FRMAC Ingestion Pathway Exercise Planning Document

Updated: February 4, 2016

Table of Contents

Introduction

This document is intended to provide an overview of FRMAC support for state and licensee planners of ingestion pathway exercises (IPXs). Planners should use this document to gain an understanding of the level of support FRMAC will be providing and the associated state/licensee responsibilities for this support. FRMAC support is intended to augment and assist **offsite response organizations (OROs)** in their demonstration of Federal Emergency Management Agency (FEMA) objectives. Examples of FRMAC products and services are provided here along with supporting documents developed based upon FRMAC best practices.

FAQs

Q *How much does FRMAC charge for their services?*

A There is no charge to states or licensees for FRMAC services.

Q *How soon do we need to contact the Department of Energy to request FRMAC support for our exercise?*

A It is preferred that planners contact DOE at least 18 months to 2 years prior to the graded exercise.

Q *How are DOE and FRMAC related?*

A DOE is responsible for the management of FRMAC during day-to-day operations and to supply resources (personnel and equipment) for the on-call response teams as well as IPX exercises.

Q *How many people will you be sending to our event?*

A At the very least one assessment scientist will be sent to the outreach and graded exercise. Attendance will scale based on the need of the planners and available federal funding.

Q *Can we customize the services provided in the FRMAC support table?*

A Customization is a possibility depending upon availability of funding and planner needs.

Q *How will we share materials during the planning process?*

A Materials can be sent via email or posted CMweb, a site used by FRMAC staff during radiological events and for planning purposes. Access may be granted during the planning process.

Q *Can FRMAC send someone down for our regional planning meeting?*

A It is not common for FRMAC to physically support regional planning meetings. However, if funding is available it may be possible.

Q *We have always made our own products. Do we have to use FRMAC products?*

A No, you do not have to use FRMAC products. However, NUREG-0645, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," and the National Response Framework (NRF) outline requirements for federal support during NPP emergencies. Specifically, NUREG-0654 indicates that emergency preparedness plans include support from DOE and other federal agency assets. Furthermore, the NRF, in the Radiological/Nuclear Incident Annex, outlines requirements of the federal government in their support of NPP disasters. It is therefore encouraged that planners include realistic federal interactions so players can "train as they fight and fight as they train."

Q *Can FRMAC products be provided without technical support via in-person briefings or participation of the CM Home Team?*

A DOE does not support this concept. In keeping with lessons learned and best practices of FRMAC IPX support, FRMAC products will not be provided for outreaches, drills or graded exercises where a FRMAC representative is not available. This assumes that players have received an introduction to FRMAC products during an outreach prior to the drill.

Q *What do we need to give you to get the technical process started?*

A At a minimum, technical planners must provide the following: the wind speed and direction, radiological source term, and specifications for samples. See the text in Section 4 for more information.

Q We need to impact counties which are separated by a significant distance or are positioned in opposite wind directions from the plant. Can FRMAC provide data products to support this?

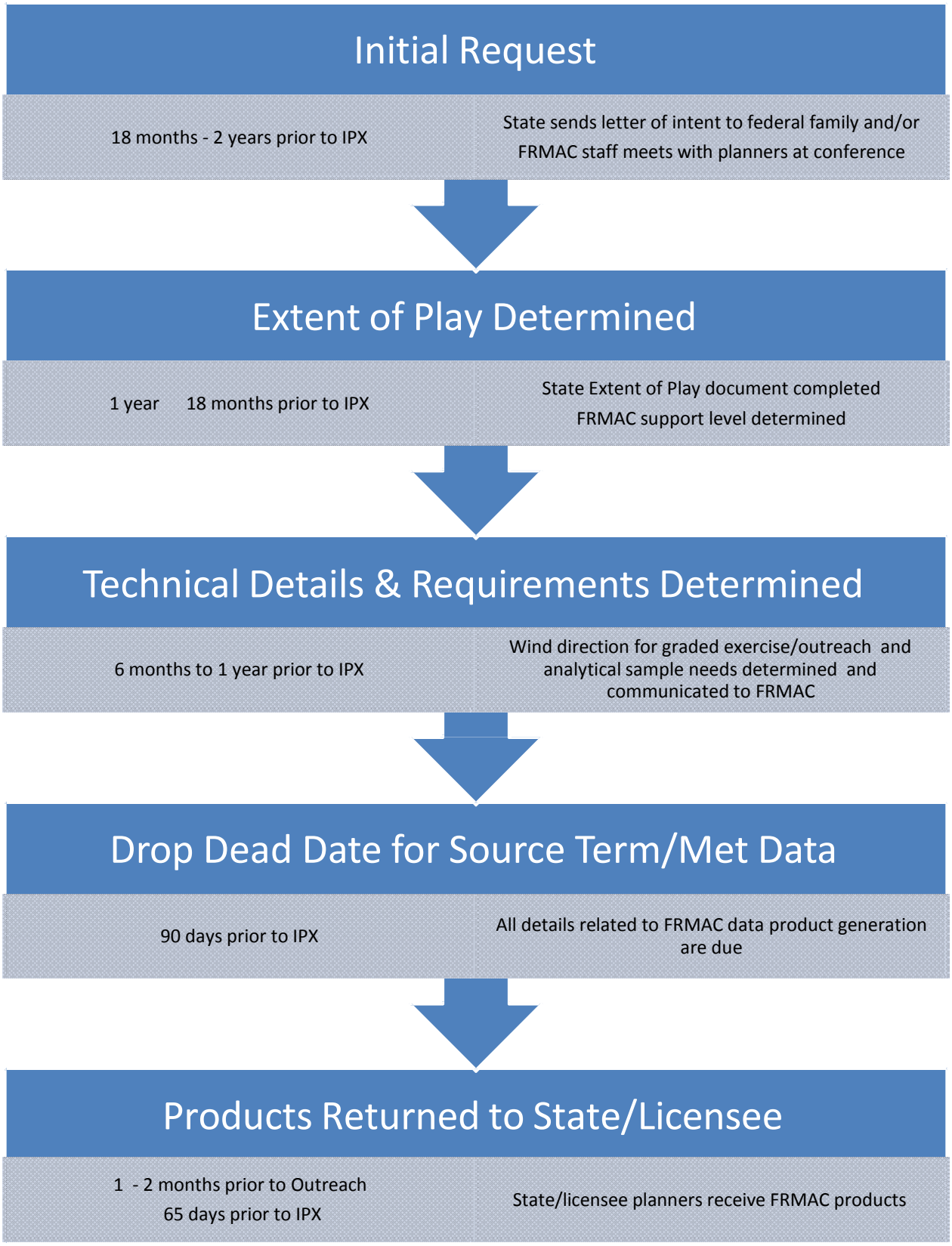
A DOE does not support the concept of generating data products which cannot be derived from normal physical meteorology and topography (i.e. dramatic wind shifts downrange with no reduction in plume concentration, strong rainouts, volcanoes in the mid-west, etc.). All map products and sample data must originate from the National Atmospheric Release Advisory Center (NARAC) dispersion model results. However, it is possible to create scenarios in which there are two or more releases which could satisfy this need. The FRMAC assessment scientist assigned to the exercise can assist the planners in meeting this objective.

Q How do we involve the Advisory Team?

A The Advisory Team is a separate organization which can be contacted via Jeff Sincek with Food and Drug Administration at (614) 227-5780 or *Jeffrey.Sincek@fda.hhs.gov*.

Q How do we involve the Radiological Assistance Program?

A The RAP team for your region can be contacted directly. If you need assistance with contacting them please contact Alvin Morris, FRMAC Program Manager, at (702) 295-4944 or Alvin.Morris@nnsa.doe.gov.


Initial Request
18 months - 2 years prior to IPX
State sends letter of intent to federal family and/or FRMAC staff meets with planners at conference
Extent of Play Determined
1 year 18 months prior to IPX
State Extent of Play document completed FRMAC support level determined
Technical Details & Requirements Determined
6 months to 1 year prior to IPX
Wind direction for graded exercise/outreach and analytical sample needs determined and communicated to FRMAC
Drop Dead Date for Source Term/Met Data
90 days prior to IPX
All details related to FRMAC data product generation are due
Products Returned to State/Licensee
1 - 2 months prior to Outreach
65 days prior to IPX
State/licensee planners receive FRMAC products

Section 1
Overview of FRMAC Support

What FRMAC provides depends on the level of support agreed upon between the Department of Energy and the lead planners of the exercise. At a minimum FRMAC provides some support to every critical element related to a graded ingestion pathway exercise. However, the level of support may vary based on the specific details requested by the planners as well as available federal funding. Table 1 indicates the products and services offered by DOE at each support level. Table 2 indicates the applicable state/licensee responsibilities and requirements at each level of support. Below are descriptions related to each item referenced in Tables 1 and 2.

Pre-Event

Prior to execution of an ingestion pathway exercise there are a series of planning meetings which must occur. These meetings will involve representatives from varying levels of government and the licensee. Some of the meetings will take place in person, such as informal meetings at National Radiological Emergency Preparedness (NREP) conferences and formal state/local/regional meetings. Representatives from FRMAC may or not be available to attend these meetings. The majority of these meetings, however, will take place as a series of conference calls. Initial calls involving the lead planning representatives will determine the extent of play for the federal partners and establish some technical details. Subsequent calls as the event dates draw closer will occur between FRMAC technical staff and those designated by state/licensee planners to work through the details about map products, sample data, and any other necessary data. The number of required calls varies from exercise to exercise.

Outreach

FRMAC will provide at least one representative to support the outreach associated with the IPX. The representative will deliver an overview presentation outlining the components of FRMAC and other DOE consequence management assets. Additionally, the representative will provide a set of standard map products with deposition in the areas of interest for the exercise planners to be used during the tabletop exercise portion of the agenda. However, the area impacted must differ significantly from that of the graded exercise products. Therefore, the technical planners from both sides (state/licensee and FRMAC) must work together at least 60 days prior to the outreach to make sure there is no conflict between the data products created for the exercise and those created for the outreach. For more details about the outreach and to view a standard agenda please see Page 12 of this document.

Planners may also request, in addition to the standard outreach support, field and dose assessment training for their staff. For intermediate and higher levels of support FRMAC staff may add an additional day of training to state, local, and/or licensee staff who wish to learn more about FRMAC field and assessment procedures. There are two courses available. The Field

Monitoring Team Training course demonstrates FRMAC procedures in collecting field samples and measurements and how to transmit those data back to a database. The second course, Dose Assessment Training, instructs state, local, and licensee staff members in FRMAC dose assessment methodology and procedures. Students in this course also gain a deeper understanding of atmospheric modeling and the Environmental Protection Agency Protective Action Guidelines (PAGs). More information about these courses can be found in Appendix A.

Drills

In preparation for a graded exercise a state and licensee may choose to have one or several functional drills. During the drills the state may wish to involve federal players. FRMAC may participate in several ways. In the standard level of support a representative will be available by phone to walk through the Advance Party Meeting Checklist (Appendix C). This document establishes contact information to be used between the federal responders and state, local, and licensee personnel. Additionally, it is the means by which FRMAC collects information about the event and any protective actions state, local, and licensee players have taken. Finally, it outlines the priorities of the unified or incident commander and how the FRMAC is to support these priorities.

If requested and funding is available, FRMAC may even provide physical support to the drill and/or additional map products.

The Graded Exercise (IPX)

Support for the graded exercise is generally the most significant support provided by FRMAC in the IPX process. Standard support to the IPX includes: five map products, sampling data for 10 locations, and sending one FRMAC assessment scientist to brief it all and to answer any questions which may arise during the exercise related to FRMAC support. For intermediate phase support and higher, FRMAC provides access to additional assets. In intermediate phase support the Aerial Measuring System (the DOE aerial asset) may make available aircraft for demonstration of DOE capabilities. Enhanced exercises may involve more field staff support to augment state, local, and licensee field teams tasked with collecting samples and measurements. Those teams would have an opportunity to utilize the FRMAC data tablet collection system, eFRMAC. Full scale DOE IPX support involves the deployment of the Phase I response team. This level of support is significant and requires a sizeable commitment of support from the **offsite response organizations** and licensee staff.

