources. The regulations also establish a constraint limit of 10 mrem/year from air emissions. This makes the NESHAP and NRC regulations comparable. Regulation 10 CFR 20 also establishes the requirements for demonstrating compliance with these limits.

Section 5.1.3 of PGDP's SAR describes the methodology to be used in demonstrating compliance with both regulations. The method involves the use of the CAP-88 computer model to estimate the exposure to members of the public. The basis is the measurement or estimate of airborne emissions from plant sources in accordance with the requirements of 10 CFR 61. The details of the methods are included in the SAR and the *United States Department of Energy Air Emissions Annual Report (40 CFR 61, Subpart H), Calendar Year 1996* (hereinafter referred to as the "NESHAP Report") and are not included in this report.

3. PROGRAM DESCRIPTIONS

3.1 NESHAP PROGRAM AND EMISSION ESTIMATES

The NESHAP program is, with the exception of the C-310 Purge and Vent Stack from which actual emissions are measured, designed to overestimate the quantity of radionuclides released from PGDP operations to the atmosphere. The objective is to provide a worst-case estimation of the resulting public dose to demonstrate that, under this worst-case scenario, PGDP is in compliance with the regulatory limits. The methods of estimating releases are described in SAR Section 5.1.3.

The emissions, along with meteorological data and receptor locations, are the site inputs to the CAP-88 program. The inputs are used to calculate, using a plume model, the resulting airborne radionuclide concentrations at specific receptor sites. Ground deposition levels and uptake into foodstuffs are also determined. The estimated radiological dose to the most exposed member of the public is compared to the regulatory limits to demonstrate that, based on the maximum credible emission estimates, the effect of PGDP operations on the health and safety of public is within regulatory limits.

3.2 AMBIENT AIR SAMPLING PROGRAM

The ambient air sampling program provides actual data concerning the concentrations of radionuclides at the sampling points. The ambient air samplers operate 24 hours a day, 365 days a year. Each sampler pulls air through a rectangular filter paper and is equipped with a screen to keep insects and pieces of debris from accumulating on the paper. The screens were installed in 1995 due to the analytical problems caused by these accumulations.

The filters are removed weekly and are analyzed by the PGDP Laboratory for total uranium, uranium assay, gross beta, and gross alpha activity. An average weekly concentration of uranium, beta, and alpha activity is calculated using the analytical results and the air flow data from the sampler.

4. COMPLIANCE PLAN

4.1 COMPLIANCE PLAN ISSUE

Issue 38 of the Compliance Plan requires that, for calendar year 1996, PGDP compare the EDE estimated by the NESHAP program with the EDE estimated from the results of the ambient air sampling program. The EDE is the sum of the estimated doses from all exposure pathways including inhalation, ingestion, air immersion, and radiation received from the ground surface.

The objective of the comparison is to provide an independent check on the methodology for demonstrating compliance with 10 CFR 20 and 40 CFR 61 limitations on public dose. The dose estimated through the NESHAP program involves the measurement or estimation of radiological releases to the atmosphere, the use of computer modeling to calculate an average annual air concentration of radionuclides at selected locations resulting from these releases, and the resulting estimate of radiological dose to members

of the public located at these locations. The computer program uses a Gaussian plume model to calculate the air concentrations of the radionuclides. The independent check of the NESHAP program is the ambient air sampling program which provides actual air data.

4.2 DEVIATION FROM COMPLIANCE PLAN

Issue 38 of the Compliance Plan requires EDEs from the NESHAP calculations and the ambient air sampler data be compared. Since the Compliance Plan issue was developed, we have determined that the method the CAP-88 program uses to estimate the dose due to ingestion does not allow such comparison.

By definition, the EDE is the dose from all exposure pathways. Using the meteorological and emission inputs, an average annual air concentration at each specified receptor location is calculated using a plume model. The inhalation and immersion doses are calculated directly from the air concentration. The direct radiation dose from ground deposition is calculated indirectly from the air concentration using deposition factors. In the case of PGDP emissions, the immersion and ground deposition pathways are insignificant.

