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OSWER Risk Management Program Evaluation Scoping Project: Scoping Assessment and Performance Data Improvement Plan

Final Report

July 12, 2013

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I. INTRODUCTION

The Risk Management Program is implemented by the Office of Emergency Management (OEM) in EPA's Office of Solid Waste and Emergency Response (OSWER). The program aims to reduce accidents at RMP facilities, which is a strategic measure under Goal 3 of EPA's 2011-2015 Strategic Plan. EPA and state and local implementing agencies conduct inspections at RMP facilities.[1] Inspections are intended to determine compliance with RMP regulatory requirements. Because resources for conducting inspections are limited, within the past few years EPA has begun focusing more (but not exclusively) on high risk facilities for RMP inspections.[2]

The objectives of this evaluation scoping project were twofold: 1) assess the readiness of the RMP Program for an outcome evaluation focusing on the role of inspections, and 2) identify any additional data collection that would be required to answer outcome questions. The project was conducted in two phases. Phase 1 examined the strengths and limitations of the program's existing data. The results of the scoping phase indicated that the existing data would not support an evaluation at the present time. Phase 2 focused on the development of a Performance Data Improvement Plan for improving the accessibility, quality, and usefulness of the program's data to make it viable for evaluation in the future. The current volume consolidates the results of the scoping assessment with the Performance Data Improvement Plan.

This project was funded by EPA's Program Evaluation Competition, through which EPA's Evaluation Support Division (ESD) encourages the use of program evaluation as a management tool throughout the Agency. The project was funded with resources from ESD, OEM, and OSWER's Center for Program Analysis. EPA contracted with Industrial Economics, Incorporated (IEc) to provide contractor support for this project.[3] The project team included representatives from ESD, OEM, OSWER's Center for Program Analysis, the Office of Enforcement and Compliance Assurance (OECA), and IEc. In addition, the project team shared the evaluation questions (presented in Section III) with the ten EPA

[1] Throughout this report, the term "RMP facilities" refers to facilities that are required to submit a Risk Management Plan; the term "RMP inspections" refers to inspections that are conducted at these facilities. For convenience, we use the phrase "RMP Program" to refer to the Risk Management Program.

[2] The *2013 National Program Manager Guidance* indicates that Regions should inspect at least four percent of the total number of regulated facilities in the Region during FY 2013; of these inspections, at least 30 percent should be conducted at high risk RMP facilities. Excerpt from *2013 National Program Manager Guidance*: Supporting Chemical Accident Prevention, Preparedness and Response at the Local and State Levels.

[3] This report is written from IEc's perspective. Terms such as "we" and "our" refer to IEc.

Regional Offices. Three Regions provided written comments, and the team further revised the questions based on their feedback.

Following this introduction, Section II presents a logic model for the RMP Program focusing on the role of RMP inspections. Section III presents the revised evaluation questions and describes their connection to the logic model. Section IV identifies potential approaches to answer the evaluation questions and the data needed. Section V discusses the data sources explored, and explores the strengths and limitations of the existing data. Section VI presents our overall evaluability assessment. The Performance Data Improvement Plan is described in Section VII.

Appendix A summarizes the key findings of the scoping assessment in a crosswalk table. A summary of the Data Improvement Action Plan is included in Appendix B.

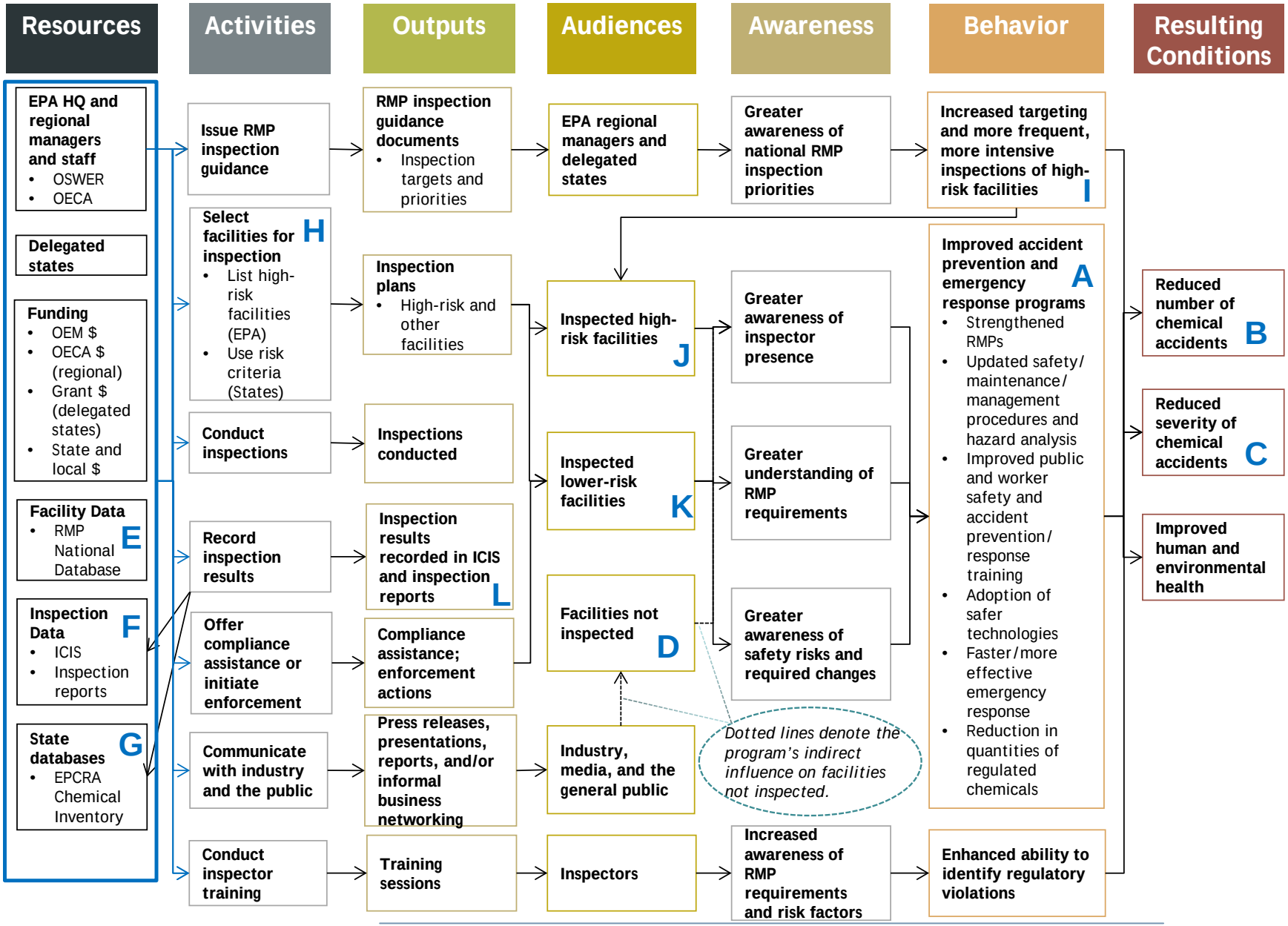
II. LOGIC MODEL

To illustrate the role of RMP inspections and to inform the development of specific evaluation questions, EPA and IEc refined the RMP logic model focusing on RMP inspections.[4] A logic model is a graphical representation of the relationships between program resources, activities, and outputs, and intended changes in awareness, behavior, and conditions. As shown in Exhibit 1, the key components of the model include:

- **Resources** — program managers, staff, and funds dedicated to the program. Resources also include databases with which the program collects information about RMP facilities and records inspection results.
- **Activities** — the specific procedures or processes used to achieve program goals. For example, the RMP Program issues RMP inspection guidance, conducts inspections, and records inspection results.
- **Outputs** — the immediate products that result from activities. For example, RMP outputs include RMP inspection guidance documents, inspection plans, and inspections conducted.
- **Audiences** — groups and individuals targeted by RMP activities and outputs. Audiences for RMP outputs include EPA Regional managers, delegated states, inspectors, inspected facilities, other facilities that are not inspected, and the general public. The model distinguishes between inspected high risk facilities, inspected facilities not judged to be high risk, and RMP facilities not inspected. The program aims to have a direct influence on inspected facilities, and an indirect influence on uninspected facilities through informal business networking, media, and other means.
- **Awareness** — changes in awareness resulting from program outputs that are causally linked to the RMP Program. For example, RMP outputs are intended to make facilities more aware of the presence of inspectors, RMP requirements, and safety risks.
- **Behavior** — changes in behavior resulting from changes in awareness. For example, the RMP Program's activities are designed to first lead to increased awareness of RMP requirements by facilities, and then lead to behavioral changes including improved accident prevention and emergency response.
- **Resulting Conditions** — the overarching goals of the program, which in RMP's case include reduced incidence and severity of chemical accidents, and improved human and environmental health.

[4] OEM undertakes a variety of activities beyond inspections that are not shown in the logic model.

EXHIBIT 1. RMP PROGRAM LOGIC MODEL FOCUSING ON THE ROLE OF INSPECTIONS



As depicted in the logic model, the Risk Management Program makes several assumptions in its design, which may or may not be true. Part of the purpose of an evaluation could be to test these assumptions:

- Facilities respond to inspections by taking actions to improve safety and compliance.
- The frequency and intensity of inspections matters: More frequent and more intensive inspections are more effective than less frequent, less intensive inspections.
- Some high risk facilities are aware of their status and respond to the *possibility* of enhanced scrutiny from inspectors. Although disclosure of the overall list of "high risk" facilities is restricted by law, inspectors sometimes inform individual high risk facilities of their status, on a case by case basis. In addition, some facilities may be able to guess their status based on publicly available inspection guidelines for high risk facilities.
- High risk facilities respond to enhanced inspector presence. Even if high risk facilities do not know their status, they may respond to more frequent inspections or more thorough inspections resulting from EPA's greater focus on high risk facilities.
- Inspections can have a deterrent effect on facilities that are not inspected – i.e., facilities may take "preemptive" corrective measures in response to: communications from EPA/states, information from business associations, media reports (e.g., enforcement cases), public scrutiny resulting from inspections, and/or their peers.

In addition to the factors shown in the logic model, RMP inspection activities and outcomes may also be influenced by a variety of external factors, including:

- Resource constraints;
- Other inspections (not RMP), e.g. OSHA;
- Quality of inspectors/inspections;
- Level of sophistication of the facility (e.g., facility management and size);
- Regulatory requirements; and
- Political and economic factors.

The evaluation team developed a set of evaluation questions to test the program theory, and to understand the extent to which the program is achieving its intended outcomes. The following section presents the evaluation questions and describes their connection to the logic model.

III. EVALUATION QUESTIONS

Building on the original evaluation questions contained in OEM's proposal for PEC funding, the evaluation team developed the following set of revised evaluation questions:

1. What effect, if any, do RMP inspections have on facility behavior?
    a. Do facilities re-submit (update) their Risk Management Plan following an RMP inspection? If yes, what changes do they make?
    b. How, if at all, do facilities change their safety practices and procedures following an RMP inspection?
    c. Do facilities adopt safer technologies and/or reduce the quantity of regulated chemicals held on-site following an RMP inspection? If yes, what changes do they make?
2. What effect, if any, do RMP inspections have on the incidence and severity of chemical accidents at RMP facilities?
    a. What portion of facilities that have received an RMP inspection report a chemical accident within two years following the inspection?
    b. How do the incidence and severity of reported accidents at inspected facilities (post-inspection) compare to the accident history at RMP facilities that have never been inspected?
3. What indications exist, if any, that RMP inspections have a deterrent effect on RMP facilities that have not been inspected?
4. What effect, if any, has the change in RMP inspection strategy (to designate some facilities as "high risk" and to devote more inspection resources to high-risk facilities) had on facility behavior and the incidence and severity of accidents?
    a. How, if at all, do inspection results (i.e., the number and type of violations, and enforcement actions) differ between high-risk facilities compared to facilities that are not judged to be high risk?
    b. How, if at all, have inspection results changed overall and by type of facility (high-risk facilities vs. facilities that are not judged to be high risk) since the strategy was adopted?
    c. How, if at all, do the incidence and severity of chemical accidents (post-inspection) vary between high-risk facilities compared to facilities that are not judged to be high risk?

d. How, if at all, have the incidence and severity of accidents changed (overall and by facility type) since the strategy was adopted?

5. Based on the results of Question 4, should EPA consider refining its approach to defining "high-risk" facilities? Should EPA reconsider the current allocation of inspection resources between high-risk facilities vs. facilities that are not judged to be high risk?

Exhibit 2 presents the evaluation questions and indicates the components in the logic model shown in Exhibit 1 that the questions are meant to inform.

