Chapter 7
Performance Review

What's Covered in Chapter 7:

- ♦ RAIMI Pilot Study Performance Review
- ♦ How To Use

From a regional program perspective, this Pilot Study is intended as a test of the RAIMI methods and approach with regard to stated design objectives (see Section 1.2) as reiterated within the text of this report. Therefore, Section 7.1 of this chapter discusses the performance of the RAIMI Pilot Study in achieving design objectives.

EPA acknowledges that the design goals would be *fully* achieved, in the Pilot Study or in other applications of the RAIMI methods and approach, only with input data of appropriate quality commensurate with the permitting or risk management decision being made. In most cases, given the current availability of data, this will be realized – for more costly or controversial risk management or permitting decisions – not at the stage of using "readily available data," but only after inclusion of site-specific additional information that results in refinement of the analysis specific to highest risk concerns and significant data gaps. However, the process of identifying and focusing on significant risk concerns based on available data is the first and necessary step in effectively considering risk management opportunities.

In addition to testing the capabilities of the RAIMI as a risk-based approach to accomplish stated objectives, the Pilot Study was successful in providing site-specific prioritization of risk concerns, as well as identification of important data gaps. Section 7.2 provides examples of how results from the RAIMI can be used in a solution oriented approach.

As is the design of the RAIMI, findings are anticipated to change as source and contaminant emission data sets become more complete, and as risk management efforts are implemented. Likewise, uncertainties are also expected to be reduced and better quantified.

7.1 RAIMI PILOT STUDY PERFORMANCE REVIEW

Design goals for the RAIMI Pilot Study, described in Section 1.2, were developed to render a standardized, versatile, and dynamic approach that utilizes available data to assess and prioritize risk concerns on a community level that result from aggregate exposure to multiple contaminants from multiple sources. This section provides a performance review of how these design goals were achieved by RAIMI through completion of the Pilot Study initial phase for the Port Neches Assessment Area. In the following discussion, the design goals are presented in italics, followed by a summary review of the RAIMI Pilot Study performance specific to each design goal.

- *Useful as a permitting tool to support EPA, state, and local permitting authorities–independently or combined–evaluate and demonstrate protectiveness of cross program (e.g., RCRA, CAA, exempt) permitting decisions and support holistic, tailored permit strategies with the flexibility to be either area (i.e., industrial complex), facility, or source-specific.*

The RAIMI approach enables the attribution of individual risk elements to source permit status and applicable regulatory program. As the results described in Section 6.1 demonstrate, impacts at a resolution to support permit decisions can be attributed to individual or grouped emissions sources, and attribution can be further linked to source characteristics such as permit status. For example, at the location profiled in the Port Neches/Nederland neighborhood, ethylene oxide emissions from four permitted individual sources accounted for about 57 percent of modeled impacts, and emissions from one grandfathered emissions source accounted for about 20 percent of modeled impacts. As such, the RAIMI approach provides permit writers the ability to consider potential impacts at a neighborhood receptor from a RCRA combustion unit relative to emissions sources grandfathered under the CAA. And, perhaps more important, permit writer–and industrial facilities–can evaluate potential risks based on a range of proposed permitted emissions levels, implementation of emissions controls, or location of proposed emissions sources. Thus, the RAIMI approach provides a flexible mechanism for the regulatory community–regulators, industry, and communities–to consider a range of risk management alternatives to ensure protectiveness.

Realization of this design goal could be significantly enhanced through the evaluation of emissions inventories that are more complete, particularly with regard to emissions speciation and inclusion of actual emissions from minor sources (such as those typically included in area grouped source subcategories). Additionally, enhancements to data management tools could be developed and incorporated into the RAIMI approach to improve the ability to access, compare, and evaluate data among the emissions characterization data sets, air dispersion modeling results, and risk modeling results. These improvements would enable risk managers assess aggregate impacts with greater confidence in results and provide a basis from which to derive pragmatic solutions to risk issues in the assessment area.