The dose from ingestion of radionuclides is calculated in a different manner. The distribution of the production of foodstuffs consumed by the receptor is established in the CAP-88 program. In the case of PGDP, the "rural default" values are used. As an example, for vegetables, the program assumes that 7.6 percent of the vegetables consumed by the receptor are produced at the receptor location with the rest produced from the remainder of the assessment area–a 50-mile radius for PGDP. Other distributions are assumed for the production of milk and meat.

The CAP-88 program uses emission and meteorological inputs to estimate the uptake of radionuclides into food products produced at the receptor location and from other locations within the assessment area. The ingestion dose is then calculated.

An analogous procedure for calculating the ingestion dose cannot be followed for the ambient air sampling data. Because the ingestion pathway is significant for PGDP, the EDE estimated by the CAP-88 program cannot be compared to an EDE calculated from the ambient air sampling data.

4.3 METHOD OF COMPLETING THE COMPLIANCE PLAN REQUIREMENT

The purpose of the comparison and the Compliance Plan issue is to provide two independent estimates of the effect of PGDP operations on the environment and the public health and safety. However, as discussed in Section 4.2 of this report, a comparison of EDEs calculated by the CAP-88 program and from the ambient air data cannot be made because the ingestion dose cannot be determined from the ambient air data.

The CAP-88 program uses a prediction of ambient air concentration as the basis for all subsequent calculations. Therefore, a comparison of the average annual concentrations of radionuclides predicted from the CAP-88 program to the concentrations measured at the sampling stations fulfills the objective of the Compliance Plan issue. Agreement between the ambient air concentrations estimated by the two methods would indicate that the NESHAP program methodology, which is the basis for the demonstration of compliance with 40 CFR 61 and 10 CFR 20 regulations, is appropriate.

5. METHODOLOGY

5.1 NESHAP PROGRAM DATA

For the Compliance Plan comparison, the receptor locations used were the locations of the ambient air sampling stations (see Figure 1). The BCP Church station is located approximately 10 miles southwest of the plant site on U.S. Highway 60. This location is not shown on Figure 1.

The data inputs to the CAP-88 program were identical to those used for the compliance demonstration described in SAR Section 5.1.3 with the exception that human receptor locations were replaced with the air sampler locations. Specific data inputs can be found in the NESHAP Report.

The NESHAP program predicts the air concentration of radionuclides at a specific point based only upon the inputs. The effect of other natural and man-made sources of radionuclides in the environment is not considered. Therefore, the results of the computer modeling do not represent the predicted absolute levels of radionuclides at the air sampling stations–only the incremental effect of PGDP operations at the sampler locations.

5.2 AIR SAMPLER DATA

The air flow through the sampler filters is measured. Using the assay and total uranium values, the activity of each uranium isotope of concern can be calculated. The uranium is reported in micrograms of total ug-U/filter which is converted to ug-U/m^3 using the volumetric air flow data. The assay and specific activities of the uranium isotopes are used to convert the mass-based results to activity-based results.

For the work described in this report, the weekly values for 1996 were then averaged to estimate the annual average uranium concentration.

One issue concerning uranium is that a significant fraction of the total uranium analyses for each sampler are below the LLD for uranium of 4 ug-U/filter. In these cases, a value of ½ the LLD (2 ug-U/filter) is assigned to these data points. The average assay is determined by averaging the assays for uranium results which were greater than the uranium LLD.

During the period from August 29, 1995, when the air samplers were placed into operation, through October 17, 1996, analyses for Tc^{99}, Th^{230}, Np^{237}, and Pu^{239} were performed. During this period, Pu^{239} was never detected above the MDA, and Np^{237} was detected only on a single occasion. Tc^{99} and Th^{230} were detected on five and three occasions, respectively. Because of the low frequency of detection, and the high MDAs for each analysis versus the MDAs for gross alpha and beta activity, these radionuclides were dropped from the analytical protocol in October 1996.