EXHIBIT 2. EVALUATION QUESTIONS AND CONNECTION TO THE LOGIC MODEL

EVALUATION QUESTIONS	CONNECTION TO THE LOGIC MODEL
1. What effect, if any, do RMP inspections have on facility behavior?	A
A. Do facilities re-submit (update) their Risk Management Plan following an RMP inspection? If yes, what changes do they make?	
B. How, if at all, do facilities change their safety practices and procedures following an RMP inspection?	
C. Do facilities adopt safer technologies and/or reduce the quantity of regulated chemicals held on-site following an RMP inspection? If yes, what changes do they make?	
2. What effect, if any, do RMP inspections have on the incidence and severity of chemical accidents at RMP facilities?	B, C, D, J, K
A. What portion of facilities that have received an RMP inspection report a chemical accident within two years following the inspection?	
B. How do the incidence and severity of reported accidents at inspected facilities (post-inspection) compare to the accident history at RMP facilities that have never been inspected?	
3. What indications exist, if any, that RMP inspections have a deterrent effect on RMP facilities that have <u>not</u> been inspected?	D
4. What effect, if any, has the change in RMP inspection strategy (to designate some facilities as "high risk" and to devote more inspection resources to high-risk facilities) had on facility behavior and the incidence and severity of accidents?	A, B, C, H, I, J, K, L
A. How, if at all, do inspection results (i.e., the number and type of violations, and enforcement actions) differ between high-risk facilities compared to facilities that are not judged to be high risk?	
B. How, if at all, have inspection results <u>changed</u> overall and by type of facility (high-risk facilities vs. facilities that are not judged to be high risk) since the strategy was adopted?	
C. How, if at all, do the incidence and severity of chemical accidents (post-inspection) vary between high-risk facilities compared to facilities that are not judged to be high risk?	
D. How, if at all, have the incidence and severity of accidents <u>changed</u> (overall and by facility type) since the strategy was adopted?	
5. Based on the results of question 4, should EPA consider refining its approach to defining "high-risk" facilities? Should EPA reconsider the current allocation of inspection resources between high-risk facilities vs. facilities that are not judged to be high risk?	H, I

IV. POTENTIAL APPROACHES AND EVALUATION DATA NEEDS

Having finalized the evaluation questions, the project team identified potential evaluation approaches. As shown in Exhibit 3, the two main approaches to answering the evaluation questions are (1) quantitative and (2) qualitative. In both cases, the goal is to understand the effect of RMP inspections on facility behavior and accidents.

Quantitative methods aim to identify the role of RMP inspections by making comparisons – over time (before/after an inspection), and/or across facilities (with/without inspections). Such comparisons can tell us whether RMP inspections are correlated with accident history. Ideally, we would go beyond correlation and show whether RMP inspections *cause* fewer, or less severe, chemical accidents. However, demonstrating causality requires the ability to control for confounding factors, such as other types of inspections (non-RMP inspections) and inspector/inspection quality.[5] To detect differences across groups and strengthen confidence in results, quantitative studies generally aim to collect a large number of observations across standard and reliable metrics. This approach allows researchers to extrapolate findings from our sample to the general population; however, we may overlook important variables that are difficult to quantify. Moreover, it does not tell us *how* and *why* a program is (or is not) working.

EXHIBIT 3. POSSIBLE APPROACHES TO ANSWERING THE EVALUATION QUESTIONS

QUANTITATIVE	QUALITATIVE
Before-and-after comparison: • Compare pre- and post-inspection behavior and accident history at inspected facilities	• **Thematic analysis** of data gathered through interviews, focus groups, document reviews, and literature search • In-depth **case studies** of the program's pathways of influence and factors that mediate success • Understand **how and why** the program is or is not effective
With-and-without comparison: • Compare the behavior and accident history of facilities with an RMP inspection to facilities without an RMP inspection • Compare the behavior and accident history of high risk facilities and facilities not judged to be high risk	

Qualitative approaches typically focus on a smaller number of observations and aim to gain greater insight into the dynamics of the program, for example, through in-depth case studies. Given the limited number of observations, case study findings may not be

[5] We may be able to extend the analysis beyond simple correlations and control for some confounding factors. For example, we could test the *strength* of the correlations between inspections and accident history, and we could control for facility characteristics that are captured in existing datasets (e.g., NAICS code). However, some of the major confounding factors are not captured in existing datasets – e.g., inspector/inspection quality.

generalizable to the population as a whole. However, case studies can go beyond standard, easily codified metrics to explore the program's pathways of influence and factors that mediate success. For example, while quantitative analysis may show a difference between facilities that have and have not been inspected, case studies can shed light on *why* inspections were or were not effective in certain situations.

Quantitative and qualitative approaches need not be used in isolation. In fact, using a combination of quantitative and qualitative approaches often generates a more comprehensive understanding of the program, and enables us to cross-check our findings from across multiple data sources, thereby strengthening confidence in the results.

Having identified general approaches to answering the evaluation questions, the team turned its attention to the data needed to implement each approach. The rest of this section identifies the major types of data needed; Section V describes the data sources that we investigated.

- **Inspection data.** This is a basic data requirement for assessing the effectiveness of RMP inspections. Simply put, we need to know if and when an RMP inspection was conducted at a facility. It would be optimal to have more information about the inspections – for example, what triggered the inspection, the type and intensity of the inspection, number and type of violations discovered, and resulting enforcement actions. At a minimum, though, we need to be able to distinguish between facilities that have and have not received an RMP inspection.

- **Behavioral indicators.** The idea that facilities change their behavior in response to inspections is a key element of the program theory, as reflected in the logic model. Therefore, Evaluation Question 1 addresses changes in facility behavior. Behavioral change is the crucial link between program activities (i.e., conducting RMP inspections) and the ultimate goal of the program (reduced chemical accidents). As we move from left to right along the logic model (from program resources and activities, to resulting conditions), other factors beyond the control of the RMP Program come into play. For example, if an inspected facility is found to be in violation of RMP regulations and later returns to compliance (change in behavior), we can be reasonably confident that the inspection caused the facility to change its behavior. On the other hand, if an inspected facility never has a chemical accident (resulting condition), we cannot state with any certainty that the inspection *caused* the facility not to have an accident.[6] After all, many facilities without an RMP inspection never have an accident. Therefore, showing that inspections cause facilities to change their behavior is a key intermediate step for assessing the effectiveness of inspections.

  Therefore, we need information showing if and how facilities changed their behavior following an RMP inspection. We are interested in the behaviors reflected in the logic model, including: strengthened Risk Management Plans (RMPs); updated safety/maintenance/management procedures and hazard analysis; improved public and worker safety and accident prevention/response training; adoption of safer

[6] This is a key challenge for prevention programs in general, where success is defined as something not happening (e.g., a chemical accident).

technologies; faster/more effective emergency response; and reduction in quantities of regulated chemicals held on-site. Optimally, we would also like to understand if/how RMP inspections *contributed* to changes in behavior. Qualitative methods, including reviews of RMPs and inspection reports and interviews with inspectors and facility managers, may be helpful for understanding how RMP inspections influenced facility behavior.

- **Accident data.** The ultimate goal of the program is to reduce the number and severity of chemical accidents. Evaluation Question 2 aims to assess the role of inspections in achieving this goal. As the question implies, we could calculate the portion of inspected facilities that have a chemical accident; we could also compare the accident history of RMP facilities that did and did not receive an RMP inspection. This would not, on its own, prove that inspections are or are not effective; as discussed throughout this document, other confounding factors can influence accident history. However, when combined with changes in facility behavior, accident history provides a useful (and necessary) indicator of the effectiveness of RMP inspections.
- **Information about uninspected facilities.** Evaluation Question 3 aims to understand the deterrent effect of RMP inspections on facilities that have not been inspected. This effect – known in the literature as "general deterrence" – could result from uninspected facilities observing or interacting with facilities that have been inspected, reading newspaper articles about facilities that were inspected, etc. By definition, there are no inspection results for facilities that have never been inspected. However, it may be possible to obtain anecdotal information about how uninspected facilities changed their behavior in response to inspections at other facilities. The literature also includes examples of general deterrence.
- **Risk status of RMP facilities.** Evaluation Question 4 seeks to compare outcomes for facilities that were targeted as "high risk" to facilities that were not judged to be high risk. At a minimum, answering this question requires knowing which facilities were specifically designated as high risk facilities, and which were not.
- **Qualitative data.** As indicated in Exhibit 3 above, qualitative research may encompass a variety of methods including interviews, focus groups, document reviews, literature search, and case studies. Each method has corresponding data needs. For example, access to key informants (interview data), inspection reports or other documents, and relevant academic literature may be required.

V. DATA SOURCES

This section describes potential data sources for answering the evaluation questions. While most of the team's effort was focused on identifying and assessing existing data sources, we also considered new data that could be collected. Therefore, while most of this section focuses on existing data sources, the last part of this section discusses new data collection. The table in Appendix A presents a crosswalk of evaluation questions, approaches, and data sources.

We investigated several data sources to assess the readiness of the RMP Program for an outcome evaluation focusing on the role of inspections. These include: the RMP database, inspection data in the Integrated Compliance Information System (ICIS) database, and ICIS enforcement data. In addition, we investigated the connections among these three data sources. Below, we describe each data source and the connections across data sources.

RMP DATABASE

RMP-registered facilities are required to submit a Risk Management Plan (RMP) to RMP Info. OEM provided the RMP Info data in a Microsoft Access database: RMP Review.[7] The data are stored in numerous tables in the database. Working closely with OEM, we determined that two tables – Accident History (tblS6) and Facilities (tblS) – are the primary sources of data relevant to the evaluation questions. The Facilities table contains information about facilities that have submitted a Risk Management Plan, including: facility name, address, and contact information for the representative in charge of the facility's RMP. The Accident History table contains information about the release of RMP-regulated substances at facilities, including: accident date, accident time, type of release, reported cause of the release, and the type of damage caused (e.g. worker deaths, worker injuries, property damage, etc.).

- **Strengths.** RMP Info is a relatively comprehensive database for all facilities that have submitted an RMP to EPA. The Accident History table contains rich information both on the number of accidents and their severity (e.g., number of deaths). Notably, the database includes accident history for facilities that have been inspected and facilities that have not been inspected. Therefore, we can compare outcome data for facilities that have and have not received an RMP inspection.
- **Limitations.** We have several concerns about the quality and usability of the data. First, the data contained in RMP Info are self-reported by regulated facilities, and may not be accurate due to a facility's potential bias to report information that shows

[7] We use the terms RMP Info and RMP Review interchangeably throughout this report.

itself in a positive light. Reporting facilities may also misinterpret RMP data fields and provide information that is not relevant or accurate.

Second, the database may not include information for all facilities whose behavior is affected by the program. Some facilities that are required to submit an RMP may not comply with this requirement. Moreover, facilities that would be required to submit an RMP may reduce the quantity of chemicals held on-site below the regulatory threshold, and thus no longer be required to submit an RMP. Even if we examined all of the data in RMP Info, we would not have information for non-reporting facilities.

Third, EPA is not able to correct mistakes that it identifies in RMP Info. If EPA recognizes an error in a facility's RMP, the Agency contacts the facility and asks it to resubmit its RMP with corrected information. This creates a delay between the time that errors are discovered and the time they are corrected in the database.

Fourth, attributing revisions in a facility's Risk Management Plan to an RMP inspection would be challenging and may not be possible. RMP submissions do not indicate whether changes in the Plan, if any, were due to an RMP inspection. In addition, a significant amount of time may elapse between when a facility receives an RMP inspection and when it resubmits its RMP (facilities are only required to submit an RMP once every five years or within six months following an accident[8]). The time lag between receiving an inspection and resubmitting an RMP makes it difficult to tie changes in the RMP directly to an inspection. In fact, facilities that were inspected within the past five years may not yet have resubmitted their RMP. Moreover, the number of RMP submissions for an individual facility may be limited: The RMP Program has been in place since 1999; if facilities submitted an RMP once every five years, we would expect to find two RMPs per facility as of 2013. However, a facility's requirements may have changed over that time period (e.g., due to an increase or decrease in the volume of chemicals held on-site) such that they have only submitted one RMP.

Finally, RMP Info does not include reliable indicators of changes in facility behavior; it also does not contain any information about whether a facility has received an RMP inspection or the results of the inspection. Inspection data are contained in the separate ICIS database; as discussed below, this requires linking the facility data in RMP Info to the inspection data in ICIS.

[8] There are several complicating factors related to accident history: First, inspections may increase the likelihood that facilities *report* an accident; we may not be able to differentiate between actual changes in the incidence of accidents vs. changes in reporting behavior. Second, because facilities have up to six months to report an accident, accidents reported within six months of an inspection need to be scrutinized to see if the accident occurred before or after the inspection was conducted. Third, facilities can report information related to the same accident more than once. If we want to know when the facility first reported the accident, we need to look at the *earliest* date when the accident was reported. In this regard, RMP Info sometimes has duplicate entries for the same accident as facilities update minor details about the incident. Identifying and removing duplicate records would require additional time and resources.