Table 1 - Overview of FRMAC Support Levels

Level of Support	FRMAC Support per Event			
	Pre-Event	Outreach	Drills	IPX
Standard	Planning conference Calls	Attendance Pre-produced data products	Pager/phone support during drill including completion of Advance Party Meeting Checklist	Attendance Specialty maps Sample data for 10 locations **Standard Package**
Intermediate	Planning conference calls	Attendance Pre-produced data products Field Team Training Assessment Training	Pager/phone support during drill including completion of Advance Party Meeting Checklist Map product support	Standard Package AMS Support
Enhanced	Planning conference Calls In person attendance at Federal level meeting with NRC/FEMA and/or State/local level planning meetings	Attendance Specialty map products Field Team Training Assessment Training	Pager/phone support during drill including completion of Advance Party Meeting Checklist Map product support Sample data for 10 locations	Standard Package AMS Support Field Team Support
Full Scale	Planning conference Calls In person attendance at Federal level meeting with NRC/FEMA and/or State/local level planning meetings	Attendance Specialty map products Field Team Training Assessment Training	Pager/phone support during drill including completion of Advance Party Meeting Checklist Specialty map products Sample data for 10 locations	Standard support Small Scale FRMAC Deployment

Table 2 - State/Licensee Requirements

Level of Support	State/Licensee Requirements			
	Pre-Event	Outreach	Drills	IPX
Standard	Participate in planning conference calls	Provide agenda of activities	Notify participating FRMAC player when play has begun	Provide radiological source term Provide meteorological data
	Provide technical POC for data discussions	Request participation from applicable agencies	Maintain technical and management POC for APM checklist	Provide sampling locations Participate in conference calls
Intermediate	Same as standard	Same as standard plus: Provide wind direction for products Invite participants to trainings Reserve classrooms	Same as standard plus: Provide wind direction for products	Same as standard plus: Determine landing location Coordinate with FAA for access to power plant airspace
Enhanced	Same as standard	Same as intermediate plus: Provide radiological source term Provide meteorlogical data	Same as intermediate plus: Provide sample locations	Same as intermediate plus: Coordinate with FRMAC monitoring staff to determine resource requirements
Full Scale	Same as standard	Same as enhanced	Same as enhanced plus: Provide radiological source term and meteorological data	Participate in a significant number of conference calls and meetings. Provide staff as controllers and players. Create injects and staff a data simcell.

Section 2 Outreach

The purpose of table top exercises (TTX) during an IPX Outreach is twofold. First, it is to provide state and utility players with an opportunity to walk through all of the processes and procedures to activate federal assets. Through this they will better understand the level of support they will receive and how soon after activation the support will be available. Second, outreaches are useful for the federal asset players to increase their understanding of how each state handles radiological emergencies. A well moderated TTX will provide a good foundation to build upon for future interactions during the IPX itself.

Attendees

Table top exercises are most effective when attendance is restricted to key players and decision makers. The key here is to ensure that play is not hindered due to lack of participation from crucial agencies or groups and that those participating have the authority to make the necessary decisions required to move the TTX along. It suggested that the following federal agencies have representation during a TTX:

- *Nuclear Regulatory Commission (NRC)*
- *Federal Radiological Monitoring and Assessment Center (FRMAC)*
- *Environmental Protection Agency (EPA)*
- *Federal Emergency Management Agency (FEMA)*
- *United States Department of Agriculture (USDA)*
- *Food and Drug Administration (FDA)*
- *Centers for Disease Control (CDC)*
- *Radiological Assistance Program (RAP)*

It is recommended that TTX attendance be limited to 20-25 people. If attendance exceeds this number effectiveness of the discussion may be compromised.

The Moderator

Selecting the moderator as early as possible during the planning stages is extremely helpful for everyone involved in the process. FRMAC will brief the maps, and work with the appropriate leads during the outreach planning, but they DO NOT moderate the outreach. The moderator will come from one of the following:

- *Utility*
- *State*
- *FEMA*
- *NRC*

It is important to note that there is not a set policy for FEMA or NRC to moderate the outreach TTX; however, in many regions there are experienced representatives who are capable and willing to provide this assistance.

Logistics

Things to consider when choosing a venue for outreaches include:

- *Size*
- *Available audio/visual equipment*
- *Room layout*

There will be several presentations most likely supported by PowerPoint so it is good to have a laptop, projector, and large screen available. If possible have presenters meet early to load presentations ahead of time to avoid awkward lulls while loading presentations. The layout of the room should allow for personnel from similar organizations to sit close by while still being able to speak to others unassisted by a microphone.

Agenda

Most states have adopted a similar outreach style whereby the agenda is divided into two sessions. The morning session is devoted to presentations by each agency and the afternoon session is an interactive TTX followed by a hot wash and discussion.

Morning Session

In this portion of the outreach, each agency should be given the opportunity to present a brief overview of their agency. The presentations should be limited to 30-45 minutes per agency, and they should cover high-level topics such as:

- *What type of support they have*
- *When they will arrive*
- *How to contact them*

As a moderator of this session it is very important to enforce presentation time limits. Any significant deviation by one or more presenter will cut into precious TTX time. A short question and answer period of 3-5 minutes should follow each presentation. This will allow the audience a chance for clarification of presented material. The time here should also be closely monitored.

Afternoon Session

The afternoon session should begin with another short question and answer period for queries that may have come up over lunch. After this the moderator should begin the TTX. The first objective is to explain the scenario briefly to the participants. The briefing can be given by a state or utility representative or the moderator. This briefing should cover the history of the

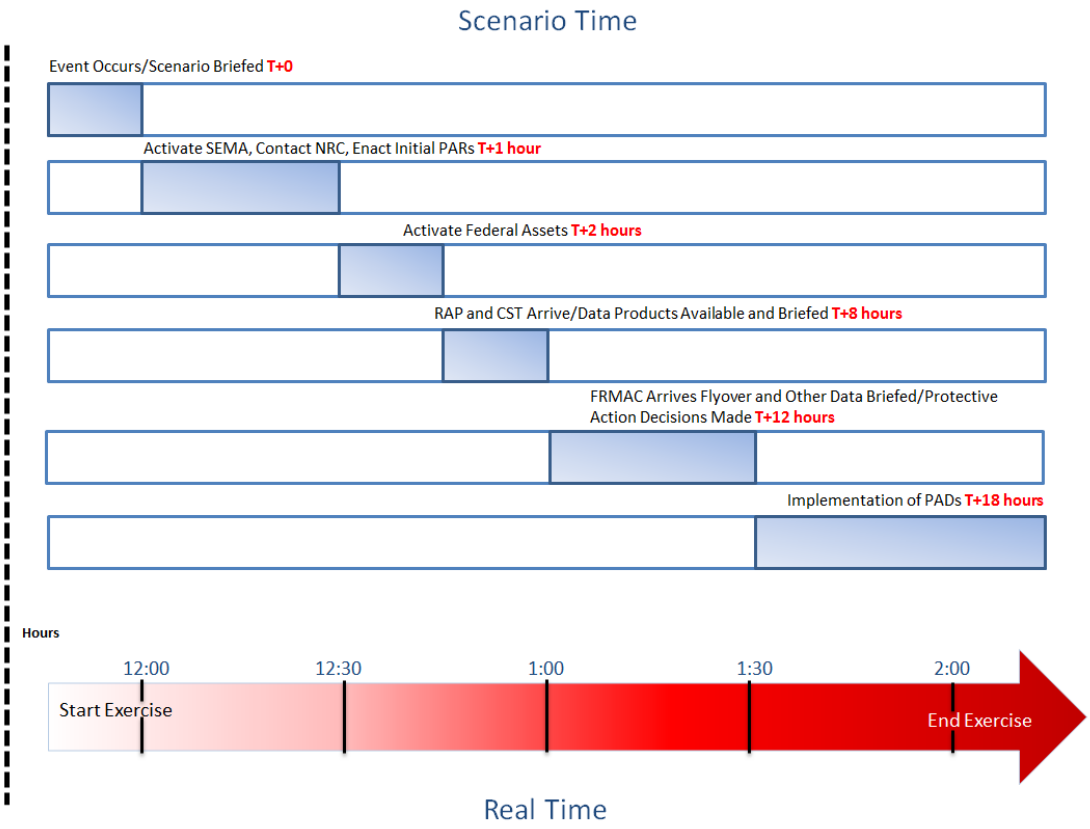
incident (who, what, where, and how). The participants should be allowed to ask questions for clarification. Inevitably, someone will want to bring up discrepancies or impossibilities of the scenario. Discussions about these things can quickly derail the session. The moderator should simply acknowledge the concern but advise the participant(s) that for purpose of moving forward in the exercise certain things may have to be accepted as true.

The moderator's job is to ensure that each agency is engaged, that there is constant dialogue, and that the TTX objectives are met. These objectives include but, are not limited to:

1. *Activation state and other local assets – this can be done notionally if agency is not present*
    a. *State emergency management*
    b. *State radiation health department (or similarly functioning organization)*
    c. *Utility personnel*
    d. *Law enforcement*
    e. *Health department*
    f. *Drinking water authority*
    g. *Others as needed*
2. *Identifying concerns*
    a. *Sensitive populations (schools, daycare centers, prisons, etc.)*
    b. *Shelter-in-place/evacuation*
    c. *Agriculture*
    d. *Road closures*
    e. *Victim care*
3. *Identify need for help and how to get it*
4. *Activation of federal assets*
        a. *NRC*
        b. *RAP*
        c. *FRMAC*
        d. *A-Team*
5. *Cooperative work between federal and local personnel*

The planners should have some ideas about the topics they would like to cover. The moderator must be mindful of not only the time of day (to keep people on task) but also the time in the exercise. Remind participants with time cues such as "Ok, we're at T+4 hours." It is easy to lose track if conversation is vigorous. It is also a good idea to prompt representatives from the agencies with questions such as "So, what would the state radiation bureau do at this time?" or "Do you have the equipment or personnel to assist with them with this task?" Questions like this

can help to overcome potential lulls in conversation. Once all of the objectives have been met EndEx (end of exercise) can be called. Below is a sample timeline for the TTX.



Hotwash and Discussion

At the end of the exercise a brief discussion should take place to discuss important take-away points of the exercise. The moderator should facilitate this discussion by choosing one agency at a time to describe what they learned and what they may do differently with this new knowledge. Participants may also use this time to further clarify their understanding of other agencies or help others understand theirs.

Sample Agenda

Maryland Department of The Environment
1800 Washington BLVD
Baltimore, Md. 21230
please park in the "Blue" lot

2009 FEDERAL OUTREACH MEETING IN PREPARATION FOR THE CALVEX 09 INGESTION EXERCISE

September 9, 2009

AGENDA

I. Opening Remarks (8:30-9:00)	Maryland Department of the Environment (MDE) Maryland Emergency Management Agency (MEMA) FRMAC
II. NRC Response/National Response Framework (9:00-9:30)	NRC DHS/FEMA
III. DOE RI - RAP Team/FRMAC Resources (9:30-10:20)	DOE
IV. Break (10:20-10:30)	
V. The Advisory Team (10:30-11:00)	USDA
VI. Maryland Ingestion Response/ (11:00-11:30)	MDE
VII. Lunch (11:30-12:30) Provided	
VIX. Talking Tabletop Exercise (12:30-2:30)	ALL
X. Break (2:30 – 2:45)	
XI. Exercise Participation Discussion (2:45-3:30)	ALL
XII. Wrap-up/Critique (3:30-4:00)	ALL

Products

There are several details that will need to be organized during the planning of an outreach. The scenario must be developed, and informational handouts created and/or gathered. It is also helpful to provide the power point presentations as handouts to attendees. In addition, FRMAC map products are utilized during the table top portion of the outreach.