The average gross beta activity level for each sampler is determined in pCi/m^3 using the analytical results and the air flow data. A conservative assumption that 100 percent of the total beta activity is due to Tc^{99} was made because the ambient air sampler filters are not specifically analyzed for Tc^{99}. The weekly values are averaged to estimate the annual average Tc^{99} concentration.

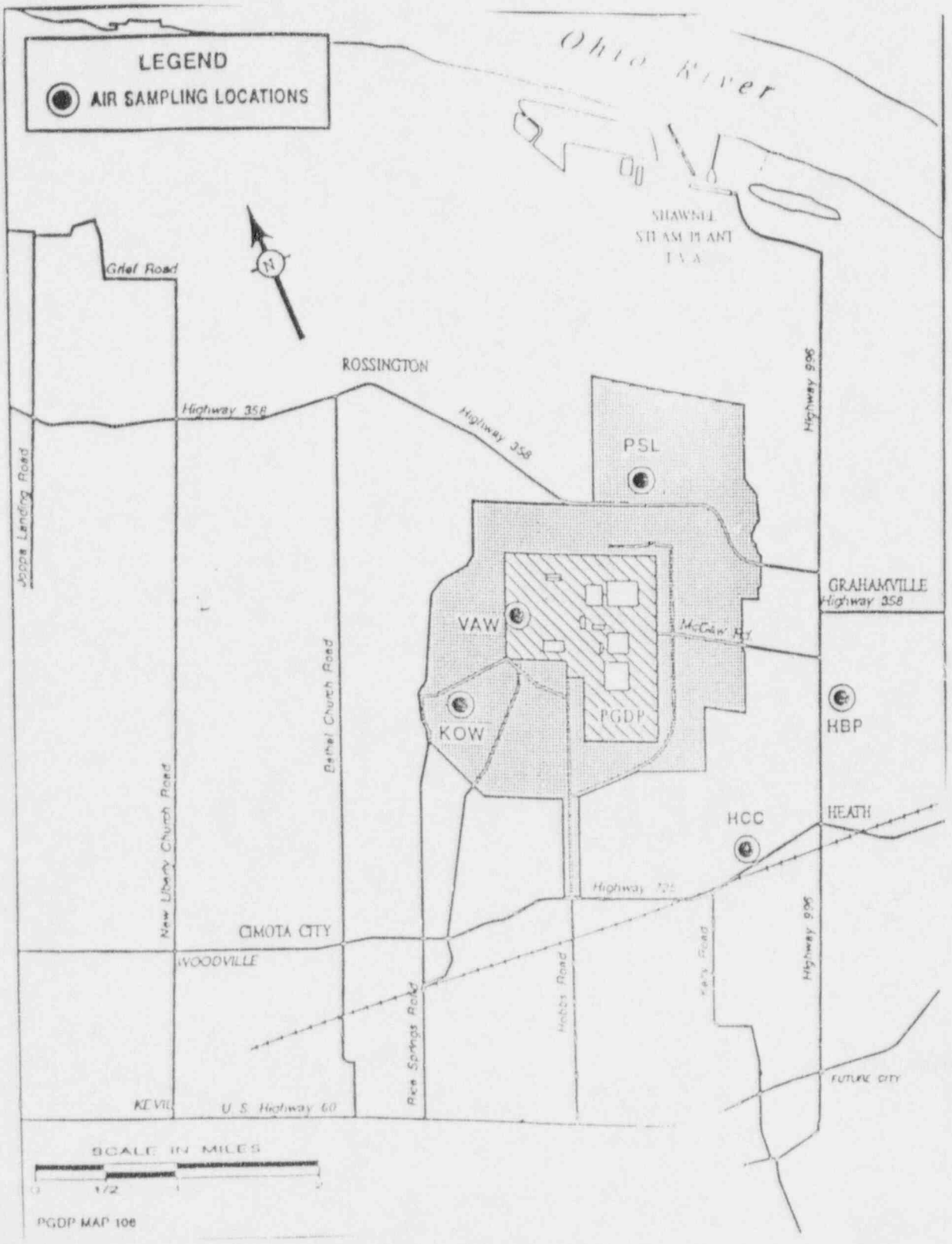

Figure 1. Ambient air sampling station locations

Radionuclides, including uranium and alpha and beta emitters, are in the environment from other man-made sources such as fallout from nuclear weapons testing and burning of coal in power plants. Uranium is naturally occurring in soils in the vicinity of PGDP. Because the ambient air samplers cannot distinguish between uranium and alpha and beta activity emitted by site operations, and the uranium and alpha and beta activity in the environment from natural and other man-made sources, the BCP station, which is approximately 10 miles southwest of the plant in the direction from which the prevailing wind blows, was established as the remote "background" station upwind from the PGDP site. This station is intended to provide data from an environment which should be, to a great extent, unaffected by PGDP emissions. Therefore, to determine the contribution of PGDP emissions to the radionuclide levels at each of the stations, the levels from the BCP station were subtracted from the other stations.

This method places the data from the ambient air stations on the same basis as the predictions from the NESHAP program.

The gross alpha data is not used in this comparison. During 1996, there was only one instance where the gross alpha activity exceeded the MDA of 0.77 pCi/filter. The dust loading of the filters results in the shielding of any alpha radiation present. While uranium is an alpha emitter, the total uranium present is determined by chemical analysis while the alpha radiation is determined using a counting technique. This would account for the lack of alpha detection in the presence of uranium.

For this reason it was determined that the gross alpha data was not useable for the airborne concentration comparison.

5.3 COMPARISON METHOD

As described in Sections 5.1 and 5.2 of this report, the data from the NESHAP program and the ambient air sampling program must be placed on the same basis for comparison. Once this is accomplished, a station-by-station comparison can be made.