- *Provide a standardized and consistent means by which all permitting authorities could account for and assess aggregate health effects to multiple contaminants from multiple sources, which are often subject to multiple permitting schemes, but cumulatively impacting the same receptor neighborhoods.*

The integrity of identified and prioritized risk concerns–using any methodology–is incumbent on the establishment of a standardized and consistent means to evaluate risk, particularly when multiple sources, multiple facilities, and multiple regulatory programs are involved. The use of current guidance, adopted to the multi-source scenario to assess aggregate impacts, and proven models provides the standardized and consistent framework for evaluation. For example, for emissions of ethylene oxide in the Port Neches/Nederland neighborhood, five individual sources account for about 75 percent of these impacts, the remainder coming from 10 individual sources and four grouped source subcategories. Risk managers using these results can be confident that impacts from these individual sources are reliable–to the extent the emissions inventories are complete. That is, these results are derived from the same process: reported emissions, prioritized to identify the most significant sources, were modeled through a state-of-the-art air dispersion and risk models, to achieve a prioritization of emissions sources for further risk management consideration. Therefore, the RAIMI results–the prioritization of sources based on risk impacts–is a standardized and consistent means to begin assessment area risk management activities and the allocation of resources in the Port Neches Assessment Area.

There are some uncertainties in any evaluation of this nature that are difficult to eliminate through the implementation of a standardized approach such as RAIMI, and the complete realization of this design goal is constrained by these limitations. For example, toxicity factors for different contaminants may be derived differently, and some factors may be in a state of flux with regard to the value currently recommended or accepted by a scientific or regulated community (see Table 6-2 and the discussion on 1,3-butadiene in Section 6.1.1.1). Additionally, two facilities in an assessment area may follow different approaches regarding the extent to which emissions are speciated for reporting, which may bias impacts toward the facility that provides a greater degree of speciation in its annual inventory (see Table 6-21, which lists speciated and unspeciated emissions from facilities in the Port Neches Assessment Area).

- *Provide the necessary level of detailed information to prioritize, and simultaneously begin identifying potential solutions, for sources resulting in unacceptable risks by* *estimating combined health effects resulting from multiple contaminants and sources. This should be done at a community level of resolution that is specific to definable individual locations, and generated in a fully transparent fashion such that aggregate risk levels are completely traceable to each contaminant, each pathway, and each source.*

This design goal has been fully realized through the RAIMI Pilot Study. The RAIMI initial phase results presented in Section 6.1 provide risk managers the ability to prioritize risk concerns, identify risk management opportunities and significant data gaps that may have an effect, and allocate resources towards particular issues of interest or concern. These results are useable and reliable for these purposes. The various multi-source elements contributing to risk at a particular receptor location are fully transparent; the RAIMI methodology ensures that each elemental component of risk or modeled air concentration is fully traceable to the culpable source, as is indicated in the attribution tables in Section 6.1.

Although this design goal has been fully achieved, it is important to note that these results are based on the available emissions inventories, which have been demonstrated to be incomplete in terms of containing the necessary emissions data to fully characterize contaminant-specific and source-specific impacts. However, the versatility of the RAIMI approach ensures the ability to readily incorporate new or refined emissions data, and even to incorporate newly identified individual sources, to reduce these limitations and improve the reliability and certainty of results.

- *Calculate and track risks from literally hundreds of sources and contaminants based on actual emissions data submitted by facilities to the state agency. As new or refined data become available, it can be directly incorporated into the assessment to obtain revised risk estimates on practically a real time basis.*

Achievement of this design goal is demonstrated by the Pilot Study modeling within the Port Neches Assessment Area of about 113 individual sources and 588 census-tract specific grouped source subcategories (42 subcategories for 14 census tracts). For example, Table 6-3 attributes the risk impacts in the Port Neches/Nederland neighborhood from 1,3-butadiene emissions to 27 individual sources and 14 grouped source sub-categories. Attribution of impacts from the modeled emissions at the receptor location are fully traceable to the contributing emissions sources. Although many of these sources may contribute to risk impacts below some level of interest concern, the RAIMI approach nonetheless maintains this information in a readily available manner for use by risk managers. If other sources of 1,3-butadiene are identified through refined emissions characterization, then impacts from these emissions can be readily evaluated through the RAIMI approach and incorporated into the Pilot Study results.

Realization of this design goal could be enhanced through improved data management tools to facilitate the processing, manipulation, and tracking of even larger quantities of information among the emissions characterization, air dispersion modeling, and risk modeling components of the RAIMI approach. Additionally, certain aspects of the technical approach can be modified to reduce the amount of extraneous data generated. For example, each source in the Pilot Study included the calculation of an air concentration at each grid node in the assessment area, regardless of the source location in the assessment area–the Port Neches Assessment Area is 23 km by 12 km. By better correlating potential exposure areas of concern with the distance from a source for which an air concentration parameter will be calculated, a significant reduction could be realized in the amount of data to be generated and maintained through reducing the size of the receptor grid node array.