Under the standard support level outreach, FRMAC Outreach Map Products are created using shape files from a cache of data. There is NO NEW DATA generated for the outreach. This means that even if the planners are generating data for the players to practice with, FRMAC will not be able to run a source term for this event. Additionally, there is NO SAMPLE information created for the standard support level outreach. If a non-standard outreach was agreed upon before planning was initiated, then the FRMAC planner can discuss what options will be modified for the event.

What FRMAC provides

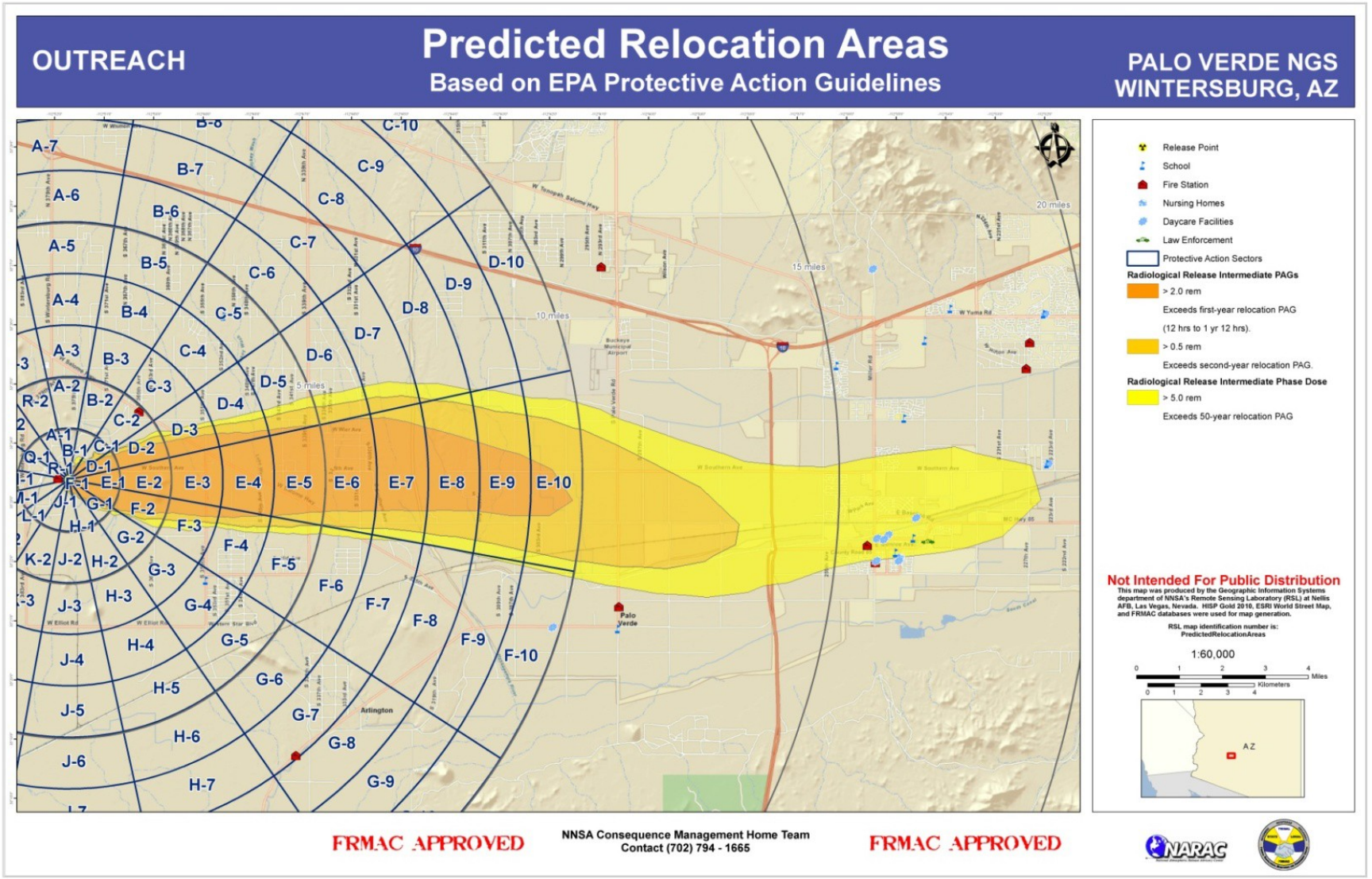
At a minimum, the FRMAC will provide at least one representative to support outreach training meetings. The representative will give the FRMAC overview presentation, brief the map products, and participate during the TTX session. Additionally, the representative will provide a set of representative map products with deposition in the areas of interest for the exercise planners. However, the area impacted must differ significantly from that of the graded exercise products. Therefore, the technical planners from both sides (state/licensee and FRMAC) must work together at least 60 days prior to the outreach to discuss the details of the products.

Standard Support Level Products

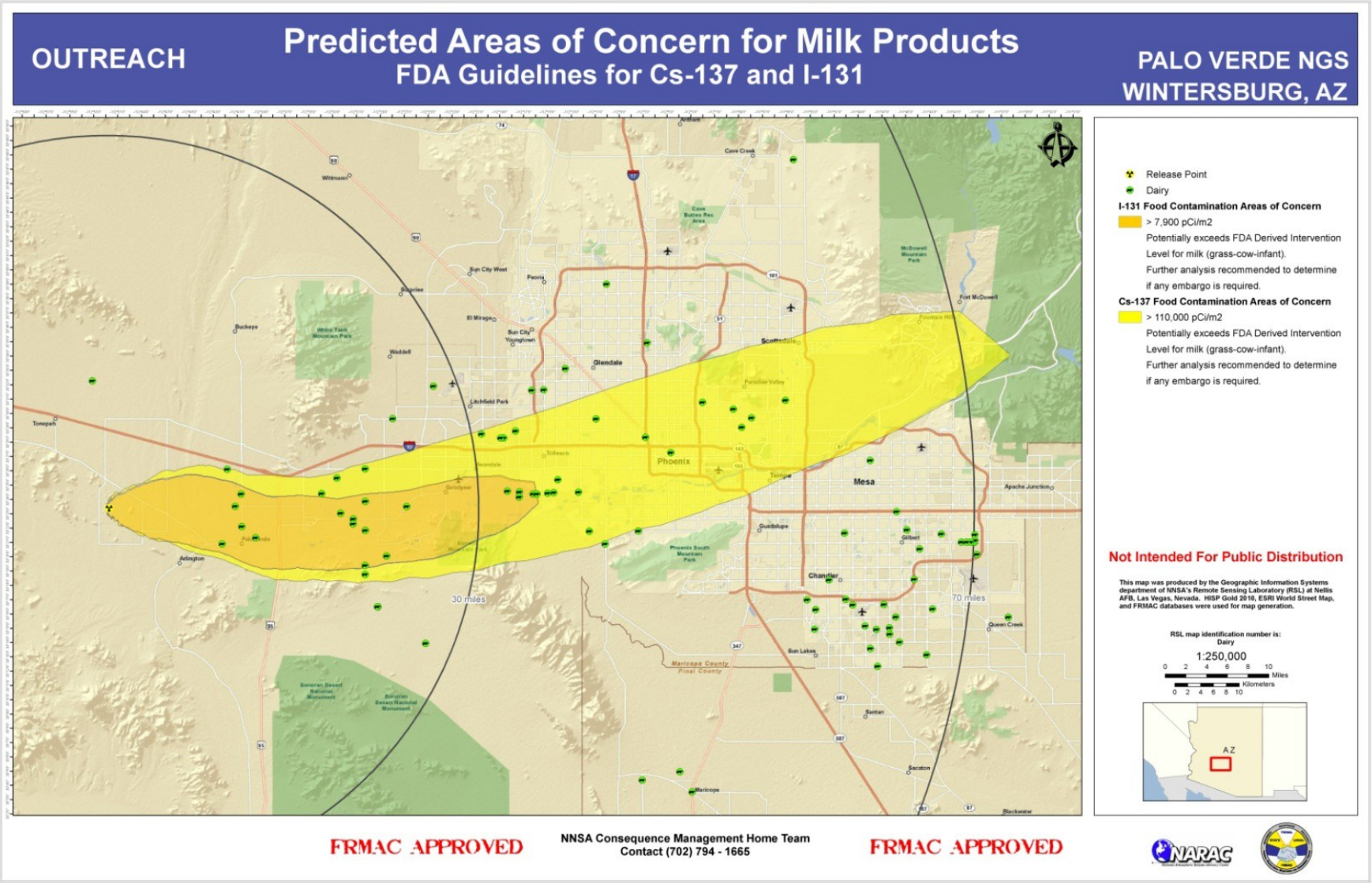
The following pages outline the products that FRMAC will develop for the outreach. Each product type has an explanation of what it is, how it is used, and a sample. Included are:

- *Relocation Map*
- *Dairy Map*
- *Mature Produce Map*
- *AMS Map*
- *Integrated Dose Map*

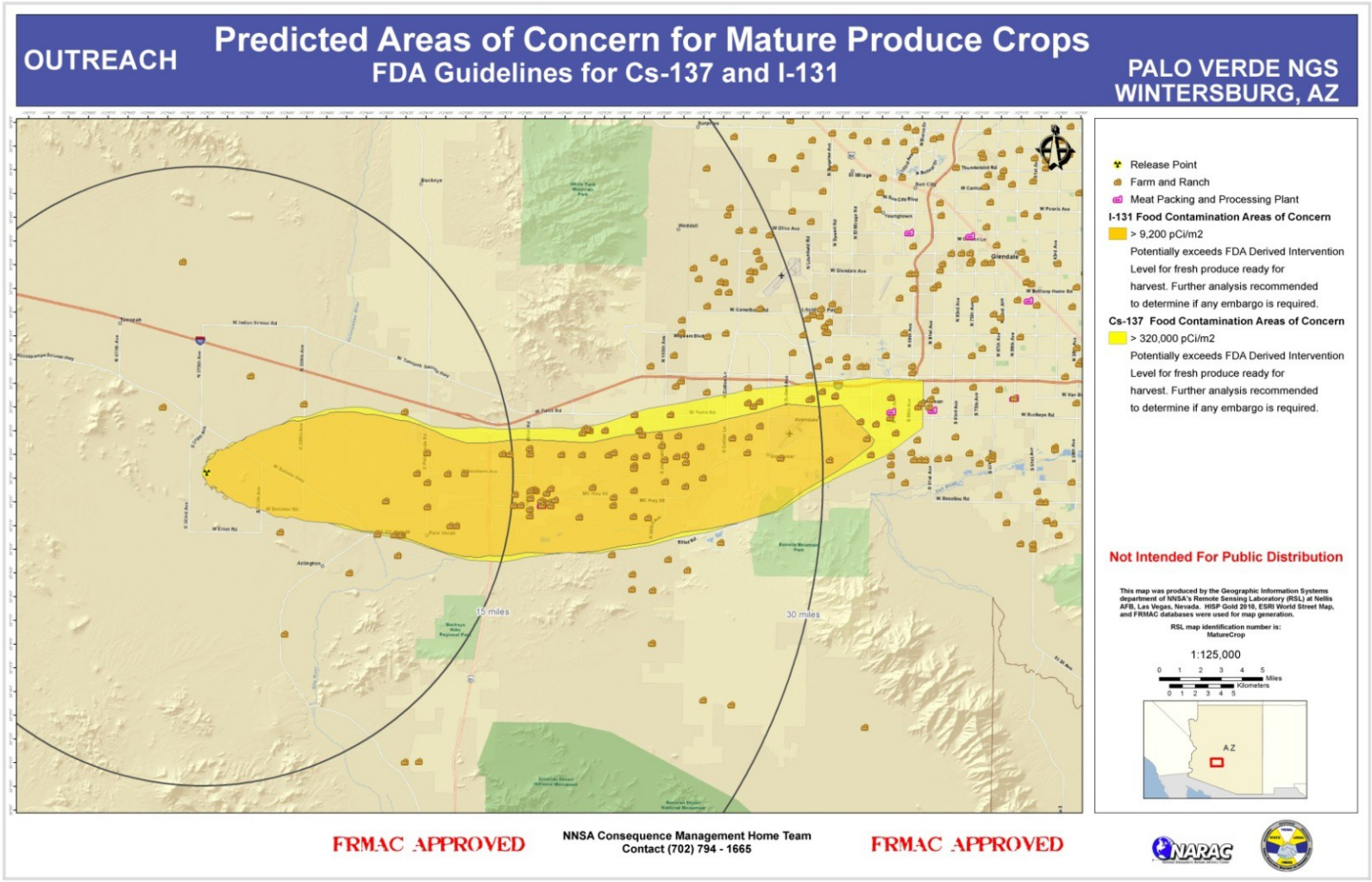
- **Relocation Map**
  - The relocation map typically displays the EPA 1st and 2nd year relocation guidance. The FRMAC planner should be notified if the 50 year relocation PAG is to be included.
  - The relocation map product is often released early in the exercise. It can be introduced to players in the scenario as a NARAC model with minimal to no measurements, or as "truth" based off of ground measurements and the AMS flyover. The FRMAC planner will ask which route the scenario planners are taking in order to correctly brief the map during the exercise.