The NESHAP program does not result in a "dose calculation." The program is a screening process to demonstrate that, using a conservative approach, PGDP emissions do not result in the most exposed member of the public receiving a radiological dose in excess of regulatory limits. As has been discussed, the objective of the NESHAP program is, where emissions are not actually measured, to overestimate the emissions so as to provide a worst-case scenario for the screening process. Consequently, the program should overstate the predicted ambient air concentrations at the air sampling stations.

Because the NESHAP results do not represent actual data, a statistical comparison between these results and the air sampling program cannot be made. It would be expected that the NESHAP predictions would be higher than the measured results; therefore, a simple station-by-station comparison of the two programs will be made.

6. RESULTS

6.1 URANIUM

The results of the CAP-88 computer model for uranium are shown in Table 1. These data represent the predicted average annual air concentrations of uranium isotopes at each station. As discussed in Section 5.2, this represents the incremental effect of PGDP operations at each station. The program predicts the concentrations of each individual isotope based upon the inputs. The Total Uranium column is the sum of the isotopic concentrations.

The results of the ambient air sampling program are shown in Table 2. These are the absolute uranium concentrations at each station. In this case, the Total Uranium column presents the actual analytical results. The isotopic concentrations are calculated from the assay and the total uranium data. For 1996, the uranium assay at all stations was determined to be 0.71 percent–"normal assay."

Table 2 also presents the number of data points available for each station in 1996 (i.e., the number of filters analyzed) and the number of points below the uranium LLD.

As has been discussed, the results of the CAP-88 program (Table 1) predict the effect of plant emissions at the sampling locations. The program does not take into account any other source of radionuclides; therefore, the CAP-88 results may not be directly compared to the ambient air results in Table 1. As can be seen from Table 1, plant emissions were predicted to have had some effect at the BCP station. This predicted effect cannot be removed from the comparison as there is no other remote background station against which the data from the BCP site can be compared.

The results of the subtraction of the BCP uranium concentrations from the site-vicinity stations are shown in Table 3.

Table 4 shows the comparisons between the ambient air sampling data from Table 3 and the CAP-88 data from Table 1. As can be seen for the total uranium results, the air samplers consistently detected a greater level of uranium than was predicted by the NESHAP program.