ICIS INSPECTION DATA

The ICIS database provides inspection data for RMP inspections and other types of inspections (e.g., OSHA). Some of the ICIS data are publicly available through the EPA Compliance History and Enforcement Online (ECHO) website. However, ECHO does not provide access to all of the information in ICIS; moreover, accessing information from ICIS in a user-friendly format can be challenging. Therefore, IEc relied on OECA to provide the data. OECA exported the data into an Excel file, including RMP inspections conducted in fiscal years 2007 through 2012. The data include the following information: date of inspection, compliance monitoring activity name, sections code, compliance monitoring activity reason, FRS facility name, FRS ID, compliance monitoring type, and activity ID.

- **Strengths.** The ICIS inspection data indicate if and when an RMP inspection was conducted at a facility, along with some basic information about the inspection type and reason. This information is fundamental for identifying and comparing facilities that have and have not received an RMP inspection.
- **Limitations.** The ICIS data only go back to FY 2007, effectively limiting our study period to about six years if we conduct an evaluation in 2013. Moreover, ICIS does not provide the actual inspection reports; therefore, it is not possible to determine the outcomes and other specific details of an inspection by reviewing the database alone. A detailed analysis of inspection outcomes would require a time-consuming manual review of paper copies of the inspection reports that are stored at EPA's Regional Offices. The data also do not indicate whether a facility was targeted as "high risk," and do not provide information on the intensity of the inspection. Furthermore, because the RMP Program aims to inspect about five percent of RMP facilities per year – and given the relatively young age of the program – many facilities have never been inspected, and very few facilities have been inspected more than once. The lack of longitudinal inspection data is a significant limitation, because the best way to identify the results of previous inspections is to conduct follow-up inspections.[9] Given these limitations, the inspection data will tell us if and when an inspection was conducted, but will not tell us how inspections affected facility behavior.

ICIS ENFORCEMENT DATA

The ICIS database provides information about enforcement actions taken against facilities due to RMP-related (and other) regulatory violations. OECA provided an export of the ICIS enforcement data for fiscal years 2007 through 2012 in Excel. The enforcement data provided contained the following information: enforcement action ID, facility name, the Region in which the facility is located, primary law violated, section code violated, final order date, federal penalty assessed, compliance action value total, assessed cost recovery, and final order type.

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[9] *Longitudinal* data tracks the same type of information (e.g., inspection results) for the same subjects (e.g., facilities) at multiple points in time. Longitudinal studies yield multiple or repeated measurements on each subject. Longitudinal data would enable us to measure *changes* in inspection outcomes at individual RMP facilities over time.

- **Strengths.** The ICIS enforcement data indicate if and when facilities settled RMP-related enforcement actions and the settlement value. The settlement value can serve as a rough proxy for the severity of the violation settled in the enforcement case.
- **Limitations.** Again, the ICIS data only goes back to FY 2007. In addition, the ICIS enforcement dataset that we received does not indicate the specific violation that triggered the enforcement action, and the data also do not indicate how facilities changed their behavior in response to the enforcement action. Also, the enforcement data are only available for enforcement cases that have been settled. Enforcement cases that are still pending are not represented in the data. However, we understand that unsettled enforcement cases represent a small fraction of the total.

DATABASE CONNECTIONS

In addition to reviewing the above datasets, we investigated the ability to link facilities across data sources. The ability to link across data sources is necessary for analyzing the relationships among inspections, enforcement actions, and Risk Management Plans (including accident history). First, we discuss linking ICIS inspection data with ICIS enforcement data. Second, we describe the process for linking from ICIS to RMP Info. Third, we summarize the information available after we link across datasets.

INTERNAL ICIS CONNECTIONS: LINKING INSPECTION AND ENFORCEMENT DATA

The ICIS inspection and enforcement data are stored in separate databases. There are two methods for linking inspection and enforcement data; both methods have advantages and disadvantages. The first method uses the Enforcement Action ID in the inspections database to link to related enforcement actions. However, this approach requires the ICIS user who enters the inspection data to manually set the link between the inspection and the corresponding enforcement action. OECA provided data linked in this manner for FY 2012.[10] IEc verified that the existing linkages were accurate. However, the ICIS data specialists subsequently realized that the data were not complete, due to some missing linkages in the database.

We subsequently received an updated data pull using a different method: linking inspection and enforcement data on the FRS ID. That data pull includes comprehensive inspection and enforcement data for FFY 2007 through FFY 2012. However, because it links on FRS ID (the facility identifier) rather than Enforcement Action ID (which specifically links inspections to their related enforcement action), the results include some enforcement actions that were not triggered by RMP inspections. For example, enforcement actions at some facilities occurred long *before* an RMP inspection was conducted at those same facilities. Removing entries where the enforcement date precedes the inspection date is relatively straightforward. However, this still does not guarantee that all remaining enforcement actions were the direct result of RMP inspections. Overall, this option is more comprehensive than linking on the Enforcement

[10] For this evaluability assessment, we used FY 2012 data to test whether it was possible to link across ICIS inspection data, enforcement data, and RMP Info. If we conducted a full evaluation, we would use all available years of data.

Action ID and is therefore the preferred alternative of the ICIS data specialists. However, neither method is ideal.

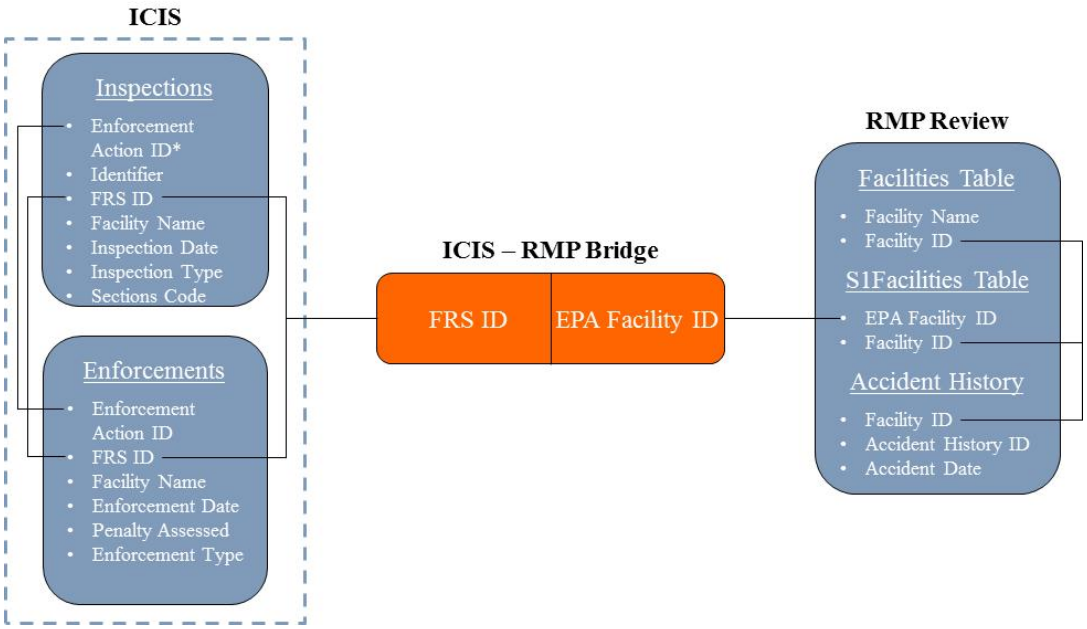
LINKING BETWEEN ICIS AND RMP INFO

To answer the evaluation questions, we need to link a facility's inspection and enforcement data in ICIS with the facility's accident history in RMP Info. However, RMP Info and ICIS use different facility identifiers: RMP Info uses the EPA Facility ID to identify unique facilities, whereas ICIS uses the FRS ID. Linking the two datasets requires a "bridge table" that associates each EPA Facility ID with the corresponding FRS ID. EPA has created a bridge table for roughly 80 percent of facilities in RMP Info. An analysis that uses the current bridge table would include 80 percent of facilities in RMP Info, but would exclude the other 20 percent of facilities that are not in the bridge table. Most of the time and effort in linking the two datasets involves building out the bridge table, an effort that EPA is leading. Once the bridge table has been developed, it is relatively straightforward to link between ICIS and RMP Info using the bridge table.

LINKING ACROSS ICIS INSPECTION DATA, ICIS ENFORCEMENT DATA, AND RMP INFO

Exhibit 4 summarizes the process for linking between the ICIS inspection data and ICIS enforcement data, and for linking between the ICIS data and RMP Info. Linking the data in the manner shown in Exhibit 4 allows us to analyze the relationships among RMP inspections, enforcement actions, and accident history. Most importantly, by linking the data sources, we can compare accident histories at facilities that have and have not been inspected, and identify whether a facility reported a chemical accident within the two years following an RMP inspection.

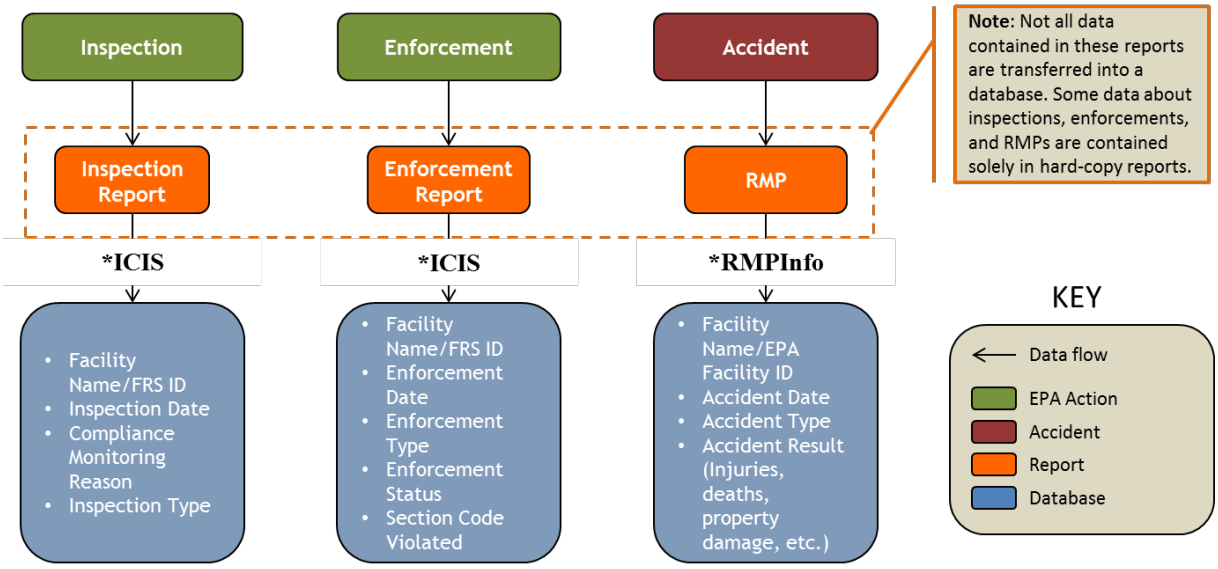
EXHIBIT 4. LINKING INSPECTION, ENFORCEMENT, AND RMP DATA



Notes: The diagram shows selected fields only. It does not show every field included in the data tables.
* The Enforcement Action ID is not always available for inspections that triggered an enforcement action.

Exhibit 5 summarizes the key information available in ICIS and RMP Info that would support answering our evaluation questions. Note that while Exhibit 4 shows the *linkages* across datasets, Exhibit 5 summarizes the *content* of the information contained within the databases that would help us answer the evaluation questions. By linking across databases, we may obtain a basic understanding of a facility's inspection, enforcement, and accident history.

EXHIBIT 5. LINKING INSPECTION, ENFORCEMENT, AND RMP DATA



Notes: *The diagram shows selected fields only. It does not show every field included in the databases.

As shown in Exhibit 5, some information is only contained in paper files and does not get entered into an electronic database. For example, as discussed in the following section, some inspection data are contained solely in hard-copy reports, and are not entered into ICIS. To obtain the data that are not entered into ICIS, such as detailed inspection results, we would need to obtain the paper files from EPA's Regional Offices.

INSPECTION REPORTS

As discussed in the previous section, ICIS contains some – but not all – of the data found in the inspection reports. The inspection reports are stored in paper copy at the EPA Regional Offices. The format of the reports differs across Regions. While the inspection guidance issued by EPA Headquarters includes a report template,[11] none of the Regions currently uses a report format that exactly matches what is in the guidance. For this evaluability assessment, EPA provided IEc with a sample of four inspection reports – one each from Regions 3, 5, 7, and 9. The reports provide detailed descriptions of inspection activities and findings, including potential violations. The reports do not describe resulting enforcement actions, or changes in facility behavior following the inspection.