- *Serve as a versatile and dynamic project platform, allowing for the rapid identification, characterization, assessment, and management of aggregate environmental exposures that pose the greatest health risks to the public.*

The designed flexibility of the RAIMI approach to the assessment and management of aggregate risks are demonstrated through the Pilot Study. As this is a Pilot Study, the versatile and dynamic nature of the platform has not been fully tested, but the pilot study results demonstrate that the RAIMI approach to the use of available emissions data in established air and risk models does enable the fulfillment of this design goal. Additional applicability of the RAIMI approach that demonstrates its dynamic nature can include the evaluation of risk impacts from multiple emissions scenarios using actual, allowable, or proposed permit emissions rates. The risk impacts from emission rate trends can also be readily evaluated by revising the modeled emissions rate for sources that have been air dispersion modeled, and new sources can be easily added to the modeled data set. In addition, additional receptor locations can be modeled, as well as varying the exposure inputs for each receptor grid node.

7.2 HOW TO USE RESULTS

In addition to testing the capabilities of the RAIMI as a risk-based approach to accomplish stated objectives, the Pilot Study results presented in Chapter 6 successfully provide site-specific prioritization of risk concerns using the best available emissions data for sources within the air shed of the Port Neches Assessment Area. Identification of important data gaps that may have the most influence on the accuracy and completeness of these results is also provided. This section presents some examples of how such results may be used.

It is important to note that presentation of results in this section is for illustration of examples only, and should not be viewed as inclusive or of more importance in regard to the other results obtained for the Port Neches Assessment Area. As is the design of the RAIMI, findings are anticipated to change as source and contaminant emission data sets become more complete, and as risk management efforts are implemented. Likewise, uncertainties are also expected to be reduced and better quantified.

7.2.1 Prioritize Risk Concerns

The intent of the RAIMI approach is to utilize available data to prioritize risk concerns and issues that may requiring further refinement or actions. Pilot Study results presented in Chapter 6 detail the contaminants, emissions sources, and facilities of potential risk-based concern specific to a neighborhood location. For example, review of the RAIMI Pilot Study results for the Port Neches/Nederland neighborhood (see Section 6.1) indicates, at a minimum, the following:

- Modeling available emissions characterization data identifies emitted concentrations of 1,3-butadiene to be a concern (see Figure 6-2);
- Individual emission sources at the Huntsman and Ameripol Synpol facilities are the most significant contributors of 1,3-butadiene to this neighborhood location (see Table 6-3); and
- Incomplete emissions characterization appears to be the most significant data gap potentially effecting results; therefore, improving the completeness of the available emissions inventories will likely effect the magnitude of modeled risk impacts from 1,3-butadiene and other contaminants.

As demonstrated by review of results presented in Chapter 6, identifying and focusing on significant risk concerns based on available data is the first and necessary step in effectively considering risk management opportunities.

7.2.2 Refine National-Scale Assessments

The more refined localized approach of the RAIMI can be used to complement national-scale assessments that generally report risk concerns on a broad scale (typically county-level resolution). Jefferson County, Texas, was selected for the RAIMI Pilot Study in part based on the results of the CEP, a national-scale assessment of contaminants in air. While the CEP results broadly identify Jefferson County and certain contaminants as being of potential risk concern, the Pilot Study provides results at an increased level of resolution such that risk based concerns can be identified specific to neighborhoods and definable emission sources.

Regarding resolution of assessment results, an important benefit of refinement to a local-scale assessment is illustrated by considering the methods by which emissions data are applied to the models. To achieve the objectives of a national-scale assessment within a feasible scope of time and resources, assumptions and allocations of emissions are typically made to simplify modeling. An example would be the use of artificial source locations which are assigned generalized source parameters as inputs to the air model to represent all emission sources at a facility; such as at the centroid of the facility property (typically done when modeling TRI emissions), or, in the case of the National Air Toxics Assessment (NATA), at the centroid of the census tract or zip code area. While this approach allows national-scale assessments to broadly identify contaminants of potential concern across large geographical areas, the assigning of source locations–or other sensitive parameters–in such a manner limits resolution and transparency, as well as the ability to define or prioritize individual sources based on risk. The RAIMI approach is more localized and can compliment the national-scale assessment by providing an increased level of source specificity and detail required not only for prioritization, but also for accurate development and tracking of solutions to manage risk concerns.