6.2 GROSS BETA/Tc^{99}

The results of CAP-88 modeling for Tc^{99} are shown in Table 1. Because the Tc^{99} emissions are estimated/measured directly, the program predicts the Tc^{99} concentration.

The results of the ambient air sampling program are shown in Table 5. The gross beta results are the measured results. The Tc^{99} concentrations are calculated as 100 percent of the gross beta levels.

Table 3 shows the results of subtracting the gross beta levels at the BCP station from the gross beta levels at the other station. The results are expressed as Tc^{99}.

The results in Table 5 are rounded to two significant figures in accordance with the accuracy and precision of the analytical results. Statistically (based on a matched-pairs analysis between the individual station results and the BCP results) there is no difference between the average air concentrations of gross beta activity at the stations in the vicinity of the plant and the concentrations of gross beta activity at the BCP station. However, for the purposes of illustration for the subtraction to generate the results in Table 3, six digits were retained from the conversion of activity in pCi/filter to pCi/m^3.

As can be seen from the table, the ambient air samplers at the VAW and PSL stations detected less Tc^{99} (as 100 percent of the gross beta activity) than was predicted by the NESHAP program. The HBP and HCC stations detected more Tc^{99} than was predicted by the NESHAP program. The data for KOW is inconclusive because the KOW sampler detected less Tc^{99} at KOW than at BCP.

To further explore the relationship between Tc^{99} and gross beta activity, a comparison of the respective MDAs can be made. The Tc^{99} MDA has been established by the PGDP Laboratory at 25 pCi/filter. If a nominal air flow rate of 10,000 m^3/filter is assumed, this is equivalent to 2.5E-3 pCi/m^3 of Tc^{99}. The gross beta MDA is 0.51 pCi/filter which is equivalent to 5.1E-5 pCi/m^3 of gross beta activity. Therefore, if Tc^{99} is present, it could be detected as gross beta activity but not as Tc^{99} by specific analysis.

During the period from August 29, 1995, through October 17, 1996, there were three instances where Tc^{99} was detected above the MDA. These occurred at the HCC, KOW, and PSL stations (4.1E-3, 4.6E-3, and 4.2E-3 pCi/m^3, respectively) on October 10, 1996. None of these occurrences coincided with abnormally high gross beta activity levels, elevated Tc^{99} emissions from C-310, or identified unplanned releases from PGDP. However, because the gross beta levels routinely averaged higher than these Tc^{99} levels by a factor of approximately 3, it would not be expected that the Tc^{99} levels detected would appreciably affect the gross beta levels.

6.3 OTHER RADIONUCLIDES

The NESHAP program also predicts the average annual air concentrations for Np^{237}, Pu^{239}, and Th^{230}. These predictions are shown in Table 6. The ambient air sampler filters are not analyzed specifically for these radionuclides.

6.3.1 Pu^{239}

Pu^{239} is an alpha-emitting radionuclide. During 1996, there was only one instance when the alpha activity on an ambient air filter exceeded the MDA of 0.77 pCi/filter. That occurred at the VAW station on November 26, 1996, when the alpha activity was 0.8 pCi/filter. During the period from August 29, 1995, when the air samplers were placed in operation, to October 17, 1996, there were no instances of Pu^{239} being detected above the MDA of 1.5 pCi/filter.

If a nominal air flow rate for each sampler of 10,000 m^3/filter is assumed (the actual average flow rates for 1996 varied from 10290 to 11080 m^3), the following MDAs can be calculated:

Pu^{239}–1.5E-4 pCi/m^3
Gross alpha–7.7E-5 pCi/m^3

From Table 6, it can be seen that the highest predicted Pu^{239} concentrations are well below the MDA for Pu^{239}, and it would not be expected that Pu^{239} would be detected. This is consistent with the data from the ambient air samplers.

6.3.2 Np^{237}

Np^{237} is both an alpha- and beta-emitter. Based on an MDA for Np^{237} of 3.5 pCi/filter and a flow rate of 10,000 m^3/filter, an MDA of 3.5E-4 pCi/m^3 can be calculated. As can be seen from Table 6, this is greater than the predicted Np^{237} concentrations predicted by the NESHAP program.