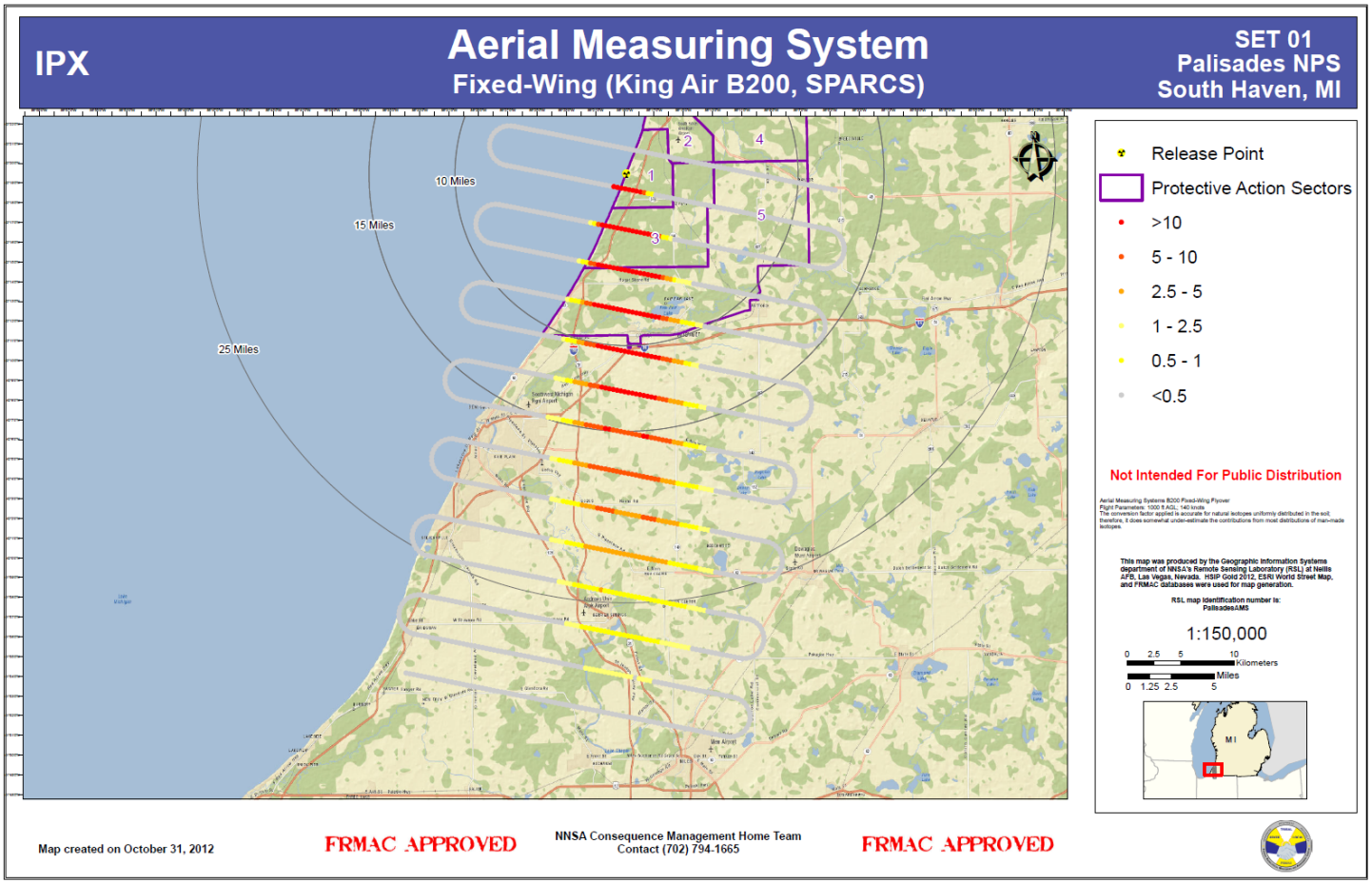
- **Dairy Map**
  - The dairy map is produced by relating the potential contamination on the ground to the Food and Drug Administration (FDA) Derived Intervention Levels (DILs) by using Derived Response Levels (DRLs).
  - The product is produced using the most limiting radionuclides, which for milk are Cs-134/137 and I-131.
  - The state agricultural department may look at these products and determine which embargo decisions must be made.
  - This map can be introduced during play as "ground truth" as a guide from which a sampling plan can be made.



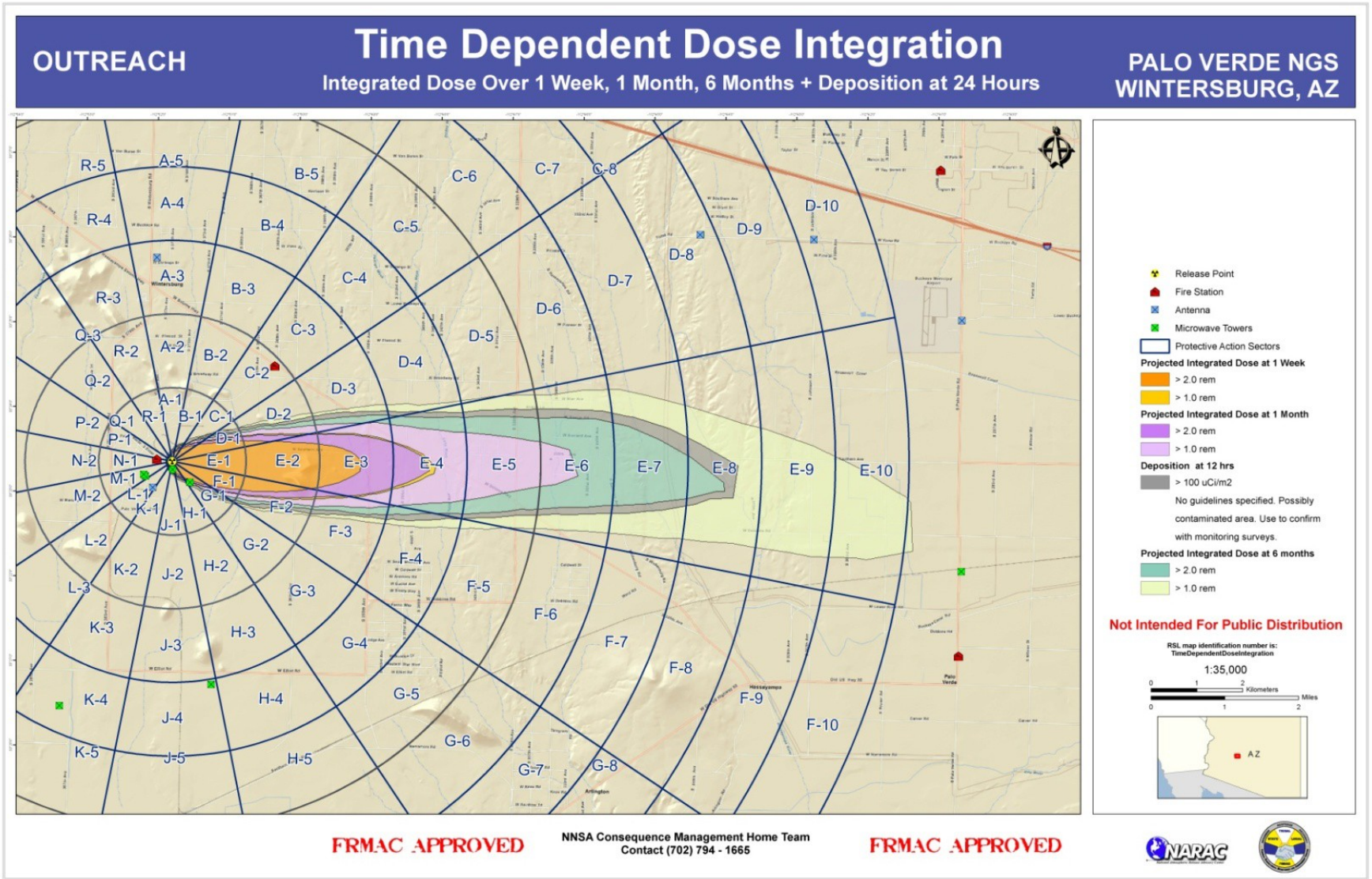
- **Mature Produce Map**
  - The mature produce map is produced by relating the potential contamination on the ground to the FDA DILs by using DRLs and symbolizing only those products which are currently ready for harvest.
  - The product is produced using the most limiting radionuclides, which for produce are Cs-134/137 and I-131.
  - The state agricultural department will have to look at these products and determine what embargo decisions must be made.
  - This map can be introduced as “ground truth”, or more frequently, as a guide from which to make the sampling plan.



- **AMS Flyover Map**
  - The AMS flyover map relates dose rate data to levels of interest. It is often requested that they be consistent with the EPA Relocation PAG DRLs but, this is not required.
  - The flyover map is another key element that is typically used in play to confirm the initial situational assessment was accurate.



- **Integrated Dose Map**
  - This map details the dose received to individuals from ground shine and inhalation of resuspended material after plume passage at various time phases.
  - The objective here is to answer the question from state dose assessment groups and decision-makers about the effects of a delayed relocation decision or determination of re-entry or return of the population.



Creating the Maps

To create the maps for the outreach, the FRMAC data planner only needs a wind direction. Some planners may also have requests regarding the distances of the contours for each map type to meet objectives of outreach play. In this case, the FRMAC planner can first look through their cache of data to see if any meet those requests. If not, a request can be made for custom outreach maps, but this must be approved through the FRMAC program manager.

Special Requests

Special requests can be met, depending on their complexity, at the discretion of the FRMAC program manager. The FRMAC support staff personnel can assist in this process.