[11] *Guidance for Conducting Risk Management Program Inspections under Clean Air Act Section 112(r).*

Presumably, enforcement information is contained in separate reports, while information on changes in behavior would be documented during follow-up inspections.[12]

A recent report by EPA's Office of Inspector General (OIG), titled *Improvements Needed in EPA Training and Oversight for Risk Management Program Inspections*, calls into question the consistency and quality of the existing inspection reports. Based on their review of 29 inspection reports for high risk facilities identified by OEM, OIG concluded that, "Generally, inspection reports did not explain the extent to which the inspectors reviewed specific elements of a covered process to determine compliance."[13] According to the OIG report, in June 2011, OEM started a review of inspection reports and identified problems consistent with what OIG identified, including lack of supporting facts and documentation, and basing the inspection findings on the existence or completeness of required documentation rather than actual facility status or conditions. OIG recommended that EPA should develop minimum inspection reporting requirements and a monitoring program to assess the quality of inspections. EPA generally concurred with the recommendations, and has already initiated corrective actions in some cases.[14]

LIST OF HIGH RISK FACILITIES

Neither RMP Info nor any other publicly available database indicates whether a facility was designated as "high risk." This information is considered confidential and is not shared with the public because of security reasons. The RMP high risk list is derived from RMP Offsite Consequence Analysis (OCA) information, and as such, is restricted by law (Public Law 106-40) to "covered persons," which essentially means government employees and contractors with a need for the information. IEc does not have access to the list, and we have not examined its contents.[15] However, EPA provided information about the list, which we describe below.

- **Strengths.** The list of high risk facilities is critical for assessing the effectiveness of EPA's inspection strategy. Knowing which facilities have been designated as "high risk" would allow us to compare inspections and accident histories for high risk and non-high risk facilities. According to OEM, facilities on the high priority list can be linked back to RMP Info data using the EPA Facility ID. OEM indicated that linking to ICIS is more challenging, but is done every year when tallying up inspections.
- **Limitations.** EPA has only been implementing the strategy of designating "high risk" facilities for a few years, which may not be enough time to establish comparisons between high risk and non-high risk inspections and accidents. During this time, the policy has evolved (and continues to evolve). The strategy has been adopted at different times by different EPA Regions and in different sectors. To assess the

[12] As discussed throughout this document, very few facilities have received more than one RMP inspection.
[13] U.S. EPA Office of Inspector General, *Improvements Needed in EPA Training and Oversight for Risk Management Program Inspections*, Report No. 13-P-0178, March 21, 2013.
[14] Ibid.
[15] As an EPA contractor, IEc could go through the process of obtaining the list. This would require us to complete EPA's process for OCA access, which includes study materials and an exam.

strategy, we would need to know the date when each Region adopted the policy and for which sectors, and how the policy has been applied in practice in each context. Given the new and evolving nature of the policy, the small number of facilities inspected each year, and the diversity of EPA Regions and industrial sectors, it would be difficult to make a robust assessment of the strategy at the present time.

STATE DATA

While the RMP Program is administered by EPA, a small number of states have received delegated authority for the program. Programs in delegated states must be at least as stringent as EPA, but they can use their own data systems. Region 4 in particular has several active delegated states; at least two states in the Region maintain their own databases. We explored whether these state databases capture data not stored in ICIS or RMP Info that would help us answer our evaluation questions. The project team held a discussion with OEM's point of contact in Region 4 and representatives from two states in the Region: North Carolina and Florida. Both states provided data to the evaluation team via their Region 4 contact. A brief summary of the state data follows:

- **North Carolina.** IEc reviewed data provided by North Carolina related to chemical accidents and RMP inspections. The data were provided in three Excel files and two summary reports (PDF files). The data show: basic facility information (facility name, location, etc.), whether each facility is subject to RMP regulation, the date an accident was reported (if any), chemicals released, impact of the release (e.g., injuries and evacuations), whether a Notice of Violation and/or penalties were issued as a result of the accident, and trends in chemical accidents from FY 2010 onwards. In addition, North Carolina provided a list of RMP regulated facilities in the state and a list of the facilities inspected under the state's RMP program starting in FY 2010. The North Carolina data identify high risk facilities, in contrast to ICIS and RMP Info, which do not identify high risk facilities. However, in other respects, the North Carolina data face many of the same limitations as the national RMP Program data. For example, most facilities have only received one inspection, and the data do not provide clear indicators of changes in facility behavior.

  In addition to the information described above, the North Carolina dataset includes the ratio of accidents by NAICS code for FY 2011, calculated as the number of accidents divided by the total number of RMP facilities in the specified NAICS code. This analysis could potentially be used to control for the effects of industry sector on accident history.

- **Florida.** The State of Florida provided annual inspection schedules (Excel files), an inspection map (PDF file), annual reports, and inspection and facility data (Microsoft Access database). Of these, the database appears the most relevant for addressing our evaluation questions. The database contains RMP inspection data and information about regulated facilities (e.g., chemicals stored on site). The inspection data include: facility name, inspection date, inspection reason, and inspection results. Additionally, the inspection data indicate whether the inspected facility is a high risk facility. The database was created in 2010 and contains all of the inspection data from that point

onward. Some archived inspection information has been added to the database, but is incomplete for all years prior to 2010. However, the data provided do not include facilities' accident history.

In addition to the information in the database, Florida provided historical inspection reports and follow-up reports for nine facilities that were inspected prior to 2010. The reports contain information on the issues uncovered during the inspection, and describe corrective actions taken by the facility to address the problems. This information could be useful for conducting case studies of changes in facility behavior following RMP inspections.

If EPA chooses to conduct an evaluation of the RMP Program, we could draw on analytical approaches used by the states (e.g., analysis of accident history by NAICS code), and/or supplement the national data with state-level data. However, we would not be able to extrapolate from the North Carolina and Florida data to the national RMP Program, due to differences across states and between the EPA-administered RMP Program and state-delegated programs. Therefore, we would adopt a "case study" approach, looking for insights for those specific states.

QUALITATIVE DATA

Qualitative data could play an important role in supplementing quantitative data and providing additional insights for the RMP Program. Interviews and document reviews, in particular, may provide insight into when and how RMP inspections influence facility behavior. The Paperwork Reduction Act (PRA) requires obtaining an Information Collection Request (ICR) from the Office of Management and Budget (OMB) when asking the same question of more than nine non-federal entities; therefore, EPA would either need to obtain an ICR or limit the number of interviews. In addition, reviewing a representative sample of inspection reports from across a wide range of facilities and Regions would require significant time and resources. It would also require relative consistency in the way that different Regions record inspection results. As discussed above, the OIG report identified areas for improvement regarding the consistency and comprehensiveness of Regional inspection reports.

An alternative to conducting a representative sample of inspection reports would be to conduct in-depth case studies of a smaller number of reports, supplemented with interview data for the same facilities. This approach could provide useful and valuable insights into the role of RMP inspections; however, we would not be able to generalize the results of the case studies to the RMP Program as a whole.

VI. EVALUABILITY ASSESSMENT

Section VI presents our evaluability assessment for Evaluation Questions 1 – 5.[16] This section is organized by evaluation question; for questions where we contemplate a mixed-methods approach, the section is further divided into an evaluability assessment of quantitative and qualitative approaches. To improve the flow of the document, this section presents our high-level findings for the topic-level evaluation questions. The crosswalk table in Appendix A breaks out our detailed findings by sub-question.

1. WHAT EFFECT, IF ANY, DO RMP INSPECTIONS HAVE ON FACILITY BEHAVIOR?

- **Quantitative: *Mostly not evaluable.*** Neither RMP Info nor ICIS provides reliable indicators of changes in facility behavior as a result of inspections. RMP Info presents changes in Risk Management Plans, but it is not possible to attribute these changes to RMP inspections. The RMP database does not provide reliable or detailed information about changes in facilities' safety policies and procedures, or the adoption of safer technologies. We also have concerns about data quality, including the self-reported nature of the data, potential underreporting, and the inability for EPA to directly correct errors in RMP submissions. Also, it is at present possible to link RMP Info and ICIS data for 80 percent of facilities in RMP Info; we would not be able to conduct the analysis for the remaining 20 percent of RMP facilities.

  ICIS contains inspection data and enforcement data, but in separate databases. In some cases, inspections are linked directly to related enforcement actions, but the linkages are not comprehensive; linking all of the inspection and enforcement data is less direct and more prone to error. Importantly, even if we could determine that an enforcement action resulted from an inspection, ICIS would not provide the detailed inspection results or indicators of changes in facility behavior following the inspection. Detailed inspection results are contained in paper files at EPA's Regional Offices, but the quality of the reports is inconsistent, and obtaining and reviewing these documents on a large scale would require significant time and resources.

  The best way to identify changes in facility behavior is to conduct a follow-up inspection. In general, this is not yet possible for the RMP Program; many facilities

[16] Our evaluability assessment focuses on the national RMP Program. Most of the issues raised in this section also apply to the data provided by North Carolina and Florida, but with two notable exceptions: (1) Both states identify "high risk" facilities in their databases, and (2) Florida has rich descriptive information on behavioral changes at facilities that have been inspected more than once. We would not be able to extrapolate findings from North Carolina and Florida to the national RMP Program, but we could potentially conduct case studies with the state-level data to supplement national-level data.

have never been inspected, and very few facilities have received more than one RMP inspection.

- **Qualitative: *Evaluable.*** This question is evaluable with a case study approach. Specifically, we may be able to interview inspectors and facility managers for selected cases, and review the corresponding inspection reports for the selected facilities, to develop an understanding of the role of inspections on facility behavior. Case studies would provide insight into whether the program worked as intended in those specific cases, why or why not, and the mediating factors that influenced outcomes. However, we would not be able to generalize our case study findings to the total population of RMP facilities. This analysis could be conducted for up to nine non-federal facilities without obtaining an ICR; more than nine non-federal facilities would require an ICR and additional resources.

2. WHAT EFFECT, IF ANY, DO RMP INSPECTIONS HAVE ON THE INCIDENCE AND SEVERITY OF CHEMICAL ACCIDENTS AT RMP FACILITIES?

- ***Evaluable.*** RMP Info includes outcome data (accident histories) for facilities that have and have not been inspected. By linking from the inspection data in ICIS to RMP Info, we can separate out facilities that received an RMP inspection from those that have not, and compare accident histories across the two groups. We can also examine the accident histories at inspected facilities before and after an RMP inspection was conducted. Although we would not be able to control for all important confounding factors – and therefore would not be able to assert causality – this approach would tell us whether a relationship exists between RMP inspections and chemical accidents. A limitation is that the ICIS data only go back to FY 2007.

3. WHAT INDICATIONS EXIST, IF ANY, THAT RMP INSPECTIONS HAVE A DETERRENT EFFECT ON RMP FACILITIES THAT HAVE NOT BEEN INSPECTED?

- ***Evaluable with qualitative methods.*** We could prepare case studies to: a) understand the conditions under which inspections may affect behavior at uninspected facilities; b) verify and document examples of general deterrence related to RMP inspections; and c) assess channels of influence. We could ground truth our interview results in the literature on general deterrence. This approach would be subject to the caveats listed for Question 1 above – namely, a small sample size and lack of generalizability.

4. WHAT EFFECT, IF ANY, HAS THE CHANGE IN RMP INSPECTION STRATEGY (TO DESIGNATE SOME FACILITIES AS "HIGH RISK" AND TO DEVOTE MORE INSPECTION RESOURCES TO HIGH-RISK FACILITIES) HAD ON FACILITY BEHAVIOR AND THE INCIDENCE AND SEVERITY OF ACCIDENTS?

- **Quantitative: *Not evaluable.*** Assessing the effect of the RMP inspection strategy on facility behavior is not possible, because RMP Info and ICIS do not provide reliable indicators of changes in facility behavior. Moreover, longitudinal data on the effects of the strategy on accident history are limited, given the short time frame that has

passed since the strategy was implemented. The policy of targeting "high risk" facilities began a few years ago, and EPA guidance in this area continues to evolve. The situation is further complicated by differences in how the Regions have implemented the policy as well as differences across sectors.

- **Qualitative:** ***Partly evaluable.*** If we could obtain the list of "high risk" facilities, we might be able to employ a case study approach. However, lack of generalizability may be even more of a limiting factor for Question 4 than for previous evaluation questions. We would want to separate out "high risk" facilities from other facilities, which would reduce the number of facilities in each category. In addition, the new and evolving nature of the inspection strategy – and differences across Regions and sectors – would further confound efforts to extrapolate lessons from the case studies to the RMP Program as a whole.