During the period from August 29, 1996, through October 17, 1996, there was only one instance in which Np^{237} was detected above the MDA. This occurred at the HCC station on July 25, 1996, when the Np^{237} concentration was determined to be 1.0E-3 pCi/m^3. This is well above the gross alpha MDA of 7.7E-5 pCi/m^3.

Np^{237} emits alpha and beta radiation in approximately equal proportions. The July 25 gross alpha results were below the alpha MDA, and the gross beta results were 1.1E-2 pCi/m^3. If Np^{237} were truly present in the sample, the gross alpha emissions would be expected to be above the MDA (excluding the shielding effects of dust). Because this was not the case, the Np^{237} results are considered suspect and no conclusions can be drawn.

Because the Np^{237} concentration was well below the gross beta level no conclusions can be drawn using this comparison.

Because the MDAs for both Np^{237} and gross alpha activity are well above the concentrations predicted by the NESHAP program, the detection of either would not be expected. With the exception of the single July 25, 1996, result, this is consistent with the data from the ambient air samplers.

6.3.3 Th^{230}

Th^{230} is an alpha emitter and therefore should be detected as gross alpha activity as well as Th^{230}. The MDA for Th^{230} has been established at 2.5 pCi/filter which, using the 10,000 m^3/filter air flow rate converts to a value of 2.5E-4 pCi/m^3. This is well above the gross alpha MDA; therefore, it is possible for Th^{230} to be present as alpha activity but at a level below the Th^{230} MDA as determined by specific analysis.

During the period from August 29, 1995, through October 17, 1996, there were five occurrences of Th^{230} detected above the MDA. These were all on different dates at different sampling stations, and none of the occurrences was associated with alpha activity above the alpha MDA. However, because Th^{230} is a decay daughter of U^{238}, it could be expected that Th^{230} would be associated with elevated levels of uranium. None of the five instances were associated with elevated uranium.

From Table 6, it can be seen that the predicted Th^{230} levels would be well below either the alpha or Th^{230} MDAs.

7. DISCUSSION OF RESULTS

7.1 URANIUM

The CAP-88 program consistently predicts a lower concentration of uranium than was detected by the air samplers during 1996. This could be due to the presence of uranium from other naturally-occurring and man-made sources. All of the filters are routinely coated with dust. Uranium in the soil which is resuspended through activities such as vehicular traffic, farming, etc., and particulates in the atmosphere would contribute to the dust loading. Because the uranium emitted by PGDP operations would hydrolyze with moisture in the atmosphere, such uranium would also be present in a particulate form. Therefore, removing the particulate material from the filter prior to analysis would not be appropriate.

The NESHAP program is designed to overestimate the uranium emissions from site point sources to ensure that the site remains below regulatory limits. However, releases from building ventilation systems are not estimated (per the NESHAP program plan and SAR Section 5.1) unless air samples from inside the building exceed a threshold level. This could mean that uranium emissions from the building ventilation systems are underestimated.

Because of the presence of uranium from other sources, it could be expected that the uranium detected by the air samplers would exceed the levels predicted by the computer model.

The EDE resulting from site operations to the most exposed member of the public, as determined through the NESHAP program, was estimated at 5.2E-3 mrem/year. Uranium is the largest contributor to the estimated dose. If the NESHAP program is underestimating uranium emissions by a factor of 10 (which is greater than the difference shown in Table 6), the resulting dose could be as great as 5.2E-2. This is still below the regulatory levels by a factor of nearly 200.

7.2 Tc^{99}

The NESHAP program predictions were close to levels of Tc^{99} measured at the air samplers on a gross beta basis. However, because there are many beta-emitting radionuclides in the environment (K^{40} for example), and due to the assumption that 100 percent of the beta activity is due to Tc^{99} emitted by PGDP, it is likely that actual Tc^{99} levels are less than shown in Table 4. This indicates that the dose from site Tc^{99} emissions estimated from the NESHAP program is probably greater than that which would actually be incurred at the air sampling locations. This cannot be confirmed by direct analysis for Tc^{99} due to high MDA for Tc^{99} relative to the MDA for gross beta. However, even if all of the beta activity should be due to Tc^{99}, the NESHAP method provides a realistic assessment of PGDP compliance with regulatory limits.