Section 3 Drills

Drills, in some form or fashion have always been a part of the exercise process for IPXs. Standard FRMAC support to these drills is performed remotely by phone. A FRMAC representative works with the **OROs** to complete the Advance Party Meeting (APM) checklist and notionally activate the FRMAC. However, recently with the adoption of Homeland Security Exercise and Evaluation Program (HSEEP) some states have begun to standardize their drills to be more in line with other FEMA evaluated exercises. Under HSEEP some states have added more **functional exercises.** Consequently, states have begun to request more map products to support these exercises. Therefore, in addition to answering questions about FRMAC deployment and walking through the APM checklist, the FRMAC representative will also inject map products as necessary during the exercise. This is to simulate support from the **Consequence Management Home Team (CMHT)** which is an asset that would be available to the states during the first few hours of a response. Enhanced exercise support may include on-site participation of FRMAC staff.

Attendees and Products

The attendees and activities during a drill or functional exercise differ for each state and licensee. Map products may be provided if requested depending on availability of resources.

Section 4 Graded Exercise (IPX)

Ingestion Pathway Exercises (IPXs) are by far, the most comprehensive and labor intensive of all of the exercises conducted by the stakeholders of a nuclear power plant and players from the federal family. IPXs are typically run concurrently with biannually required plume phase exercise. Therefore, the activities will begin at the Unusual Event level and progress through the alert statuses until a General Emergency is reached. All aspects of the response are demonstrated therefore, there will be "boots on the ground" as well as a tabletop portion of the exercise. Tabletop discussions during the exercise will primarily involve protecting the health and safety of the general public during the intermediate and long term phases of a radiation exposure event. Discussions will provide an opportunity for a critical evaluation of response plans, policies, and procedures while highlighting the cooperation and coordination necessary among all stakeholders to effectively respond to an incident of this magnitude.

Attendees

Due to the larger scope of the ingestion phase, the number of agencies and groups involved is typically larger than in a plume phase exercise. It follows that the number of players in an IPX is typically much larger than that of the plume phase portion. The average number of participants in an ingestion phase exercise is about 100 or more. Below are examples of the various agencies and organizations who participate in IPXs:

- State Organizations
  - *Office of the Governor*
  - *Department of Emergency Management*
  - *Department responsible for radiological safety. This may be:*
  - *Department Health and Human Services*
  - *Department of Environmental Quality*
  - *Department of Transportation*
  - *Department of Corrections*
  - *Department of Agriculture*
  - *Department of Fish and Wildlife (Gaming)*
  - *State Veterinarian Office*
  - *Department of Public Safety*
  - *Department of Water Resources (of Quality)*
  - *State Department of Homeland Security*
  - *Civil Support Teams*
- Local Players (may include: counties, parishes, judges, and/or municipalities)
  - *Emergency Management*
  - *Sherriff's Office*
  - *Mayor's Office*

    - *Department of Transportation*
    - *Environmental Services*
    - *Animal Care and Control*
    - *County/City Police Department*
    - *Department of Public Health*
- Volunteer Organizations
    - *Humane Society*
    - *American Red Cross*
    - *Salvation Army*
- Licensee
    - Federal Government
        - *FEMA*
        - *NRC*
        - *DOE*
        - *EPA*
        - *Department of Defense (DoD)*
        - *Food and Drug Administration (FDA)*
        - *United States Department of Agriculture (USDA)*
        - *Center for Disease Control (CDC)*

The attendees for the IPX will fall into one of several categories:

Participants: Designated Emergency Responders who are trained and qualified to assume the duties of their emergency response position are known as "Participant". These persons respond and take the necessary actions to mitigate, terminate, correct and/or recover from the simulated events.

Mentors: A "Participant" who is assigned to respond to their emergency position during a simulated emergency to coach the "Participant" in taking the necessary actions to mitigate, terminate, and/or recover from the simulated events.

Controllers: Those designated personnel who serve an active role during the exercise by providing scenario data to participants. Controllers also serve to initiate actions (i.e.: contingency messages) in order to assure continuity of the events described in the exercise scenario. Controllers are the only personnel who will provide information to the participants. Controllers will also serve as Evaluators.

Evaluators: Designated personnel that provide documentation and assessment of the exercise activities for the purpose of the internal self-critique. Evaluators serve a passive function (when not serving as a Controller/Evaluator) and will only note actions taken by Participants. These personnel may have specific areas to consider in their evaluation. Evaluators may ask questions to clarify actions taken or procedural concerns but should not interfere with the flow of events or players actions. Evaluators may also serve as Controllers.

Observers/Visitors: Personnel who serve no evaluation, control or participatory function in the exercise. They should not interfere with Evaluators or Participants. Questions from Observers should be directed to a Controller.

Logistics

Similar logistics requirements may exist for the IPX as it did for the outreach, although often, more space is required. Many IPXs are conducted at EOCs, as there is typically ample space for the participants, available equipment, and parking. The following will likely be necessary to take into consideration:

- *Facility Size*
- *Room layout*
- *Ideally, multiple rooms will be available*
- *Parking*
- *Available audio/visual equipment*
- *Available computers and/or space for attendees to bring their own*
- *Internet availability*
- *Nearby area for field team play*
- *Plotters for map products*

Agenda

Ingestion Pathway Exercises are usually conducted over a two to three day period. The first day will satisfy the requirement to exercise the licensee, states, and localities within the 10-mile Emergency Planning Zone (EPZ) in a plume phase exercise. The second day generally covers the ingestion phase. Exercises can continue for a third day with extra time given to process technical data such as laboratory sample results and implementation of relocation decisions. Additionally, non-standard assets may be deployed which can add time to the exercise schedule. Assets such as the EPA Mobile Laboratory, FRMAC Phase I team, and/or Aerial Measuring System (AMS) aircraft may be deployed to the exercise location where funding and time permit.

The Plume Phase Portion

This portion of the exercise is conducted in multiple locations for most exercises. The key locations are usually the State Emergency Operations Center (SEOC) and the Emergency Operations Facility (EOF) of the licensee. In the EOF plant activities are carried out such as monitoring the status of the release of radioactive material, reporting alerts to the NRC, and notifying the state. The SEOC will be activated and begin to perform activities such as public messaging, traffic access control, and reaching back to other agencies for support. Field activities are carried out in a forward staging area where state/utility field teams gather to receive briefings and mission plans. These teams travel routes to collect measurements and samples in areas predetermined by the state/utility. In fact, many nuclear power plants have pre-selected representative locations for sampling within boundaries of the power plant and the 10-mile EPZ.

This portion of the exercise ordinarily concludes by mid-late afternoon. At the conclusion of the plume phase portion of the exercise the plant has gone to a general emergency and the state has determined that additional resources will be necessary. The federal assets (such as FRMAC) are contacted for assistance. A hotwash is conducted to capture the comments of the participants and most end their day at this time. A select few, however, will stay for an extra 1-2 hours for the Advance Party Meeting.

The Advance Party Meeting is where the state, local, tribal, and Licensee organizations first meet with their federal resources and determines priorities. The personnel in this meeting (guided by the lead FRMAC representative) will walk through the Advance Party Meeting Checklist (Appendix C). It is here where the FRMAC representative will receive a briefing about current plant conditions and actions taken thus far to protect the public.

The Ingestion Phase Portion

The morning of the second day is usually the beginning of the ingestion phase portion of the exercise. The players should receive a briefing on activities that have taken place prior to that morning. They should also be told "what day it is" that is – how much time has passed since the release of radioactive material from the plant. It is common to begin on the morning of the first day after the release (i.e. Day 2). At this time the players will organize into functional groups and work through initial activities as required by their support function. Sometime later the first FRMAC maps may be released to players and briefed by the FRMAC representative. How the maps are presented (projection, handouts, poster-size maps secured to walls) and when the maps are presented (all at once, one at a time, or in small groups) should be decided ahead of time during planning discussions. It is also important to decide who the audience should be for the FRMAC map briefing and who should receive paper copies if made available.

At some point, lab analysis data generated by FRMAC will be provided to the state and/or local dose assessors. This data will be used to demonstrate the ability of the assessors to determine areas where relocation of the public and food embargo actions should be considered. Field team measurement data is not considered for use during the ingestion phase. Data for these teams is provided by controllers from utility in a good number of exercises and is not transferred to the SEOC.

Once the data have been analyzed, the dose assessors will verify their results, often times with the federal responders present. FRMAC cannot provide recommendations to the assessors but, they can assist with reasoning through the data and pull in a member of the Advisory Team when possible for additional assistance. After the data have been reviewed and a decision has been made this will be communicated to the players with a need to know. Where resources permit local players may also generate their own map products displaying decisions made.

End of Exercise (EndEx) will be called by the lead state or utility planner when he/she feels all objectives have been met. At the end of the exercise a hotwash will be conducted to allow players an opportunity to communicate lessons learned. The FEMA representatives present to evaluate the exercise will provide preliminary feedback to the players and planners. High and low points will be discussed. A more detailed assessment will be provided in later meetings. The NRC will meet with the Licensee to discuss findings while FEMA will meet with the states, locals, and tribal authorities. Lastly, a public meeting will be conducted to present findings to interested members of the public.

FRMAC Involvement and Impact

Although FRMAC provides data, data products, and participates in briefings it is not evaluated during an IPX. Rather, FEMA will grade the players based on the decisions they made using the provided data products and other scenario information. This does not mean that FRMAC data and interactions are not observed by FEMA. When Scenario Packages are submitted by the state and/or licensee for review to FEMA, the FRMAC representative can also be contacted directly for revisions. Revisions must be made to the satisfaction of the FEMA scenario evaluator before it will be accepted for use during the exercise. Therefore in order for the planning exercise to proceed, the FRMAC representative must revise the data to meet expectations.

To expedite this process a set of sample products based on the final source term are provided to the state/licensee for approval. The sample products include the results from atmospheric modeling on generic map backgrounds, assumptions, and other details required to complete a full dataset. The state/licensee are encouraged to review the products and technical details amongst themselves and to confer with FEMA on any items of interest. If the products are found to be satisfactory a signatory page will be required in order for the FRMAC representative to complete the data package.

Although special deadlines are negotiable on a case-by-case basis, the DOE will not commit to providing data products for exercises if the required scenario information is not received by the FRMAC contact by 90 days prior to the exercise. This ensures that the **Scenario Package** is submitted to FEMA in time for the 60 day deadline.

Data Submittal

The DOE is prepared to provide technical recommendations on source terms and/or meteorological data to ensure that satisfactory evacuation and relocation areas are exercised. It is suggested that licensee and state personnel submit the **Extent of Play Agreement** document to FEMA well in advance of planning with FRMAC to establish these requirements. This will reduce the likelihood that significant alterations would be made to the FRMAC products after they are submitted in the **Scenario Package**.

Sample Agenda

2011 SONGS
Post Emergency Phase Exercise
Day 2 – Dose Assessment
December 14, 2011

SDAC AGENDA*

0800 Sign-in begins

09:00 Welcome and Introductions

- *Cal EMA Welcome*
- *Participant Introductions*
- *Agenda*

09:10 Exercise Briefing

- *Exercise Purpose*
- *Safety and Housekeeping*
- *Objectives*
- *Artificialities and Assumptions*
- *Exercise Timetable: PARs, Data, Concept*
- *Players, Controllers and Evaluators*
- *FEMA Evaluation*

09:20 Session 1 - Begin Exercise

- *SDAC – Organization*
- *Participant Introductions*
- *Situational Updates: Utility, ODAC, Advance Party*
- *Prior Actions Review*
- *T+2 Data*

12:00 Lunch

12:30 Session 2

- *T+7 Data*

FEMA Calls "End-X" Exercise Debriefing

~16:00 End

** All times are approximate and dependent on accomplishing objective*

2011 SONGS
Post Emergency Phase Exercise
Day 2 – Dose Assessment
December 14, 2011

Field Demonstration AGENDA*

0800 Sign-in begins

09:00 Welcome and Introductions

- *Participant Introductions*
- *Agenda*

09:10 Exercise Briefing

- *Exercise Purpose*
- *Safety and Housekeeping*
- *Objectives*
- *Artificialities and Assumptions*
- *Exercise Timetable*
- *Players, Controllers and Evaluators*
- *FEMA Evaluation*

09:20 Exercise Begins

- *Set-up*
- *Team Briefings*
- *Team dispatch*
- *Sample receipt*
- *EWIC*

12:00 Lunch

12:45 Exercise Continues

FEMA Calls "End-X"

Exercise Debriefing

~16:00 End

** All times are approximate and dependent on accomplishing objectives*

Products

The map production process in planning an IPX will take a significant amount of time and effort. Typically, there are several iterations in the development of the final source term. Once the source term has been finalized, the development of the rest of the data package can begin. The following sections explain some considerations when creating the map products.