5. BASED ON THE RESULTS OF QUESTION 4, SHOULD EPA CONSIDER REFINING ITS APPROACH TO DEFINING "HIGH-RISK" FACILITIES? SHOULD EPA RECONSIDER THE CURRENT ALLOCATION OF INSPECTION RESOURCES BETWEEN HIGH-RISK FACILITIES VS. FACILITIES THAT ARE NOT JUDGED TO BE HIGH RISK?

- ***To be determined by EPA management.*** Question 5 flows directly from Question 4. Because we determined that Question 4 is mostly not evaluable at the present time, we would draw the same conclusion for Question 5. Ultimately, however, the allocation of inspection resources across different types of facilities is an EPA management decision. While a future evaluation might be able to inform management's thinking on this matter, other factors – such as senior management buy-in, resource availability, and potential sensitivities about specific risk-based criteria – are also likely to play a role in the allocation of inspection resources.

VII. PERFORMANCE DATA IMPROVEMENT PLAN

Having identified the data needs, and strengths and limitations of the existing data in the previous sections, Section VII presents the Performance Data Improvement Plan. The plan includes steps that EPA can take to improve the accessibility, quality, and usefulness of outcome data relating to RMP inspections.

The results of the data scoping assessment suggest two broad categories of limitations in the existing data. Each category has different causes and different potential solutions:

- **Limitations based on data quality and accessibility.** The first type of limitation concerns the quality and accessibility of the data that EPA is already collecting. The RMP Program is currently generating outcome data that could be used in an evaluation, but the data are not fully accessible because of how the data are collected or stored. For example, RMP Info contains the accident history of all RMP facilities that have submitted a Risk Management Plan. In theory, EPA should be able to link 100 percent of the facilities in RMP Info to ICIS; separate out the facilities that have received an RMP inspection from those that have not; and compare accident histories across the two groups. However, the bridge table that links RMP Info and ICIS has only been completed for 80 percent of the facilities in RMP Info. Adding more facilities to the bridge table would allow for a more comprehensive analysis, by fully using the data that EPA has already collected for these facilities. Similarly, it should be possible to link all of the inspection records and enforcement records in ICIS, but the structure of the ICIS database makes this difficult. Although there is no "quick fix" for either of these issues, there are steps that EPA can take now to address these challenges, without making any changes in the way it implements the RMP Program.
- **Data limitations based on the characteristics of the program.** The other type of limitation stems from the nature of the RMP Program itself. For example, the absence of follow-up inspection data poses a serious challenge, because the best indication of changes in facility behavior after an inspection is the results of a follow-up inspection. The lack of follow-up inspection data is a result of how the program is implemented – namely, the designated inspection frequency. Given available resources and guidance, EPA aims to inspect approximately five percent of RMP facilities each year. At this rate, it would take about 20 years to inspect 100 percent of facilities once – and even longer to inspect a significant portion of facilities twice. We refer to this as a programmatic limitation because it stems from how the program is implemented, not from the way the data are collected. In other words, even if EPA overhauled its data systems and addressed all of the data quality issued noted throughout this report, it would not change the fact that very few facilities have received more than one RMP inspection. Later in this section, we propose a pilot

study wherein EPA would inspect a relatively small (but statistically robust) subset of RMP facilities at more frequent intervals. Such a study would begin to provide useful longitudinal data within one to two years after implementation commenced.

The rest of Section VII is organized according to the two categories defined above: First, we propose actions that EPA can take to address issues of data quality and accessibility. Then, we propose a statistically valid pilot study to address data issues related to how the program is implemented.

ACTION PLAN TO IMPROVE DATA QUALITY AND ACCESSIBILITY

This section addresses actions that EPA can take to improve data quality and accessibility. We organize the discussion by indicator – Risk Management Plans, inspections and enforcement, accident history, risk status, and general deterrence. For each indicator, we briefly summarize the data needs and the limitations of the existing data, and offer proposed action items to help EPA address the limitations.

A number of the action items would require coordinated action between OEM and OECA – e.g., including more facilities in the bridge table between RMP Info and ICIS, tracking behavioral indicators in the ICIS inspection database, and evaluating the results of EPA's risk based inspection strategy for RMP facilities. Other action items would require ongoing coordination between EPA Headquarters and Regional Offices – e.g., ensuring cross-Regional consistency in inspection reports. With this in mind, we indicate the primary responsible parties for addressing each action item.

Appendix B summarizes the action items in a crosswalk table.

RISK MANAGEMENT PLANS

Initially, the project team thought that changes in facility behavior would be reflected in new or updated Risk Management Plans submitted after an RMP inspection. However, our review of RMP Info raised a number of concerns, including: potential reporting errors; potential underreporting or reporting bias; EPA's inability to correct mistakes that it identifies in the data; attribution challenges relating to the amount of time that may elapse between when an inspection takes place and when the facility (re)submits its Plan; and lack of specificity about how the plans changed. Although some of these challenges are beyond the scope of this Data Improvement Plan,[17] we suggest that OEM consider taking action in two areas: data quality assurance and indicators of behavioral change.

- **Systematically review the RMP data, notify facilities about potential errors, and track and verify that facilities make needed corrections.** OEM is not able to correct errors that it identifies in RMP Info; rather, the Office must notify the reporting facilities and request them to make changes. This is occurring mostly on an

[17] For example, addressing some of these issues would require changes in program requirements or policies – e.g., increasing required filing frequencies (to shorten the time that elapses between an inspection and the submission of an RMP) or increasing EPA's targeting of non-filers (to address potential underreporting). These are policy decisions beyond the purview of this Data Improvement Plan.

ad hoc basis - e.g., when OEM personnel happen upon a suspicious data point. Significant time may elapse between when OEM notices errors and notifies facilities, and when facilities submit their corrected data. OEM should conduct a comprehensive data quality review, assess the overall quality of the data, and make note of any specific data points that appear to be wrong or questionable. The Office should follow up with the facilities that reported the problematic data and record the date when facilities submit corrected data. This would enhance the overall quality of the data and separate out facilities whose data should not be used in an evaluation given data quality concerns. OEM should repeat this exercise at regular intervals to ensure that previously identified errors have been corrected, and to assure the accuracy of newly submitted data.

- **Include new data fields in RMP Info that can reliably capture changes in behavior as reflected in Risk Management Plans.** The scoping assessment confirmed that RMP Info does not track reliable indicators of changes in facility behavior. In addition to the data quality concerns noted in the previous bullet, we found that most of the data fields in RMP Info (except accident history) are fairly general and are expressed as dates rather than specific behaviors. For example, the database includes the fields "Change Completion Date," "Most Recent Change Date," and "Change Management Date."[18] While all three fields appear to relate to changes in facility behavior, none of them indicates what changes actually took place. OEM should consider adding new data fields to RMP Info to understand what actually changed at facilities. For answering the evaluation questions, it would be useful to include fields relating to the behaviors specified in the logic model in Section II, including: updated safety/maintenance/management procedures and hazard analysis; improved public and worker safety and accident prevention/response training; adoption of safer technologies; faster/more effective emergency response; and reduction in quantities of regulated chemicals held on-site. These items could be presented in a drop-down menu. Using a drop-down menu would reduce data entry burden and error, and would facilitate aggregation and analysis of the data. Although this would not prove that inspections caused the changes, it would give OEM a clearer indication about changes that facilities have implemented.

INSPECTIONS AND ENFORCEMENT

The project team initially thought that inspection results would provide information about the type and severity of regulatory violations, if any, discovered during an RMP inspection. We hoped that for inspections resulting in an enforcement action, the enforcement data would indicate how facilities changed their behavior to settle the enforcement case. Linking inspection findings with enforcement data was therefore expected to show how non-compliant facilities changed their behavior in response to an RMP inspection. However, we encountered a number of limitations with the data,

[18] These fields are defined, respectively, as the expected or actual date of completion of all changes resulting from a compliance audit; the date of the most recent change that triggered review or revision of safety information, hazard review, operating or maintenance procedures, or training; and the date of the most recent change that triggered management of change procedures.

including: lack of consistency in how inspections are conducted and recorded; lack of specific information about the nature and severity of violations; lack of information on how facilities changed their behavior to settle an enforcement case; limited longitudinal data in ICIS (only goes back to FY 2007); difficulties linking between ICIS inspection and enforcement data; and the fact that very few facilities have any follow-up inspection data. The action items in this section address all but the latter, which is addressed in the section below on conducting a pilot study.

EPA Headquarters can take a number of steps to improve the quality and accessibility of the inspection and enforcement data:

- **Continue to work with the Regions to ensure the quality and consistency of inspection data.** A recent OIG report found inconsistencies in the quality of inspections and inspection reports.[19] OEM confirmed that although Headquarters has a standard template for RMP inspection reports, no Region is currently following the template; each Region records inspection results somewhat differently. At the same time, IEc's review of a small number of inspection reports provided by OEM confirmed that inspection reports certainly have the potential to convey useful information about the type and severity of violations uncovered during RMP inspections. OEM and OECA should continue to work with the Regional Offices to ensure that inspection results are recorded consistently and comprehensively.
- **Add new fields to the ICIS inspections database to capture additional information about inspection results.** As EPA works to improve the consistency and quality of the hard-copy inspection reports, it should include additional data fields in ICIS to ensure the information is captured systematically. Fields should include: inspection activities conducted, specific violations discovered, severity level of each violation, whether compliance assistance was provided, and any action taken by the facility to come back into compliance during the on-site visit. In addition, EPA should consider including selected items from the Risk Management Program Inspection Checklist, including items in the following areas:[20] hazard assessment, Program 2 Prevention Program, Program 3 Prevention Program, and emergency response program. Following the Inspection Checklist, the data fields should allow one of the following responses for each item: "yes," "no," "partial," or "not applicable." Capturing the data electronically in this way would greatly improve the accessibility of the data by storing all pertinent information in a central database instead of in paper form at the Regional Offices.
- **Add new fields to the ICIS enforcement database to describe actions (beyond settlement value) that facilities take to settle enforcement cases.** The ICIS enforcement database currently includes dates and settlement values, but does not explain what specific actions (beyond paying a penalty) the facilities took to settle the

[19] U.S. EPA Office of Inspector General, *Improvements Needed in EPA Training and Oversight for Risk Management Program Inspections*, Report No. 13-P-0178, March 21, 2013.
[20] *Guidance for Conducting Risk Management Program Inspections under Clean Air Act Section 112(r),* Annex D: Inspection Checklist.

case. If we had more detailed information on how facilities settled their enforcement cases, we would have a better understanding of how these facilities changed their behavior in response to alleged RMP violations and enforcement actions. This could be accomplished by adding a drop-down menu with categories of behavioral changes, such as: new/improved technology; updated policies/procedures; updated training; etc. This would provide useful information for understanding behavioral changes at the facilities without disclosing proprietary or sensitive information.

- **Take steps to ensure that inspections are properly linked to resulting enforcement actions.** We want to use enforcement actions (and the resulting settlement) as a proxy for changes in behavior resulting from RMP inspections. However, inspection and enforcement data exist in two different universes within the ICIS database. As a result, inspections are not automatically associated with the enforcement cases they triggered. The ICIS inspection database includes an Enforcement Action ID that associates inspections with their resulting enforcement actions. However, this field is not populated for all inspections that found violations and presumably triggered enforcement actions. As a result, using the Enforcement Action ID to link inspection and enforcement records yields results that are accurate but incomplete. The alternative is to link on the FRS ID, which yields a larger number of records, but some subset of the linked records includes inspections and enforcements that should *not* be linked for purposes of our analysis.[21]

  EPA should conduct a data quality review of the existing records. Starting with the dataset that was linked on the FRS ID (the more comprehensive method of linking the data), EPA should review the data and screen out matches that should not be included. Each linked pair of inspection and enforcement actions should fall into one of three categories: (1) the match includes an underlying Enforcement Action ID and should be included; (2) the match does not include an Enforcement Action ID, and the enforcement action *precedes* the inspection, and therefore the match should be excluded; or (3) the match does not include an Enforcement Action ID, but the inspection comes before the enforcement action, and therefore it is plausible (but not certain) that the match should be included. EPA should focus on facilities in category (3) and look for any indicators that confirm or refute the hypothesis that the inspection triggered the enforcement action. If EPA determines that the inspection did trigger the enforcement action, it should ensure that the Enforcement Action ID is populated.