7.3 OTHER RADIONUCLIDES

The results for Np^{237}, Pu^{239} and Th^{230} are inconclusive. Specific analyses for these radionuclides were dropped from the analytical protocol due to the very low frequency of detection. The predicted concentrations of these radionuclides at the ambient air stations are far below the MDAs for the specific radionuclide analyses and for the gross alpha and beta analyses. No conclusions regarding the accuracy of the NESHAP emission estimates can be drawn from these data.

8. CONCLUSIONS

The objective of this exercise was to perform an independent check on the methods of estimating site emissions for the demonstrations of compliance with 40 CFR 61 and 10 CFR 20 regulatory requirements. This check was performed by comparing the radionuclide concentrations at the ambient air sampling locations predicted by the NESHAP program to the concentrations measured by the ambient air sampling program.

The results for uranium indicate that ambient air stations are measuring uranium in greater concentrations than are predicted by the NESHAP program. This could be due to the presence of uranium from other natural and man-made sources. However, there is no way to confirm this. Uranium released from PGDP would be in a particulate form at or near to the point of release. The removal of dust from the filters prior to analysis would remove uranium released by site operations as well as uranium from other sources.

The accuracy of the NESHAP program, which is the program for demonstrating compliance with 10 CFR 20 as is described in Section 5.1.3 of the SAR, cannot be directly validated using the ambient air sampling results. However, based on the uranium results, if PGDP was considered to be the source of all uranium at the stations in the vicinity of the site, the dose from these emissions would not approach the regulatory limits. Therefore, the program provides an adequate demonstration of compliance and would detect any significant increase in uranium releases before a regulatory limit was approached.

With regard to Tc^{99}, the NESHAP program significantly overestimates the Tc^{99} emissions and, consequently, the resulting EDE to the most exposed member of the public. In this regard, the program provides a very conservative demonstration of compliance. In addition, the ambient air sampling program is capable of detecting any significant change in the presence of Tc^{99} in the ambient air utilizing the gross beta activity as an indicator.

The ambient air data for gross alpha, Pu^{239}, Np^{237}, and Th^{230} is inconclusive and cannot be directly compared to the NESHAP program data. However, the program predicts that the levels of Pu^{239}, Np^{237}, and Th^{230} in the environment should be much less than can be detected by the ambient air system--a prediction that is confirmed by the data for the period from August 29, 1995, through October 17, 1996. In addition, these radionuclides are not present at PGDP in the absence of uranium. Therefore, these radionuclides will not increase in the environment as a result of PGDP operations unless uranium releases increase. The program described in Section 5.1 of the SAR will identify significant increases in uranium releases.

As discussed in Section 7.1 of this report, uranium is the largest contributor to the estimated dose to the most exposed member of the public. If plant emissions were being underestimated by as much as a factor of 10, the resulting estimated dose would still be a factor of approximately 200 below the regulatory constraint of 10 mrem/year. These results indicate that the current method of demonstrating compliance with these regulations is appropriate.

Table 1

RESULTS OF CAP-88 MODELING

Station	Radionuclide Activity (pCi/m³)				
	U^{234}	U^{235}	U^{238}	Total Uranium	Tc^{99}
VAW	3.8E-5	2.2E-6	2.4E-5	8.4E-5	1.3E-3
PSL	3.9E-5	1.6E-6	1.9E-5	5.9E-5	5.0E-4
HBP	1.2E-5	5.1E-7	6.3E-6	1.9E-5	1.6E-4
HCC	1.7E-5	7.0E-7	8.4E-6	2.6E-5	1.9E-4
KOW	1.2E-5	4.8E-7	5.3E-6	1.8E-5	1.6E-4
BCP	2.0E-6	8.0E-8	9.4E-7	3.0E-6	2.5E-5