To illustrate the potential sensitivity of source location on modeled impacts, the following Pilot Study example is provided. Monitoring station T-136, located in the Port Neches/Nederland neighborhood, is located about 750 meters west of a modeled 1,3-butadiene source (wastewater pond) at the Ameripol Synpol facility. A RAIMI modeling analysis of this source indicates that if the wastewater pond location was actually adjusted by as little as 200 meters, the resulting impact from the pond at the T-136 location increases by a factor of two. This simple example indicates the importance of resolution with regard to sensitive modeling inputs.

7.2.3 Identify Risk Trends

In addition to supporting prioritization, the RAIMI Pilot Study results can also be used to correlate source characteristics with risk trends of interest. Risk trending within the RAIMI can be accomplished by linking results to various source attributes such as regulatory status, source type or classification code (SCC), stack height, or any other source attribute being tracked. Similarly, risk trending can be specific to receptor attributes as well (varying risk impacts based on future changes in land use and demographic patterns).

For example, Table 6-3 presents the attribution profile for 1,3-butadiene in the Port Neches/Nederland neighborhood. For each source modeled, various attributes and parameters are tracked. Since risk values are estimated on a source-specific basis, results of interest can also be linked to any of the source characteristics also being tracked, such as SCC as shown in Table 7-1. Correlating source specific attributes to source specific results allows for isolation and evaluation of any resulting risk trends. As seen in Table 7-1 of this example, correlation of source classification with Pilot Study risk indicates a potential trend toward wastewater treatment units as emission sources that may require further evaluation.

While the example of Table 7-1 is very limited, it nonetheless could be expanded to include assessment results from additional facilities and neighborhoods evaluated to determine if other wastewater treatment units in the assessment area could be identified as sources needing further review. These results could also help industry evaluate the need to focus resources towards the development of improved emissions controls for wastewater treatment units associated with production of 1,3-butadiene. If warranted and supported by applicable regulatory agencies, facilities may utilize such information to assist with decisions regarding plant maintenance, upgrades, and process controls.

While the example above correlates source specific risk to source specific classification code, a similar correlation could be conducted with permit status. For example, source specific results could be correlated to source permit status of RCRA, CAA, grandfathered, and/or exempt. Risk trending

TABLE 7-1

SCC CODES FOR SIGNIFICANT 1,3-BUTADIENE SOURCES

Source Description	SCC	Source-Specific Percentage of Modeled Pathway Risk
Huntsman Corporation, *Wastewater JWWTP Blending Station #B-14* FIN: JWB14 EPN: JWB14	30182006 Wastewater Treatment Chemical Plant Wastewater System: Aerated Impoundment	23.5%
Huntsman Corporation, *Wastewater JWWTP Neutralization Basin #B-16* FIN: JWB16 EPN: JWB16	30182007 Wastewater Treatment Chemical Plant Wastewater System: Non-aerated Impoundment	14.9%
Huntsman Corporation, South B.D.E. Equipment Fugitives FIN: BDFUGS EPN: BDFUGS	30115380 Butadiene Production Fugitive Emissions	12.4%
Huntsman Corporation, TNRCC Name: Fugitives EPN: C4FU	SCC not available for this source	6.9%
Huntsman Corporation, *Wastewater JWWTP Primary Clarifier #C-6* FIN: JWC6 EPN: JWC6	30182010 Wastewater Treatment Chemical Plant Wastewater System: Clarifier	6.8%

Notes: Source-specific percentage of modeled pathway risk based on available emissions characterization data reported for 1997.

EPN Emissions point number
FIN Facility identification number

information from such a correlation could assist State or Federal permitting agencies in evaluating emissions permit conditions and their effectiveness.

7.2.4 Determine Significance of Data Gaps

The RAIMI approach not only provides a means to identify data gaps, but also can be used to evaluate the potential significance of these data gaps with regard to influence on results. As presented in Chapter 6, the Pilot Study identifies limits associated with data gaps in emissions characterization. Although numerous data gaps are identified, being able to bound the relative significance of the data gaps could be helpful in guiding, and maybe even justifying, use of resources (agency and/or facility) to resolve those data gaps with the most numerical influence on results. Since the project platform is designed to be dynamic with regard to insertion of updated information, this can be done efficiently within the RAIMI approach through numerical substitutions of best and worst case scenarios for each data gap, and observing effects on results. Similar to results, numerical bounding of data gaps can be accomplished at a resolution that is source, contaminant, and neighborhood specific. Such resolution allows focus on identifying individual source and receptor locations that may be particularly sensitive from a risk standpoint to changes in emission rates as a result of data gap resolution, providing regulatory agencies and facilities the ability to allocate resources toward those specific data gaps that have the greatest influence on results.