  To avoid similar confusion in the future, EPA should enhance ICIS to increase the likelihood that users will populate the Enforcement Action ID. We suspect one of the reasons why more users are not currently using the field is that it is only available in the inspections database, but not in the enforcement database. Therefore, if an inspection triggers an enforcement action a year later, the user not only needs to enter

[21] For example, some facilities have an enforcement action date *before* their RMP inspection date. Because our analysis aims to use enforcement actions (and the resulting settlement) as a proxy for changes in behavior *resulting from* RMP inspections, we would want to exclude this type of match from our analysis.

the data in the enforcement database, but must also remember to go back to the inspection database to populate the Enforcement Action ID. Including the Enforcement Action ID (or an alert/reminder to fill it in) in the enforcement database would help ensure that users remember to populate the Enforcement Action ID.

- **Backfill the ICIS database using pre-FY 2007 inspection reports.** Currently, the ICIS data only go back to FY 2007, which limits us to about six years of longitudinal inspection data. However, EPA has hard-copy inspection reports that precede FY 2007. After making any desired changes to the ICIS database (see previous bullets), EPA should consider backfilling the ICIS inspection data using the information in the hard-copy reports. This would be similar to Florida's efforts to backfill the data in its state RMP database. Although inconsistencies in the written record may not allow for a comprehensive backfilling of all pre-FY 2007 data, this exercise would provide at least some additional data points for conducting a longitudinal analysis.

ACCIDENT HISTORY

EPA would like to understand the effects of inspections on the incidence and severity of chemical accidents. This type of analysis requires reliable accident history data, and the ability to associate a facility's inspection history with its accident history. Both of these requirements can be met to a large extent with the existing data; however, EPA could take further steps to enhance the reliability of the data and the connections across databases:

- **Expand the bridge table between RMP Info and ICIS to include more facilities.** Accident history and inspection history are stored in separate databases (RMP Info and ICIS, respectively). Each database assigns a unique identifier to a facility, but the identifiers are not the same across the two databases. Therefore, EPA needs to link each facility's accident history ID to the facility's inspection ID. To date, EPA has created a "bridge table" that links about 80 percent of facilities in RMP Info to ICIS. OEM and OECA should continue their efforts to expand the bridge table, to add in the 20 percent of facilities that cannot currently be linked. Consider using Global Positioning System (GPS) technology to identify facilities in both databases.[22] Once the bridge table is complete (or as complete as possible), consider adding the FRS ID – the facility identifier used in ICIS – directly to the RMP database. This would accelerate the process of linking facilities across databases, and would spare EPA from having to update the bridge table when new facilities are added to RMP Info.
- **Review accident history and inspection data to establish the chronology of accidents and inspections and to account for duplicate accident records.** Several factors complicate the analysis of accident history. First, inspections may increase the likelihood of facilities *reporting* an accident without changing the underlying probability of *having* an accident. Second, because facilities have up to six months to report an accident, accidents reported shortly after an inspection may have occurred *before* the inspection took place. Third, facilities can make minor changes to their

[22] RMP Info contains facilities' longitude and latitude. ICIS contains the street address, city, state, and zip code. Using GIS software would enable EPA to link based on geography. As a first step, EPA should verify the accuracy of the longitude and latitude coordinates in RMP Info.

accident reports (e.g., time of the accident) without resubmitting their entire RMP; each change results in a new accident record, even though it relates to the same accident. The first limitation (likelihood of *reporting* an accident versus *having* an accident) should be acknowledged, but cannot be "fixed" using the existing data. However, OEM can take steps to address the second and third issues. Regarding whether an accident occurred before or after an RMP inspection, EPA should check the date when the accident occurred (*not* the date when the accident was reported), and compare the date of the accident (in RMP Info) to the date of the inspection (in ICIS). As a second check, EPA should review the "Compliance Monitoring Action Reason" given for the inspection in ICIS; this should indicate whether the inspection resulted from a chemical spill or was conducted as part of the standard inspection schedule. To account for duplicate records, OEM should carefully review the accident history for all facilities and flag the duplicates; the duplicate entries should be set aside when analyzing the total number of accidents and consequences of those accidents (e.g., number of workers injured).

RISK STATUS

To assess the effects of the inspection approach that designates some facilities as "high risk," EPA should compare high risk facilities to facilities that were not designated as high risk. This requires EPA to know each facility's risk status, and whether/how high risk facilities were targeted for inspection. A facility might appear on the list of high risk facilities, but not have been inspected in a given year. Moreover, the nature and intensity of inspections conducted at high risk facilities differ based on the Region, sector, and date of the inspection. For example, some facilities have been informed by EPA inspectors that they have been designated as "high risk" facilities, while other facilities have not been informed of their status. As discussed in Section II, the program logic assumes that high risk facilities respond differently if they know their status. Therefore, EPA needs to understand how different Regions have applied the risk targeting strategy, which facilities have been inspected under the strategy, whether or not they were informed of their status, and what type of inspection they received.

- **Develop a clearer understanding of how different Regions have implemented the inspection strategy, by sector, and how their approach has evolved.** The inspection strategy was adopted by different Regions at different times, and it continues to evolve. EPA Headquarters should collect and analyze information from each of the ten Regional Offices on when and how each Region adopted the strategy, and any changes the Region has made since first adopting the strategy. Consider asking each Regional Office to create a timeline with the date when the strategy was adopted for each sector, dates when the strategy changed, and a brief narrative of how the strategy has evolved. This would enhance EPA Headquarters' understanding of how Regions have implemented the national guidance, and would provide a baseline for assessing the effects of the strategy.
- **Verify that the list of "high risk" facilities can be linked to RMP Info and ICIS.** IEc did not review the list of high risk facilities, which is considered confidential and is not released to the public for security reasons. According to OEM, facilities on the

high priority list can be linked back to RMP Info using the EPA Facility ID. OEM indicated that linking to ICIS is more challenging, but is done every year when tallying up inspections. OEM should verify that it can link from the list of high risk facilities to their associated accident history and inspection data. In addition, EPA should consider adding a new data field to RMP Info to designate the risk status of each facility. This could be a "hidden" data field, which would only be available to EPA users with internal access to the system. At least two states – North Carolina and Florida – designate high risk facilities in their databases.

GENERAL DETERRENCE

As posited in the logic model in Section II, the program theory assumes that RMP inspections have an effect both on inspected facilities (referred to in the literature as "specific deterrence") and facilities that are *not* inspected ("general deterrence"). In the latter case, uninspected facilities may strengthen their knowledge and behavior pertaining to RMP requirements in response to the credible threat of being inspected in the future, and/or based on knowledge gleaned from media reports, neighboring facilities, their "parent" company, or other industry contacts. While EPA has anecdotal reports of general deterrence at RMP facilities, it has not studied the effects of general deterrence in the RMP Program in a systematic way. Such a study would be qualitative, and would allow OSWER and OECA to document tangible examples of general deterrence, thereby demonstrating the program's influence beyond the relatively small number of facilities that are inspected each year. Furthermore, the study would help EPA understand the mediating factors that determine whether and how general deterrence operates in various sectors and for different types of facilities. This knowledge may be useful for refining EPA's inspection strategies and maximizing the impact of limited inspection resources.

- **Conduct a study on general deterrence for the RMP Program.** The study should include a literature review and interviews with inspectors and facilities. The literature review should build on analysis that OECA has conducted in recent years,[23] but tailored to the circumstances of the RMP Program. The interviews should solicit expert opinion on when general deterrence is most effective, and should explore actual examples of general deterrence at RMP facilities. Consider preparing short cases studies for a variety of facilities that demonstrated general deterrence, to better understand and illustrate the conditions under which general deterrence occurs in the RMP Program. EPA should "ground truth" the case study findings in the academic literature, and vice versa. Note that interviewing more than nine non-federal entities would require an ICR.

PILOT STUDY TO ADDRESS DATA ISSUES RELATING TO PROGRAM IMPLEMENTATION

As discussed at the beginning of Section VII, some of the most challenging data issues for the RMP Program are the result of how the program was implemented, rather than

[23] OECA's Research Literature website compiles existing research on this topic under the heading "Understanding and Measuring Specific and General Deterrence." http://epa.gov/oecaerth/resources/reports/compliance/research/

how data were collected. In particular, the lack of follow-up inspections and the relatively small percentage of facilities that are inspected every year (five percent of the universe) create a serious evaluability limitation, because the best way to assess the results of an inspection is to examine data from a follow-up inspection. At this point, too few facilities have received follow-up inspections to employ this strategy in a meaningful way. Similarly, assessing the effects of the strategy of designating some facilities as "high risk" is hindered by the new and evolving nature of the strategy, and the even smaller number of high risk facilities that are inspected each year. Under the current inspection frequencies, it would take many years before EPA would have sufficient longitudinal data – including follow-up inspection data and post-inspection accident history data for high risk facilities – to conduct these key analyses. However, EPA may not want to wait years or even decades to evaluate the program.

In this section, we raise the idea of conducting a statistically valid pilot study that would generate longitudinal data in a shorter timeframe by targeting a subset of facilities for more frequent inspections. Targeting a subset of facilities for more frequent inspection over a period of two or three years would generate longitudinal inspection data, showing how facilities changed their behavior after receiving two or three RMP inspections.

The strategy of targeting a subset of facilities for repeated inspections is different from the inspection strategy currently used by the RMP Program. By increasing the frequency at which facilities in this targeted group are inspected, the context under which inspections are conducted for those facilities would be different than the general RMP facility population (i.e., those facilities would face different threats of inspection and possibly behave differently than under the "usual" RMP inspection program). It would therefore be difficult to extrapolate findings from the pilot study to the general facility population because the pilot study target group and the general facility population group would face different threats of inspection. However, the approach suggested below would generate data to help answer the question of how inspections affect facility behavior and chemical safety.

Designing the methodology for a statistically valid pilot study is well beyond the scope of this Data Improvement Plan; however, below we raise some topics and questions for EPA's consideration.

QUESTIONS AND CONSIDERATIONS FOR A STATISTICALLY-VALID PILOT STUDY

Conducting a statistically valid pilot study with a subset of facilities would generate data on the results of follow-up inspections and would facilitate comparing targeted facilities to non-targeted facilities. However, such a study would require significant effort and resources. Before deciding whether to undertake this type of study, EPA should consider the following issues:

- **What does EPA hope to learn from this study?** The answer to this question would inform the study design. For example, if EPA is mostly interested in collecting longitudinal data, it may want to randomly assign RMP facilities to the target group. However, if EPA's primary goal is to test the effects of its risk-based inspection strategy, it should be sure to include high risk facilities in the target group.

Furthermore, simply knowing that they are in the target group may change facility behavior, compared to a "typical" facility that is not anticipating a follow-up inspection in the foreseeable future. Therefore, EPA would need to decide whether it should disclose each facility's status to the facility. Defining the purpose of the study and developing a clear hypothesis upfront would help answer the remaining questions in this section.

- **How should facilities be assigned to the target group?** As discussed in the previous bullet, EPA could either select facilities at random (high risk and other facilities), or it could assign only high risk facilities to the target group. Another option would be a hybrid approach that stratifies the target group by high risk and other facilities, or sub-divides the group into two sub-groups: targeted high risk facilities and other targeted facilities. Related questions include:
  - Should EPA select facilities for the target group that have already had at least one RMP inspection to fully leverage existing inspection data or should it start fresh with facilities that have never been inspected?
  - Should selected facilities be informed of their status, or even be told the fact that they have been selected to participate in a pilot study?
  - Should the sample be stratified by Region, state, sector, facility size, and/or accident history?
  - Should EPA focus on a single Region for this pilot study – and, if so, which Region?
- **What is the right sample size?** The sample size should be manageable given available resources, but large enough to detect differences between groups. Whether the sample is "large enough" depends, in part, on the magnitude of the difference between groups. However, this would be difficult to predict in advance. It would also depend on how many sub-groups (e.g., sector, state, etc.) EPA wants to include when drawing the sample. After determining the basic study objectives, EPA should work closely with its evaluation experts (e.g., CPA) and statistical experts to design the sample frame and determine the appropriate sample size.
- **How would EPA collect information for facilities outside of the target group?** This group would include facilities that receive a regular inspection frequency. By definition, their inspection frequencies would be limited, and longitudinal data may not be available for these facilities. EPA should decide if it is willing to accept this limitation, or if it would try to obtain data for facilities outside the target group. One option would be to send Information Request Letters (IRLs) to all RMP-registered facilities asking them a series of questions that aim to determine their compliance with RMP requirements. Note that an ICR would be required to ask the same questions of more than nine non-federal entities.
- **How would EPA control for confounding factors?** As discussed throughout this report, myriad factors beyond RMP inspections may affect compliance at RMP facilities. EPA should identify what it considers to be the most serious confounding

factors, and should take steps to control for these factors to the extent possible and feasible. Although EPA does not have data for all confounding factors, it does have data for industry sector (NAICS) and other facility information that may influence a facility's compliance with RMP regulations. Consider running a regression analysis using these factors as control variables.