Extent of Deposition Data

This is the key issue when creating the data for use during the ingestion portion of the exercise. As related to the data development process, the players in the IPX must demonstrate the following:

- Evacuation/Shelter in Place:
  - Typically, this is an action that is automatically performed as part of the standard procedures following the notification of General Emergency to the NRC by the utility. When a release of radioactive material to the environment is either eminent or in progress actions may be taken on the basis of the inventory released and current wind direction. It is common for the recommendation to evacuate or shelter in place to be conservative and to encompass a large area.
- Relocation:
  - The **Scenario Package** submitted to FEMA must support the relocation of a significant fraction of the population within the 10-mile EPZ. Often the relocation extent is governed using procedures as established in the NUREG-0654 planning basis.
- Return:
  - The decision to return members of the public back to their homes and businesses is a technically and politically challenging one. Players will make some initial decisions about how to begin to address this issue at the conclusion of the ingestion phase.
- Reentry:
  - The players will make decisions about whether to allow certain members of the population who were displaced from their homes or businesses to collect a certain amount of personal belongings or perform critical activities. Critical activities may include allowing farmers to milk their cows or chemical plant personnel to enter their facility to address important processes.
- Ingestion/Embargo:
  - The players will have to demonstrate the ability to address food that is considered potentially unsafe by using FDA guidance. If the state uses NUREG-0654 for their planning bases, many planners try to keep the extent of deposition that meets DRL to exceed the FDA guidelines for ingestion less than 50 miles. Please remember that evacuation/relocation areas in the 2-5 mile range often result in food

contamination areas exceeding the 50-mile EPZ. The DOE will not individually modify source term data for a particular data product to accommodate exercise play. All map products and sample data must be consistent with the scenario data.

Extent truly drives the data development process. It is absolutely imperative that your FRMAC planner has an understanding of what the needs are when developing the data package. Without that knowledge, the FRMAC planner will be unable to develop the data in a way that appropriately meets the needs of the state.

Guidance

The dose assessment guidance most often utilized in the US for nuclear power plant emergencies was created by the EPA and is titled "Manual of Protective Action Guides and Protective Action for Nuclear Incidents", EPA 400-92R. Of particular interest for this discussion are Tables 7-1 and 7-2 from the manual. These provide dose conversion factors (with and without weathering effects) for a selected set of radionuclides. It has been noted during exercises with almost every state in the country affected by a 50-mile EPZ that the tools used by state dose assessors are based on this manual. Therefore, given that IPXs are a demonstration of current plans and procedures it is the standard practice of FRMAC support staff to create product which use this guidance.

FRMAC itself has retired the use of the conversion factors from the 1992 EPA manual as newer guidance has been released. However, when supporting a state IPX, FRMAC will match the state methodology as requested.

Note: if a planner wishes to use a source term which includes radionuclides outside of those provided in the EPA manual they will need to provide the dose conversion factors for those radionuclides. The methodology employed in creating the tables is uncertain and FRMAC can only approximate these values currently.

What FRMAC provides

Once the source term, meteorological data, and other details are settled the map production process can begin. The products described on page 14 will be created for the graded exercise using these details. In addition to the map products FRMAC also provides sampling data for 10 locations at the discretion of the state/licensee planner. At these 10 locations there can be samples for up to four types of sampling media: soil, water, vegetation, and milk. Below in Figure 1, an example of a FRMAC sample sheet is shown.

Activity per Sample (µCi/kg)

Sample #	1	2	3	4	5	6	7	8	9	10
Latitude:	34.63316	36.65942	34.56534	34.49246	34.48463	34.66920	34.64873	34.41999	34.39674	34.15354
Longitude:	-87.23828	-87.19207	-87.36220	-87.29373	-87.72287	-87.30929	-87.18862	-87.56903	-87.64645	-87.73339
Description:	Location 1	Location 2	Location 3	Location 4	Location 5	Location 6	Location 7	Location 8	Location 9	Location 10
Sr-89	9.26E-01	1.36E+00	7.81E-02	3.03E-06	1.50E-03	3.55E-06	1.64E-01	3.24E-02	3.34E-02	6.34E-04
Sr-90	6.21E-02	8.73E-02	3.50E-03	2.21E-07	6.08E-05	8.17E-07	6.05E-03	1.22E-03	1.37E-03	2.83E-05
Y-91	7.73E-02	1.12E-01	7.17E-03	1.17E-06	1.46E-04	8.85E-07	1.39E-02	2.66E-03	2.78E-03	5.83E-05
Zr-95										
Nb-95										
Ru-103	7.25E-01	1.14E+00	2.88E-02	1.45E-06	3.44E-04	2.87E-06	6.69E-02	7.60E-03	8.78E-03	1.54E-04
Ru-106	1.77E-01	2.59E-01	7.26E-03	3.22E-07	8.98E-05	2.46E-07	1.56E-02	1.87E-03	2.05E-03	4.08E-05
Te-132	7.17E+00	1.03E+01	2.58E-01	1.33E-05	3.92E-03	1.87E-05	6.18E-01	7.99E-02	8.67E-02	1.38E-03
I-129										
I-131	5.15E+01	7.50E+01	3.63E+00	2.31E-04	5.50E-02	3.84E-04	1.05E+01	1.12E+00	1.34E+00	2.53E-02
I-133	2.06E+01	3.28E+01	4.75E-01	9.25E-05	7.55E-03	2.34E-05	9.95E-01	1.45E-01	1.61E-01	2.77E-03
Cs-134	7.07E-01	9.63E-01	6.19E-02	1.08E-05	1.29E-03	3.98E-06	1.21E-01	2.59E-02	2.77E-02	5.07E-04
Cs-137	9.27E-01	1.23E+00	8.50E-02	2.36E-06	7.97E-04	5.56E-06	7.51E-02	1.57E-02	1.69E-02	3.44E-04
Ba-140	3.44E+00	4.48E+00	3.02E-01	1.25E-05	3.12E-03	2.34E-05	2.95E-01	5.52E-02	6.70E-02	1.30E-03
Ce-141										
Ce-144	8.12E-01	1.18E+00	5.40E-02	1.17E-06	4.10E-04	2.70E-06	6.74E-02	8.12E-03	8.89E-03	1.29E-04
Np-237										
Np-239	1.76E+00	2.44E+00	1.49E-01	7.35E-06	3.14E-03	4.46E-05	3.01E-01	5.87E-02	6.54E-02	1.52E-03
Pu-238										
Pu-239										
Am-241										
Pu-241										
Cm-242										
Cm-244										

Using FRMAC Method M.5.8 from FRMAC Assessment Manual Volume 1, 2003
Based on default crop growth and retention rates

Data Available for Calculation:		X.XXE+XX
No Data Available-Not Included:		
Below MDA - Not Included:		XXX.XX

Figure 1-Example of sample data sheet

These values are directly correlated to deposition on the ground as determined by the NARAC atmospheric model. Conversion factors to crop values are derived from FRMAC Assessment Manual methodology. This sheet can be provided directly to players as a means to inject laboratory results during the ingestion phase of the exercise. This file will be provided to the planner in a comprehensive document along with the controller support data sheets as a PDF.

Below (Figure 2) is an example of a Controller Sample Sheet which would accompany the sample sheets to be provided to the players. This sheet provides an indication of FRMAC assessment of the data set and is not intended to be used for FEMA grading purposes. An important items to note:

- FRMAC will assess water data based upon the requirements set forth in the EPA Safe Water Drinking Act which allows no more than 4 mrem additional dose per year.
- Soil sample samples are assessed according to relocation requirements in the EPA PAG manual
- Milk and vegetation samples are assessed according to FDA DILs

Sample Control #	1	Location:	Location 1	Analyst:
Sample Type:	Food	Latitude:	34.633163	Date:
Sample Description:	Berries	Longitude:	-87.238284	Time:

^{90}Sr & ^{131}I Tests		Column A	Column B			Column C	Column D
Ratio concentration to corresponding DIL. Fail, if ratio ≥ 1.0.	Nuclide	Food Concentration (unit*/kg)	DIL (Bq/kg)	DIL (pCi/kg)	DIL (µCi/kg)	A/B Match units of A and B	Mark with X if Column C ≥ 1.0
	^{90}Sr	6.21E-02	160	4,300	4.30E-03	1.44E+01	x
*Bq/kg, pCi/kg, or µCi/kg	^{131}I	5.15E+01	170	4,600	4.60E-03	1.12E+04	x

^{134}Cs & ^{137}Cs Test		Column A	Column B			Column C	Column D
Ratio sum of both concentrations to corresponding DIL. Fail, if ratio ≥ 1.0.	Nuclide	Food Concentration (unit*/kg)	DIL (Bq/kg)	DIL (pCi/kg)	DIL (µCi/kg)	A/B Match units of A and B	Mark with X if Column C ≥ 1.0
	^{134}Cs	7.07E-01					
	^{137}Cs	9.27E-01					
*Bq/kg, pCi/kg, or µCi/kg	Sum ∑A	1.63E+00	1,200	32,000	3.20E-02	5.10E+01	x

^{238,239}Pu & ^{241}Am Test		Column A	Column B			Column C	Column D
Ratio sum of all 3 concentrations to corresponding DIL. Fail, if ratio ≥ 1.0.	Nuclide	Food Concentration (unit*/kg)	DIL (Bq/kg)	DIL (pCi/kg)	DIL (µCi/kg)	A/B Match units of A and B	Mark with X if Column C ≥ 1.0
	^{238}Pu	0.00E+00					
	^{239}Pu	0.00E+00					
	^{241}Am	0.00E+00					
*Bq/kg, pCi/kg, or µCi/kg	Sum ∑A	0.00E+00	2	54	5.40E-05	0.00E+00	

^{103}Ru & ^{106}Ru Tests		Column A	Column B			Column C	Column D
Ratio concentrations to their corresponding DILs, then sum. Fail, if ratio ≥ 1.0.	Nuclide	Food Concentration (unit*/kg)	DIL (Bq/kg)	DIL (pCi/kg)	DIL (µCi/kg)	A/B Match units of A and B	Mark with X if Column C ≥ 1.0
	^{103}Ru	7.25E-01	6,800	180,000	1.80E-01	4.03E+00	
	^{106}Ru	1.77E-01	450	12,000	1.20E-02	1.48E+01	
*Bq/kg, pCi/kg, or µCi/kg					Sum∑C	1.88E+01	x

If any one test fails, then the sample exceeds PAG.	No Principal Radionuclide ≥ DIL	This Sample Exceeds PAG

Figure 2 Example Sample Controller Sheet

What the state provides to FRMAC

The following sections outline each of the elements that the FRMAC planner will need to obtain from the state/utility planners. Each detail fits into the final product similar to how puzzle pieces combine to form a puzzle. Individually, they may not seem significant, but with any one piece missing, the puzzle, or final product, cannot be completed.