Table 2

AMBIENT AIR SAMPLER RESULTS FOR CY 1996
URANIUM

Station	Activity (pCi/m³)					
	U^{234}	U^{235}	U^{238}	Total Uranium	No. of Data Points	No. Less Than LLD
VAW	2.7E-4	1.4E-5	3.0E-4	8.9E-4	53	9
PSL	2.5E-4	1.EE-5	2.8E-4	8.3E-4	53	12
HBP	1.8E-4	9.1E-6	2.0E-4	5.9E-4	52	19
HCC	1.6E-4	8.2E-6	1.8E-4	5.4E-4	53	19
KOW	1.8E-4	9.0E-6	2.0E-4	5.9E-4	53	15
BCP	1.2E-4	6.3E-6	1.4E-4	4.1E-4	53	23

Table 3

AMBIENT AIR SAMPLING STATION DATA
AVERAGE DIFFERENCE BETWEEN SITE-VICINITY STATIONS AND BCP*

Station	U^{234} (pCi/m^3)	U^{235} (pCi/m^3)	U^{238} (pCi/m^3)	Total Uranium (pCi/m^3)	Tc^{99} (pCi/m^3)
VAW–BCP	1.5E-4	7.4E-6	1.6E-4	3.1E-4	2.6E-4
PSL–BCP	1.3E-4	6.6E-6	1.4E-4	2.8E-4	1.6E-4
HBP–BCP	5.5E-5	2.8E-6	6.0E-5	1.2E-4	3.1E-4
HCC–BCP	3.7E-5	1.8E-6	4.0E-5	7.8E-5	3.4E-4
KOW–BCP	5.5E-5	2.8E-6	6.0E-5	1.2E-4	-3.4E-4*

*The gross beta activity at KOW was less than at BCP.

Table 4

COMPARISON OF AMBIENT AIR AND NESHAP RESULTS

Station	Total Uranium			Tc^{99}		
	AA Sampler (pCi/m^3)	NESHAP Calculation (pCi/m^3)	Ratio (AA Sampler/NESHAP)	AA Sampler (pCi/m^3)	NESHAP Calculation (pCi/m^3)	Ratio (AA Sampler/NESHAP)
VAW	3.1E-4	8.4E-5	3.7	2.6E-4	1.3E-3	0.2
PSL	2.8E-4	5.9E-5	4.7	1.6E-4	5.0E-4	0.3
HBP	1.2E-4	1.9E-5	6.3	3.1E-4	1.6E-4	1.8
HCC	7.8E-5	2.6E-5	3	3.4E-4	1.9E-4	1.9
KOW	1.2E-4	1.8E-5	6.6	-3.4E-4	1.6E-4	-2.1

Table 5

AMBIENT AIR SAMPLER RESULTS FOR CY 1996
GROSS BETA ACTIVITY

Station	Activity pCi/m^3)	
	Gross Beta	Tc^{99}
VAW	1.8E-2	1.8E-2
PSL	1.7E-2	1.7E-2
HBP	1.8E-2	1.8E-2
HCC	1.7E-2	1.8E-2
KOW	1.8E-2	1.8E-2
BCP	1.7E-2	1.7E-2

Table 6

PREDICTED AVERAGE ANNUAL AMBIENT AIR CONCENTRATIONS
OF MISCELLANEOUS RADIONUCLIDES

Station	Radionuclide		
	Np^{237} (pCi/m^3)	Pu^{239} (pCi/m^3)	Th^{230} (pCi/m^3)
VAW	5.8E-8	3.3E-8	9.9E-9
PSL	4.2E-8	3.2E-8	1.7E-8
HBP	9.6E-9	1.1E-8	3.7E-9
HCC	1.0E-8	1.6E-8	5.3E-9
KOW	1.1E-8	8.5E-9	5.1E-9
BCP	1.7E-9	1.6E-9	1.1E-9