- **Would EPA supplement the statistical analysis with qualitative data?** EPA should consider supplementing the results by conducting interviews with selected facilities and inspectors. Interview data would help EPA interpret the findings and tell the story behind the numbers. Conducting interviews with more than nine non-federal facilities would require an ICR. Another option, which would not require an ICR, would be to choose fewer than nine facilities in a very selective way – for example, talk to facilities that appear to be "skewing" the results of the analysis to gain insight into what is happening at those facilities.

APPENDIX A. CROSSWALK OF EVALUATION QUESTIONS, DATA SOURCES, AND POTENTIAL METHODS

EVALUATION QUESTION	POSSIBLE APPROACHES TO ANSWERING QUESTION	DATA NEEDED TO ANSWER THE QUESTION	POSSIBLE DATA SOURCES	DATA USES	DATA LIMITATIONS AND CONFOUNDING FACTORS	EVALUABILITY ASSESSMENT
1. WHAT EFFECT, IF ANY, DO RMP INSPECTIONS HAVE ON FACILITY BEHAVIOR?						
A. Do facilities re-submit (update) their Risk Management Plan following an RMP inspection? If yes, what changes do they make?	• **Option 1:** For facilities that submitted an RMP before *and* after an inspection, document changes in the RMP • **Option 2:** Conduct interviews with facility owners and/or inspectors to understand what changes facilities make, and why	**Option 1:** • Date of RMP inspection • Dates of any/all RMP submissions by the inspected facility • Content of each RMP **Option 2:** • Interview data	**Option 1:** • RMP Info • ICIS **Option 2:** • Interviews	**Option 1:** • Link inspection and RMP Info data using the "bridge table"/ FRS numbers (this has been done for ~80% of RMP facilities) to identify date of RMP inspection • Compare the inspection date to the date of the most recently submitted RMP • Review RMPs ("before" and "after" the RMP inspection) to identify changes in content **Option 2:** • Summarize/ synthesize interview data; develop case studies on the effects of inspections on facility behavior	**Option 1:** • The standardized data fields in RMP Info are not reliable indicators of changes in facility behavior. The fields do not need to be updated following an inspection. Conversely, facilities may update the fields even if they are not inspected. • The data fields reveal the date when an event occurred, but does not describe the specific changes that were made. • More information may be available in the RMP document itself, but would require resource-intensive review; sampling would be required. • Not possible to link inspection data and RMP data for ~20% of facilities **Option 2:** • Unable to generalize case study results to the full population • ICR required to speak with more than 9 non-federal facilities or inspectors **General limitations:** • The best indicator of changes in facility behavior is reports from *follow-up inspections*; however, most RMP facilities that have been inspected, have only been	**Option 1: *Mostly not evaluable.*** Can compare the inspection date to the date of the most recent RMP, but this would not tell us anything about changes in behavior. RMP Info does not provide reliable information on changes in facility behavior following an inspection. More detailed information may be available in the text of the RMP Plan, but this would require resource-intensive document review and would likely need to be case-based rather than a representative sample. **Option 2: *Evaluable***. Would need to obtain buy-in from Regions and inspectors, and identify inspectors and facility managers who are willing to speak with us. Given the small sample and potential selection bias (e.g., only "good actors" may want to talk to us), results would not be generalizable. However, this approach could provide meaningful insight into program dynamics and pathways of influence. **Note: Because we cannot control for other types of inspections or the quality of inspections and inspectors, we would not be able to prove causality (i.e., we could not say that the RMP Program**

EVALUATION QUESTION	POSSIBLE APPROACHES TO ANSWERING QUESTION	DATA NEEDED TO ANSWER THE QUESTION	POSSIBLE DATA SOURCES	DATA USES	DATA LIMITATIONS AND CONFOUNDING FACTORS	EVALUABILITY ASSESSMENT
					inspected once – therefore, no follow-up inspection results • Unable to control for the effects of other types of inspections at RMP facilities (e.g., OSHA) • Unable to control for inspector/inspection quality	**caused these changes to occur). Whether this is an acceptable limitation depends on the purpose of the evaluation and the required threshold of evidence.**
B. How, if at all, do facilities change their safety practices and procedures following an RMP inspection?	• **Option 1:** For facilities that submitted an RMP before *and* after an inspection, review the pre-inspection and post-inspection RMP to identify changes in procedures and practices • **Option 2:** Review inspection results and enforcement actions to understand what issues were identified and resolved as a result of RMP inspections • **Option 3:** Conduct interviews with facility owners and/or inspectors to understand what changes facilities make, and why	**Option 1:** • Date of RMP inspection • Safety practices/ procedures as documented in the RMP *before* the inspection was conducted • Safety practices/ procedures as documented in the RMP *after* the inspection was conducted **Option 2:** • Issues identified during RMP inspections • Settlements of enforcement actions **Option 3:** • Interview data	**Option 1:** • RMP Info • ICIS **Option 2:** • Inspection reports • Enforcement reports • State databases **Option 3:** • Interviews	**Option 1:** • Link inspection and RMP Info data using the "bridge table" • Review changes in policies and procedures in RMPs submitted *before* and *after* inspection **Option 2:** • Review findings of violations (number and type) • Analyze enforcement data to understand the nature and severity of violations that were settled (may serve as a rough proxy for changes in behavior) **Option 3:** • Summarize/ synthesize interview data; develop case studies on the effects of inspections on facility behavior	**Option 1:** • RMP Info is not a reliable data source for understanding changes in facility behavior following inspection (see above) **Option 2:** • Lack of follow-up RMP inspection data (see above) • ICIS data only goes back to FY 2007, effectively limiting our study period to 6 years if we conduct an evaluation in 2013 • Limitations linking ICIS inspection and enforcement data • Enforcement data provide some sense of the magnitude of the violation (e.g., settlement amount), but do not provide detailed information on changes in facility behavior • Inspection reports provide additional details, but are in hard copy only, and would need to be obtained from the Regions. Quality of the reports is inconsistent. Resource and logistical constraints would require sampling	**Option 1: *Not evaluable*** (see above) **Option 2: *Mostly not evaluable.*** Enforcement data (e.g., settlement date and amount) may be a rough proxy for changes in behavior. However, the ICIS data that IEc has received do not include information about the specific nature of the violation or specific actions taken by the facility to address the violation. Inspection reports contain additional details, but quality of reports is even, and resource and logistical constraints would require sampling **Option 3: *Evaluable***. **Note: See above for general limitations.**

EVALUATION QUESTION	POSSIBLE APPROACHES TO ANSWERING QUESTION	DATA NEEDED TO ANSWER THE QUESTION	POSSIBLE DATA SOURCES	DATA USES	DATA LIMITATIONS AND CONFOUNDING FACTORS	EVALUABILITY ASSESSMENT
					• Unable to generalize findings from delegated states to the national RMP Program **Option 3:** • See above for interview-related caveats (non-generalizable, resource-intensive) and confounding factors	
C. Do facilities adopt safer technologies and/or reduce the quantity of regulated chemicals held on-site following an RMP inspection? If yes, what changes do they make?	• **Option 1:** For facilities that submitted an RMP before *and* after an inspection, review the pre-inspection and post-inspection RMP to identify adoption of new technologies and/or changes in the quantity of regulated chemicals held on-site • **Option 2:** Review inspection results and enforcement actions • **Option 3:** Conduct interviews with facility owners and/or inspectors to understand what changes facilities make, and why	**Option 1:** • Date of RMP inspection • Quantity of chemicals held on-site *before* the inspection was conducted • Quantity of chemicals held on-site *after* the inspection was conducted • Technologies used *before* the inspection as conducted • Technologies used *after* the inspection was conducted **Option 2:** • May be able to glean information from inspection and enforcement data **Option 3:** • Interview data	**Option 1:** • RMP Info • ICIS **Option 2:** • Inspection data • Enforcement data • State databases? **Option 3:** • Interviews	• See above	• See above • May be difficult to characterize technologies used by a facility *before* and *after* inspections were conducted	**Option 1: *Not evaluable*** – see above. **Option 2: *Mostly not evaluable*** – see above. **Option 3: *Evaluable*** - see above.

EVALUATION QUESTION	POSSIBLE APPROACHES TO ANSWERING QUESTION	DATA NEEDED TO ANSWER THE QUESTION	POSSIBLE DATA SOURCES	DATA USES	DATA LIMITATIONS AND CONFOUNDING FACTORS	EVALUABILITY ASSESSMENT
2. WHAT EFFECT, IF ANY, DO RMP INSPECTIONS HAVE ON THE INCIDENCE AND SEVERITY OF CHEMICAL ACCIDENTS AT RMP FACILITIES?						
A. What portion of facilities that have received an RMP inspection report a chemical accident within two years following the inspection?	• Calculate the portion of inspected facilities that report an accident following an RMP inspection	• Total number of inspected facilities • Number of inspected facilities reporting an accident • Date of RMP inspection • Accident date	• RMP Info (accident history) • ICIS inspection data • State databases	• Identify all facilities that received an RMP inspection (ICIS) • Link inspection and RMP Info data using the "bridge table" • Query the accident history of inspected facilities (RMP Info) • Verify that the date of the accident was *after* the RMP inspection • Divide the number of inspected facilities reporting an accident (post-inspection) by the total number of inspected facilities	• Not possible to link inspection data and RMP data for ~20% of facilities • Inspections may increase the likelihood of facilities reporting an accident. May not be able to discern if trends in accident data are due to actual accidents vs. changes in reporting • Facilities have up to 6 months to report an accident. If an inspection falls within that 6-month window, it may be reported *after* the inspection even if it happened *before* the inspection • RMP Info may record multiple entries for an "accident" each time facilities update minor details about the accident (e.g., the time of day the accident occurred). Need to manually review the records to ensure that we are not double counting • Unable to control for confounding factors, e.g. other types of inspections, and inspector/inspection quality Unable to generalize findings from delegated states to the national RMP Program	***Evaluable,*** *but the need to correct for reporting anomalies and potential double counting (see previous column) may limit the number of facilities that we could review.* **Note: confounding factors – see above; also, would not be able to control for the effects of inspections on *reporting* behavior (as opposed to actual accidents)**
B. How do the incidence and severity of reported accidents at inspected	• Compare the portion of inspected facilities reporting an accident (post-inspection) to the	• Date of RMP inspection (for inspected facilities only) • Incidence and	• RMP Info (accident history) • ICIS inspection data	• Link RMP inspection and accident history data in 2A • Divide the number of inspected facilities	• Same as 2A above	***Evaluable, given the caveats noted above.*** May want to select a cutoff date for our analysis (e.g., limit the "look-back period" for uninspected

EVALUATION QUESTION	POSSIBLE APPROACHES TO ANSWERING QUESTION	DATA NEEDED TO ANSWER THE QUESTION	POSSIBLE DATA SOURCES	DATA USES	DATA LIMITATIONS AND CONFOUNDING FACTORS	EVALUABILITY ASSESSMENT
facilities (post-inspection) compare to the accident history at RMP facilities that have never been inspected?	portion of uninspected facilities reporting an accident • Weight results by severity	severity of chemical accidents at inspected facilities (post-inspection) • Incidence and severity of chemical accidents at uninspected facilities	• State databases	reporting an accident (post-inspection) by the total number of inspected facilities • Divide the number of uninspected facilities reporting an accident by the total number of uninspected facilities		facilities to the past 2 years).
3. WHAT INDICATIONS EXIST, IF ANY, THAT RMP INSPECTIONS HAVE A DETERRENT EFFECT ON RMP FACILITIES THAT HAVE NOT BEEN INSPECTED?						
	Option 1: • Interview facilities, trade association representatives, and/or inspectors to obtain insights into the effect of inspections on uninspected facilities **Option 2:** • Review the literature on general deterrence, and attempt to apply lessons to RMP inspections	**Option 1:** • Interview data **Option 2:** • Journal articles, previous evaluations, etc.	**Option 1:** • Interviews **Option 2:** • OECA and other literature on general deterrence • Previous evaluations of RMP Program and/or other inspection programs	**Option 1:** • Prepare case studies of selected facilities to understand: a) the conditions under which inspections may affect uninspected facilities; b) verify/ document examples of general deterrence related to RMP inspections; and c) assess channels of influence **Option 2:** • Summarize the current literature on inspections and general deterrence, and its relevance to the RMP Program	**Option 1:** • Qualitative, case-based approach → limited sample size, cannot generalize findings • Resource and logistical constraints for scheduling interviews • ICR requirements (number of interviews) – would need to obtain an ICR or limit the number of interviews with non-federal facilities to 9 or fewer **Option 2:** • May not be any literature on general deterrence specific to the RMP Program; may be difficult to tailor findings to the program	**Option 1: *Evaluable.*** **Option 2: *Evaluable if we can "ground truth" findings with RMP facilities; suggest combining with Option 1.*** **Note: Both options are qualitative; this question is not evaluable using a quantitative approach.**