With regard to the Port Neches/Nederland neighborhood, Chapter 6 identifies lack of speciated emissions as a potential limiting data gap within emissions characterization. For example, sources at the Huntsman Corporation facility are identified as potentially contributing significant impacts from emissions of 1,3-butadiene (see Table 6-3). However, the Huntsman Corporation facility, which reported for 1997 a total of 238 tpy of speciated 1,3-butadiene emissions, also reports 1,779 tpy of unspeciated nonmethane VOCs (TNRCC 1999d). The large quantity of unspeciated emissions, if speciated, could alter predicted risk values and associated attribution profiles for 1,3-butadiene in the assessment area.

Specific to this example, a potential range or bounding of influence on results that might occur if the 1,779 tpy of unspeciated grouping of nonmethane VOCs were to be speciated could be determined by assuming various percentages of the unspeciated nonmethane VOCs to be 1,3-butadiene and inserting the assumed emission scenario into the risk modeling component of the assessment. Also, since the 1,779 tpy of unspeciated nonmethane VOCs are reported specific to individual sources, then resolution of the bounding would likewise be source specific. Such an exercise of numerical bounding could be used to guide decisions of whether or not speciation of the nonmethane VOCs would be warranted, and if so, which sources would be of greatest interest.

Although the above example is very specific to a contaminant, sources, and facility, from a program development standpoint, the RAIMI could also be used to focus the design of emissions reporting requirements to ensure the applicability of such data in air and risk modeling initiatives.

7.2.5 Track Emissions Reduction Efforts

The Pilot Study results are based on emissions data that mostly originate from the1997 emissions inventory. Since then, the emissions picture has assuredly changed, with emissions reductions from some sources and increased emissions from others. Indeed, one criticism of national-scale assessments is that the results do not represent current emission levels. While it may take facilities and regulatory agencies several years to compile emissions data for a given reporting year, once these inventories are available they can readily be inserted into the risk modeling component of an existing RAIMI project to determine the relative change in risk impacts for current reported emissions compared to previous years. This allows emissions reduction efforts to be correlated to effective reductions in modeled risk, and tracked from year to year. Additionally, refinements to emissions reporting (e.g., more complete speciation, inclusion of process upset and maintenance emissions) can also be incorporated when the data sets are available. Similarly, this functionality enables an assessment of varying risk impacts based on potentially changing land use and demographic patterns as well.

7.2.6 Support Monitoring Programs

The Pilot Study results provide contaminant and source-specific information that can be used to support the planning and implementation of ambient air monitoring programs. Results presented in Chapter 6 are based on air modeling that provides locations of hot spots, contaminants of concern, identification of contaminants not currently being monitored (such as ethylene oxide and formaldehyde), and the spatial extent of areas potentially impacted by emissions. The Pilot Study results also attribute modeled impacts at a receptor–or monitor–location to the responsible individual and grouped sources of contaminants of concern. This information can be used to optimize monitor site selection and other monitoring parameters to achieve the design goals of the monitoring program.

For example, a monitoring system could be designed to activate emergency control procedures that prevent or alleviate air pollution episodes that exceed an established air quality standard for specific contaminants, or trigger public health measures for individual well being. The Pilot Study results and the RAIMI approach, in conjunction with a more complete and accurate emissions inventory, can be used to optimize monitoring design with respect to emissions quantities and contaminant toxicities to ensure that the system focuses on the contaminants and sources that pose the greatest concern.

Other monitoring objectives could be to ensure that the sources of toxic air pollutants are well controlled or to monitor the effectiveness of a emissions control program. For these objectives, the transparency of the RAIMI results with regard to source-specific attribution could be helpful in isolating a monitoring location that focuses on the emissions sources subject to the control program and minimizes potential impacts from excluded sources.

One final possibility for the application of RAIMI results in support of air monitoring programs could be to observe pollution trends throughout an assessment area region. Over time, emissions sources may come online, be shut down, or become subject to emissions control equipment that changes the emissions profile of a source, facility, or industrial corridor. In addition, the characteristics of the neighboring communities could change such that new monitoring demands are required. The flexibility of the RAIMI approach enables emissions profiles to be quickly updated