The IPX Planning Document

The very first set of information to obtain from the data planners must include all of the specifics about the release that is built into the IPX scenario. The IPX planning document (Appendix B) helps to streamline this process by providing a simple mechanism to ensure that the FRMAC planners obtain much of the necessary information from the data planners. The following sections outline the other pieces of information that are required during the planning process.

Agriculture Locations

State/licensee planners should provide sample locations as soon as a modeling dataset is decided upon. This process can be accomplished in tandem with the map production process. Many options are available to assist the state/licensee planner in choosing the sample locations. The simplest option is to provide them with a .kml or .shp file (files which function in Google Earth and/or ArcGIS products). In this case the planner can create tables or "drop pins" for sample locations and provide this to the FRMAC planner. If this is of interest to the state/licensee planner the FRMAC point of contact can assist them with the process. The state/licensee planner can also hand draw locations on map images as well. Finally, FRMAC point of contact can also choose the locations if that is desired by the state/licensee.

It is important that these locations are chosen strategically. In general, FEMA would like to see samples which exceed the FDA DILs for multiple types of media and relocation in several locations. In addition there should be samples which are below action levels. If there are any special needs or instructions this needs to be communicated to the FRMAC point of contact when the locations are chosen. For example, if cattle are on stored feed and water then perhaps, in the "affected area" all milk samples will be below the FDA DIL. A quick note about these needs to the FRMAC point of contact is sufficient. Below is an example of what data are required for samples.

Sample Type	Latitude	Longitude	Special Instructions/Comments	Returned FRMAC Value
Soil	XX.XXXXX	-XXX.XXXXX	NA	Concentration of nuclides in uCi/m^2
Water	XX.XXXXX	-XXX.XXXXX	Covered water source with no venting	Concentration of nuclides in uCi/L
Vegetation	XX.XXXXX	-XXX.XXXXX	Ready for harvest	Concentration of nuclides in uCi/kg
Milk	XX.XXXXX	-XXX.XXXXX	Cows on stored feed	Concentration of nuclides in uCi/L

Meteorological Information

The weather conditions can have a major impact on the final deposition footprint. Changes to the speed of the wind will alter the extent of the footprint, and potentially, the width as well. Wind speeds can be used to make major as well as minor adjustments to the overall area that is impacted by the contamination for the IPX scenario.

Using real meteorological information or rain could create hot spots that are isolated from the rest of the footprint. Additionally, the edges of the footprint generally have curves and random movement evidenced on the map products. Including canned meteorological information typically produces a non-varying cigar-like shape. Figure 3 illustrates the affects of real versus canned met. The locations are different, but the general illustration of the shape will be consistent with what is usually encountered. These types of effects must be considered in the early data planning stages.

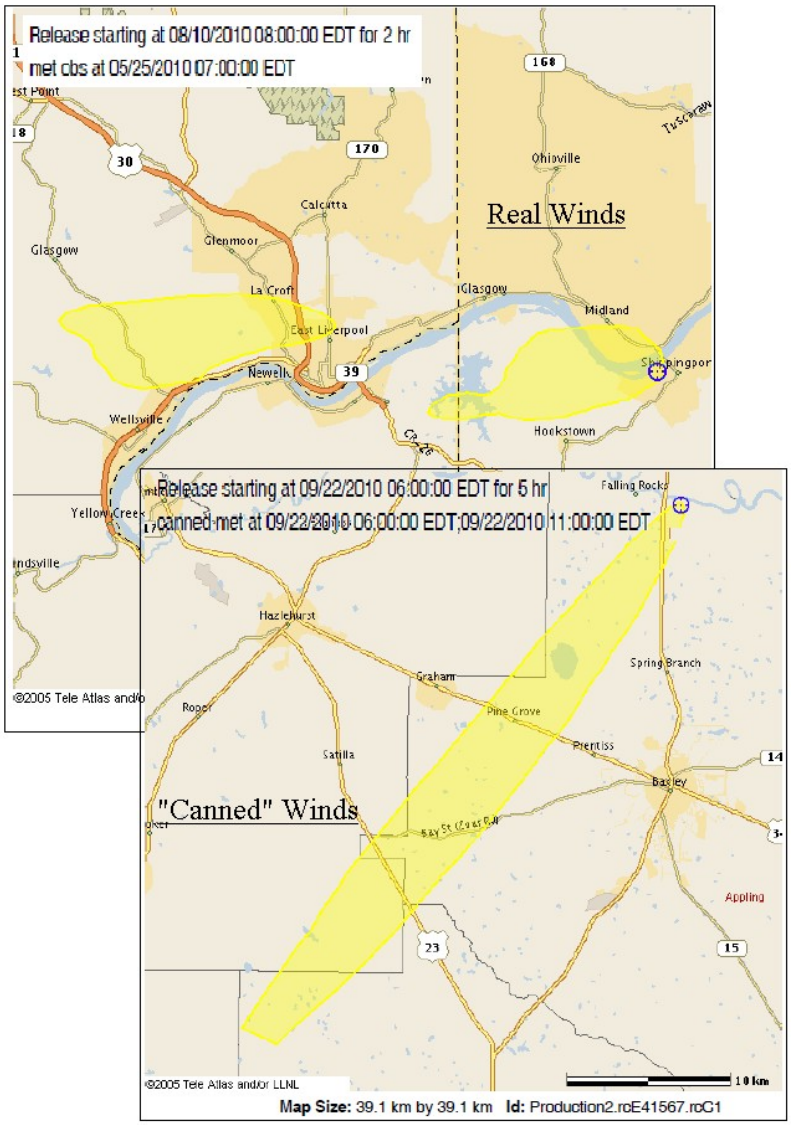


Figure 3 Example of the effects of canned vs real winds

Source Term

The source term contains a list of radionuclides, along with their quantities, and release rates for an event. It also must include the length of time over which the release occurred. The planner can send this information in any format, but it is preferred as an Excel compatible .csv file from RASCAL. Alternatively, the FRMAC planner is able to suggest a source term from a previous exercise with a nuclear power plant of similar type with known quantities of material that would meet the specific objectives of the state/utility planners. Figure 4 is an example what a source term may look like.

Data Elements

Much of what is included on the map products comes from national databases provided to the FRMAC Graphical Information System (GIS) team. While this source of information is extremely helpful, there are a few inherent flaws in the use of a national registry for local information. For example, the data may be out of date or may rely on a third-party data collector that may have some inaccuracies.

Therefore, when it can be obtained, getting the local agricultural locations from the state is very helpful for maintaining accuracy in these elements.

Another area in which local knowledge is very helpful is in determining what plants guide the growing season. By knowing what agricultural products are currently in season, the maps can be adjusted to only include the relevant farm locations to the date on which the IPX is being staged. For example, during December on the East Coast, there would be no need to include strawberry farms on the maps, since there would be no strawberries currently growing at that time.

Other Details

Any other details that the state/plant data planners find important or relevant need to be addressed at the initial planning stage. If the plant requires a special map, or something that deviates from the standard practice, the FRMAC planner should know this as early on in the process as possible. FRMAC planners also appreciate receiving a copy of the exercise plan and/or scenario to ensure there is congruency between the products and objectives.

	1730	1745	1800	1815	1830	1845
Name	uCi/15 min	uCi/15 min	uCi/15 min	uCi/15 min	uCi/15 min	uCi/15 min
Kr-85	7.48E+07	6.78E+07	2.53E+07	1.27E+07	2.56E+06	2.58E+05
Kr-85m	9.15E+08	7.99E+08	2.87E+08	1.39E+08	2.69E+07	2.60E+06
Kr-87	8.06E+07	6.38E+07	2.08E+07	9.12E+06	1.60E+06	1.41E+05
Kr-88	1.26E+09	1.07E+09	3.76E+08	1.78E+08	3.37E+07	3.18E+06
Sr-89	2.68E+07	2.43E+07	9.08E+06	4.57E+06	9.20E+05	9.25E+04
Sr-90	1.04E+06	9.46E+05	3.53E+05	1.78E+05	3.58E+04	3.60E+03
Sr-91	1.80E+07	1.60E+07	5.86E+06	2.90E+06	5.72E+05	5.66E+04
Y-91	2.31E+06	2.09E+06	7.81E+05	3.93E+05	7.92E+04	7.97E+03
Mo-99	1.13E+07	1.02E+07	3.80E+06	1.91E+06	3.84E+05	3.85E+04
Ru-103	8.53E+06	7.73E+06	2.88E+06	1.45E+06	2.92E+05	2.94E+04
Ru-106	1.85E+06	1.68E+06	6.27E+05	3.16E+05	6.36E+04	6.40E+03
Sb-127	8.16E+06	7.38E+06	2.75E+06	1.38E+06	2.77E+05	2.78E+04
Sb129	1.33E+07	1.15E+07	4.14E+06	2.00E+06	3.87E+05	3.74E+04
Te-129m	7.78E+06	7.05E+06	2.63E+06	1.32E+06	2.66E+05	2.68E+04
Te-131m	1.55E+07	1.40E+07	5.20E+06	2.60E+06	5.21E+05	5.21E+04
Te-132	1.62E+08	1.47E+08	5.46E+07	2.74E+07	5.50E+06	5.53E+05
I-131	2.76E+08	2.50E+08	9.32E+07	4.69E+07	9.43E+06	9.48E+05
I-132	3.57E+07	3.00E+07	1.04E+07	4.84E+06	9.02E+05	8.42E+04
I-133	4.43E+08	3.99E+08	1.47E+08	7.36E+07	1.47E+07	1.47E+06
I-134	1.14E+06	8.49E+05	2.60E+05	1.07E+05	1.77E+04	1.46E+03
I-135	2.19E+08	1.93E+08	7.03E+07	3.45E+07	6.76E+06	6.63E+05
Xe-131m	1.27E+08	1.15E+08	4.30E+07	2.16E+07	4.36E+06	4.38E+05
Xe-133	2.15E+10	1.94E+10	7.24E+09	3.64E+09	7.32E+08	7.36E+07
Xe-133m	7.08E+08	6.40E+08	2.38E+08	1.19E+08	2.40E+07	2.40E+06
Xe-135	2.36E+09	2.10E+09	7.69E+08	3.80E+08	7.50E+07	7.41E+06
Xe-138	1.43E+00	6.23E-01	1.12E-01	2.70E-02	2.61E-03	1.26E-04
Cs-134	1.81E+07	1.64E+07	6.13E+06	3.08E+06	6.21E+05	6.25E+04
Cs-136	7.12E+06	6.45E+06	2.41E+06	1.21E+06	2.44E+05	2.45E+04
Cs-137	1.16E+07	1.05E+07	3.92E+06	1.97E+06	3.98E+05	4.00E+04
Ba-140	6.04E+07	5.47E+07	2.04E+07	1.03E+07	2.06E+06	2.08E+05
La-140	2.68E+06	2.42E+06	8.98E+05	4.50E+05	9.03E+04	9.04E+03
Ce-144	8.11E+06	7.36E+06	2.74E+06	1.38E+06	2.78E+05	2.80E+04
Np-239	1.45E+08	1.31E+08	4.86E+07	2.44E+07	4.89E+06	4.91E+05

Name	Total Release uCi
Kr-85	5.00E+08
Kr-85m	6.51E+09
Kr-87	7.22E+08
Kr-88	9.34E+09
Sr-89	1.78E+08
Sr-90	6.92E+06
Sr-91	1.22E+08
Y-91	1.53E+07
Mo-99	7.53E+07
Ru-103	5.66E+07
Ru-106	1.23E+07
Sb-127	5.42E+07
Sb129	9.31E+07
Te-129m	5.16E+07
Te-131m	1.04E+08
Te-132	1.08E+09
I-131	1.88E+09
I-132	2.86E+08
I-133	3.05E+09
I-134	1.68E+07
I-135	1.56E+09
Xe-131m	8.53E+08
Xe-133	1.35E+11
Xe-133m	4.76E+09
Xe-135	1.63E+10
Xe-138	3.03E+05
Cs-134	1.24E+08
Cs-136	4.89E+07
Cs-137	7.95E+07
Ba-140	4.02E+08
La-140	1.79E+07
Ce-144	5.38E+07
Np-239	9.63E+08
Total Activity	1.84E+11

Figure 4 Example Source Term

Conclusion

The DOE considers FRMAC and NARAC IPX participation an important and worthwhile endeavor for all parties. We strive to supply supporting data products for these exercises that will provide useful tools for the players during the exercise. We thank you for including us in this crucial component of the national radiological emergency response effort.