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4. WHAT EFFECT, IF ANY, HAS THE CHANGE IN RMP INSPECTION STRATEGY (TO DESIGNATE SOME FACILITIES AS "HIGH RISK" AND TO DEVOTE MORE INSPECTION RESOURCES TO HIGH-RISK FACILITIES) HAD ON FACILITY BEHAVIOR AND THE INCIDENCE AND SEVERITY OF ACCIDENTS?						
A. How, if at all, do inspection results (i.e., the number and type of violations, and enforcement actions) differ between high-risk facilities compared to facilities that are not judged to be high risk?	**Option 1:** • Analyze inspection and enforcement data, comparing high-risk facilities to facilities not judged to be high risk **Option 2:** • Conduct interviews with inspectors	**Option 1:** • Facility risk classification • Inspection data for high-risk facilities • Inspection data for facilities not judged to be high risk • Enforcement data for high-risk facilities • Enforcement data for facilities not judged to be high risk **Option 2:** • Interview data	**Option 1:** • List of high-risk facilities • ICIS • Inspection reports • State databases **Option 2:** • Interviews	**Option 1:** • Link inspection and enforcement data in ICIS • Analyze enforcement data to understand the nature and severity of violations that were settled • Review inspection reports and describe inspection results • Compare results for high-risk facilities and facilities not judged to be high risk **Option 2:** • Summarize interview data	**Option 1:** • RMP Info and ICIS do not track risk status. The list of high-risk facilities is considered sensitive and is not publicly available, but could be shared with an EPA contractor after the contractor obtains OCA clearance. • Difficult to link inspection and enforcement data in ICIS • Difficult to control for differences between high-risk and other facilities that may be correlated with inspection results (e.g., accident history) • Enforcement data provide some sense of the magnitude of violations (e.g., settlement amount), but limited detail • Inspection reports in hard copy only, would need to be obtained from Regions. Uneven quality. Would require sampling • One state database specifies high-risk facilities and facilities not judged to be high risk; however, not generalizable **Option 2:** • Interview-related limitations (not generalizable, response bias, resource constraints, ICR requirements)	**Option 1: *Not evaluable.*** The "high risk" designation was adopted by different Regions/sectors at different times, starting a few years ago, and the strategy continues to evolve. The list of high-risk facilities is not public, but could be shared with an EPA contractor after the contractor obtains OCA clearance. One state database (FL) specifies risk designation; may be able to conduct limited analysis for this state (case study approach) **Option 2: *Partly evaluable, if we know which facilities were targeted as "high risk."*** Small sample size may be even more of a limiting factor for this question than for other questions, since we are trying to compare two different types of facilities (high risk vs. other), and cannot hold other factors constant due to differences in how and when Regions adopted the strategy

EVALUATION QUESTION	POSSIBLE APPROACHES TO ANSWERING QUESTION	DATA NEEDED TO ANSWER THE QUESTION	POSSIBLE DATA SOURCES	DATA USES	DATA LIMITATIONS AND CONFOUNDING FACTORS	EVALUABILITY ASSESSMENT
B. How, if at all, have inspection results changed overall and by type of facility (high-risk facilities vs. facilities that are not judged to be high risk) since the strategy was adopted?	• Same as Option 1 above, plus look at changes over time	• Same as Option 1 above, plus the date the strategy was adopted (may differ across Regions and sectors) and date of inspection (i.e., was the inspection carried out before or after the strategy was adopted?)	• Same as Option 1 above, plus Regions would need to verify the dates the strategy was adopted	• Same as Option 1 above, plus analyze changes over time overall and for each type of facility	• Same as Option 1 above, plus may be difficult to adjust for differences in when the strategy was adopted for different Regions and sectors • The strategy continues to evolve; may be difficult to select a firm cutoff date for the analysis	***Not evaluable.*** The "high risk" designation was adopted by different Regions/sectors at different times, starting a few years ago, and the strategy continues to evolve. Furthermore, limited longitudinal data (post-adoption of the strategy) exists at present.
C. How, if at all, do the incidence and severity of chemical accidents (post-inspection) vary between high-risk facilities compared to facilities that are not judged to be high risk?	**Option 1:** • Compare accident history for high-risk facilities to facilities not judged to be high risk • Attempt to weight accident history by severity **Option 2:** • Conduct interviews with inspectors	**Option 1:** • Facility risk classification • Incidence and severity of chemical accidents at high-risk facilities • Incidence and severity of chemical accidents at facilities not judged to be high risk **Option 2:** • Interview data	**Option 1:** • List of high-risk facilities • RMP Info (accident history) • State databases **Option 2:** • Interviews	**Option 1:** • Divide the number of high-risk facilities reporting an accident by the total number of high-risk facilities • Divide the number of non- high-risk facilities reporting an accident by total number of facilities that are not judged to be high risk **Option 2:** • Summarize interview results	**Option 1:** • RMP Info and ICIS do not track risk status. The list of high-risk facilities is considered sensitive and is not publicly available, but could be shared with an EPA contractor after the contractor obtains OCA clearance. • Difficult to control for differences between high-risk and other facilities that may be correlated with inspection results (e.g., accident history) • Not possible to link inspection data and RMP data for ~20% of facilities • Inspections may increase the likelihood of facilities reporting an accident. May not be able to discern if trends in accident data are due to actual accidents vs. changes in reporting • Facilities have up to 6 months to report an accident. If an inspection falls within that 6-	**Option 1: *Not evaluable*** – The "high risk" designation was adopted by different Regions/sectors at different times, starting a few years ago, and the strategy continues to evolve. Also, would not be able to control for the confounding factors listed in previous column **Option 2: *Partly evaluable, if we know which facilities were targeted as "high risk."*** Small sample size may be even more of a limiting factor for this question than for other questions, since we are trying to compare two different types of facilities (high risk vs. other), and cannot hold other factors constant due to differences in how and when Regions adopted the strategy

EVALUATION QUESTION	POSSIBLE APPROACHES TO ANSWERING QUESTION	DATA NEEDED TO ANSWER THE QUESTION	POSSIBLE DATA SOURCES	DATA USES	DATA LIMITATIONS AND CONFOUNDING FACTORS	EVALUABILITY ASSESSMENT
					month window, it may be reported *after* the inspection even if it happened *before* the inspection • RMP Info may record multiple entries for an "accident" each time facilities update minor details about the accident (e.g., the time of day the accident occurred). Need to manually review the records to ensure that we are not double counting • Unable to control for confounding factors, e.g. other types of inspections, and inspector/inspection quality Unable to generalize findings from delegated states to the national RMP Program • One state database specifies high-risk facilities and facilities not judged to be high risk; however, not generalizable **Option 2:** • Interview-related limitations (not generalizable, response bias, resource constraints, ICR requirements)	
D. How, if at all, have the incidence and severity of accidents changed (overall and by facility type) since the strategy was adopted?	• Same as Option 1 above, plus look at changes within groups over time	• Same as Option 1 above, plus date the strategy was adopted (may differ across regions and sectors) and date of accident	• Same as Option 1 above, plus Regions would need to verify date the strategy was adopted	• Same as Option 1 above, plus analyze changes over time, overall and for each type of facility	• Same as Option 1 above, plus may be difficult to adjust for differences in when the strategy was adopted for different Regions /sectors • The strategy continues to evolve; may be difficult to select a firm cutoff date for the analysis	***Not evaluable*** – see C1 (option 1) above.

EVALUATION QUESTION	POSSIBLE APPROACHES TO ANSWERING QUESTION	DATA NEEDED TO ANSWER THE QUESTION	POSSIBLE DATA SOURCES	DATA USES	DATA LIMITATIONS AND CONFOUNDING FACTORS	EVALUABILITY ASSESSMENT
5. BASED ON THE RESULTS OF QUESTION 4, SHOULD EPA CONSIDER REFINING ITS APPROACH TO DEFINING "HIGH-RISK" FACILITIES? SHOULD EPA RECONSIDER THE CURRENT ALLOCATION OF INSPECTION RESOURCES BETWEEN HIGH-RISK FACILITIES VS. FACILITIES THAT ARE NOT JUDGED TO BE HIGH RISK?						
	• Opinion/judgment based on answers to question 4	• See above (question 4)	• See above (question 4)	• See above (question 4)	• See above (question 4) • Potential lack of senior management buy-in for the recommendations • Resource availability • Political sensitivities regarding the ways in which risk criteria are defined and applied	***To be determined by EPA management.***

APPENDIX B. DATA IMPROVEMENT ACTION PLAN

NO.	INDICATOR	DATA NEEDS	DATA SOURCES	DATA GAPS	ACTION ITEM	RESPONSIBLE PARTIES
1	Changes in Risk Management Plans	Changes in safety procedures, policies, training, or technologies	RMP Info	Data quality is questionable: facilities self-report their data, and EPA cannot correct errors, but must ask the facility to make corrections	Systematically review the RMP data, notify facilities about potential errors, and track and verify that facilities make needed corrections	OEM
2	Changes in Risk Management Plans	Changes in safety procedures, policies, training, or technologies	RMP Info	Most of the relevant fields include the date a change was made, but do not describe what changed in any detail	Include new data fields in RMP Info that can reliably capture changes in behavior as reflected in Risk Management Plans	OEM
3	Changes in facility behavior following an RMP inspection	Inspection results *(necessary but not sufficient for understanding changes in behavior)*	Inspection reports	Lack of consistency in how inspections are conducted and recorded	Continue to work with EPA's Regional Offices to ensure the quality and consistency of inspection data	OECA and OEM, working with EPA's regional offices
4	Changes in facility behavior following an RMP inspection	Inspection results *(necessary but not sufficient for understanding changes in behavior)*	ICIS inspection database	Lack of specificity about the nature and severity of the violations	Add new fields to the ICIS inspections database to capture additional information about inspection results	OECA, working with OSWER and other EPA agencies that report into ICIS
5	Changes in facility behavior following an RMP inspection	Corrective measures taken to settle enforcement actions that resulted from an RMP inspection	ICIS enforcement database	Lack of information on how facilities changed their behavior to settle an enforcement case	Add new fields to the ICIS enforcement database to describe actions (beyond settlement value) that facilities take to settle enforcement cases	OECA, working with OSWER and other EPA agencies that report into ICIS
6	Changes in facility behavior following an RMP inspection	Linking ICIS inspection data to ICIS enforcement data	ICIS inspection database ICIS enforcement database	Difficulties linking between ICIS inspection data and ICIS enforcement data due to lack of consistent use of the Enforcement Action ID	Take steps to ensure that inspections are properly linked to resulting enforcement actions	OECA
7	Changes in facility behavior following an RMP inspection	Follow-up inspection data	ICIS inspection database	ICIS only goes back to FY 2007; data for inspections prior to FY07 not included in database	Backfill the ICIS database using pre-FY 2007 inspection reports	OECA, in coordination with EPA's Regional Offices
8	Accident history at facilities with and without an RMP inspection	Linking facility accident history to inspection data	RMP Info ICIS	RMP Info – ICIS bridge table not complete for 20% of facilities in RMP Info	Expand the bridge table between RMP Info and ICIS to include more facilities	OECA OEM

NO.	INDICATOR	DATA NEEDS	DATA SOURCES	DATA GAPS	ACTION ITEM	RESPONSIBLE PARTIES
9	Accident history at facilities with and without an RMP inspection	Reliable accident history record	RMP Info	A facility may have multiple records for the same accident (e.g., if the facility updates the date)	Review accident history and inspection data to establish the chronology of inspections and accidents and to account for duplicate accident records	OEM
10	Comparison of high risk facilities to other facilities	Facility status (high risk or not)	List of high risk facilities Interviews/online questionnaire	The inspection strategy has been implemented at different times, and in different ways, in different Regions and sectors	Develop a clearer understanding of how different Regions have implemented the targeting strategy, by sector, and how their approach has evolved	OECA, with cooperation from EPA's Regional Offices
11	Comparison of high risk facilities to other facilities	Inspection history and accident history, by facility type (high risk or not high risk)	List of high risk facilities RMP Info ICIS inspection database	Neither ICIS nor RMP Info indicate if a facility is "high risk" List of high risk facilities not publicly available	Verify that the list of "high risk" facilities can be linked to RMP Info and ICIS	OEM OECA
12	Effects of RMP inspections on facilities that are not inspected	Anecdotal examples, supplemented with a review of the literature on general deterrence	Interviews Literature review	EPA has not undertaken a systematic study of general deterrence specifically for RMP-regulated facilities	Conduct a study on general deterrence for the RMP Program	OEM OECA