Appendix A
FRMAC Technical Training Agenda
IPX Dose Assessment Training

This course provides an overview of the key concepts and methodologies used in assessing radiological data in an emergency response situation. More specifically, it is designed to assist state, local, and tribal dose assessment personnel in performing calculations necessary during an ingestion pathway exercise (IPX). This course is best suited for students who, during a radiological emergency, would be expected to perform dose calculations or otherwise determine the effects of radiation on people and the environment.

Delivery method: Lectures aided by Power Point presentation slides and instructor led example calculations.

Optimal number of students: 20 – 25

Instruction period: 3 hours

Course Topics:

1. Understanding Environmental Protection Agency Protective Action Guidelines (PAGs) and Food and Drug Administration Derived Intervention Levels (DILs)
2. How to calculate Derived Response Levels (DRLs)
3. Compare/contrast the RASCAL and the National Atmospheric Release Advisory Center (NARAC) atmospheric models.
4. Compare/contrast RASCAL and TurboFRMAC software capabilities
5. Overview of FRMAC data products
6. Overview of updated guidance documents
7. Other topics as requested

FRMAC Technical Field Training

The field-training course introduces FRMAC field equipment and methodologies. Students will have an opportunity to use FRMAC equipment and forms and to learn about FRMAC procedures. This course is best suited for students who, during a radiological emergency, would be called upon to collect field samples or monitoring data.

Delivery method: Lectures aided by Power Point presentation slides and hands-on activities

Optimal number of students: 20 – 25

Instruction period: 5 - 6 hours

Course Topics:

1. Overview of the FRMAC and consequence management assets
2. Demonstration of FRMAC monitoring and sampling equipment to include eFRMAC data tablets
3. Overview of FRMAC monitoring and sampling techniques
4. Sample processing and receipt
5. Other topics as requested

Appendix B
IPX Planning Checklist

	Data Development Questions:	Answers:
1	Who will be the data FINAL Approver for the IPX? Contact Email: Contact Phone:	
2	What are the specific extent (in miles) objectives for the maps? Relocation: Evacuation: Ingestion:	
3	Is there a maximum distance that we cannot pass for the extent? Relocation: Evacuation: Ingestion:	
4	Are there any locations/counties that you NEED TO have affected? Relocation: Evacuation: Ingestion:	
5	Are there any locations/counties that CANNOT be affected? Relocation: Evacuation:	

	Data Development Questions:	Answers:
	Ingestion:	
6	Do you have a specific wind direction?	
7	What guidance should be used for your nuclide mix (see guidance comparison Table)?	
8	Do you have any specific requests for your map products (for example, a map with the sample point locations and pass/fail noted; the AMS flyover map without the footprint layer shown, etc)?	
9	Who will be selecting the sample locations (FRMAC data planner, Plant, etc)? Contact Email: Contact Phone:	
10	What are the names for the POCs that will gain access to CMWeb (See CMWeb tab)?	
11	Can you print your maps? If yes, what is the POC information to have the maps printed? If no, what to what address/name should we mail the maps?	

	IPX Planning Questions:	Answers:
1	Where will the advanced party meeting be held?	
2	At what day and time should FRMAC arrive?	
3	Where will the IPX be held?	
4	At what time should FRMAC arrive?	
5	Who will send us the agenda?	

	Data Development Questions:	Answers:
	Contact Email: Contact Phone:	
6	Are there ANY scenario driven requests for the map release order/timeframe?	
7	Are there any other questions, requests, or concerns that FRMAC can address?	

Guidance Comparison:

EPA 1992		EPA 1992 + FDA 1998		NUREG-1465 (1995)			ICRP60+ Dosimetry Model	
ICRP Reference:	26/30	ICRP Reference:	26/30	ICRP Reference:	26/30		ICRP Reference:	60/66
Description:	This comes from the original Protective Action Guide (PAG) Manual - EPA 400-R-92-001 Tables 7-1 and 7-2.	Description:	This guidance uses the same model as EPA 1992 for post-plume phase, but also includes references to nuclides from the FDA 1998 manual for ingestion.	Description:	This guidance references nuclides with abundances in line with expected release ratios from nuclear generating stations.		Description:	This is a more comprehensive list of nuclides which have dose conversion factors derived from ICRP 60 and 66 publications. A more complex resuspension model is used for dose projections over extended periods of time.
Key Considerations:	Dose conversion factors (DCF) here are used to make intermediate phase decisions. This guidance uses ICRP lung models which can produce more conservative dose conversion factors for Am/Pu/Np inhalation.	Key Considerations:	Additional nuclides from the FDA 1998 manual that are not present in the EPA 1992 manual will contribute to PAG dose projections but slight variations in the dose conversion factors (and therefore projections) may occur.	Key Considerations:	This model agrees with TurboFRMAC calculations. DCFs will be: 1. Derived from TurboFRMAC using the 1992 resuspension method. -or- 2. Derived from TurboFRMAC using the 2010 method.		Key Considerations:	Calculations will be in total agreement with the NARAC model. Results can also be correlated to those from RASCAL.
Select One:	☐		☐		☐			☐
Nuclides with Guidance:		Nuclides with Guidance:		Nuclides with Guidance:			Nuclides with Guidance:	
Zr-95		Cs 134	Pu-239	Zr-95	Cm-242	Pr-143	Cs-134	Ce-144/Pr-44/Pr-144m
Nb-95		Cs 137	Am-241	Nb-95	Cm-244	Pr-144	I-131	Pm-147
Ru-103		Ru-103	Ru-103 + Ru-106	Ru-103	Te-127	Pr-144m	La-140	Pu-241/U-237
Ru-106		Ru-106	Sr-89	Ru-106	Te-127m	Nd-147	Nb-95	Ra-226/Rn-222
Te-132		Zr-95	Sr-91	Te-132	Te-129	Pu-238	I-133	Ru-103/Rh-103m
I-131		Nb-95	I-129	I-131	Te-129m	Kr-85	Am-241	Ru-106/Rh-106
I-132		Te-132	Ce-141	I-132	Te-131	Kr-85m	Ce-141	Sb-127/Te-127
I-133		I-131	Ce-144	I-133	Te-131m	Kr-87	Cm-242	Sb-129/Te-129
I-135		Ba-140	Np-237	I-135	Te-133	Kr-88	Cm-244	Se-75
Cs-134		Sr-90	Np-239	Cs-134	I-134	Xe-131m	I-129	Sr-90/Y-90
Cs-137		Cs-134 + Cs137	Pu-241	Cs-137	Cs-135	Xe-133	Sr-89	Sr-91/Y-91m
Ba-140		Pu-238 + Pu-239 + Am-241	Cm-242	Ba-140	Cs-136	Xe-133m	Np-239	Te-129m/Te-129
La-140		Pu-238 + Pu-239 + Am-241	Cm-244	La-140	Cs-138	Xe-135	Pu-239	Te-131m/Te-131
				Sr-89	Ba-137m	Xe-135m	Cs-136	Te-132/I-132
				Sr-90	Ce-143	Xe-138	Co-60	Tm-170
				Sr-91	Zr-97	Y-90	Kr-87	Cs-137/Ba-137m
				Ce-144	Mo-99	Y-91	I-134	Gd-153
				I-129	Tc-99	Y-91m	Xe-133	Ba-140/La-140
				Ce-141	Tc-99m	Co-58	Xe-135	Yb-169
				Np-237	Rh-103m	Co-60	Xe-138	Zr-95/Nb-95m/Nb-95
				Np-239	Rh-105	Rb-86	Y-91	Cf-252
				Pu-239	Rh-106	Rb-87	Pu-238	I-135/Xe-135m
				Pu-241	Sb-127	Rb-88	Kr-88/Rb-88	Ir-192
				Am-241	Sb-129		M0-99/Tc-99m	Np-237/Pa-233

Appendix C
Advanced Party Meeting Checklist

Advance Party Meeting Checklist

Event Status and Action Worksheet

[Event Name]

[Location]

[Date]

Concurrence with APM Checklist Decisions

Title	Signature	Date
DHS Representative		
Coordinating Agency Representative		
FRMAC Director		
State Representative		
Local Representative		

Contact Information

Incident Commander/Unified Command		
Position	**Name**	**Location During Operations** **Phone Number**
Incident Commander		
Lead State Official		
DHS Representative		
FEMA Representative		
Coordination Agency Representative		

Command Staff

Contact Information

Position	Name	Location During Operations Phone Number
Incident Commander		
Planning Chief		
Operations Chief		
Finance Administrator		
Public Information Officer		
Safety Officer		
Liaison Officer		
Technical Specialist		

Contact Information

FRMAC Staff		
Position	**Name**	**Location During Operations** **Phone Number**
FRMAC Director		
FRMAC Manager		
FRMAC Monitoring Manager		
FRMAC Assessment Manager		
FRMAC Health and Safety Manager		
FRMAC Lab Manager/Sample Control		

Other Federal Agencies		
Position	**Name**	**Location During Operations** **Phone Number**
EPA Regional Representative		
Advisory Team Leader		
NRC Representative		
DOE Senior Energy Official		
Department of Defense Representative		

Contact Information

State/Local Liaisons		
Organization	**Contact Name**	**Location During Operations** **Phone Number**

FRMAC Liaisons		
Location	**Contact Name**	**Phone Number**

Unit Leaders			
Unit	**Check if Unit Req'd**	**Unit Leader Name**	**Phone Number**

Contact Information

Environmental (FRMAC Monitoring and Sampling)	☐		
Planning (FRMAC Assessment)	☐		
Health and Safety	☐		
Other	☐		
Other	☐		
Other	☐		
Other	☐		

Logistics

Event Locations		
Location of Interest	**Contact Name**	**Address and Phone Number**
FRMAC		
EOC 1		
EOC 2		
EOC 3		

Support Items		
Item	**Contact Name**	**Address and Phone Number**
Air Freight Delivery		
Radio Frequencies		
Liquid Nitrogen		
Plotter		

Situational Briefing Information

Describe the Event			
Has a release or loss occurred?	**Yes**	**No**	**Unknown**
Start Time (approximate)	**Date:**	**Time:**	
Stop Time (approximate)	**Date:**	**Time:**	**Has not stopped**
Multiple Releases?	**Yes**	**No**	**If so, how many?**
Further Details and Current Actions Taken			

Source Term
List involved isotopes and abundances if known:
What is the chemical form (powder, liquid, explosive dispersal, etc.)?

Situational Briefing Information

Data Products
Models - *Have any models been created and if so, where are they being stored and how can they be accessed?*
Sample Data – *Has there been any field sampling/monitoring data collected? How can the FRMAC obtain this data?*
What Derived Response Levels and assumptions will be used to implement Protective Action Guides (PAGs)? What is the status of the protective actions taken for the public?

Situational Briefing Information

Objective	Resource Requirements	Products Needed	Date/Time Needed
Evacuation/Shelter in Place			
Worker Dose Projection			
Road Closure/Re-Open			
Hotline Support			
Population Monitoring Support			
Monitoring Support			

Situational Briefing Information

Objective	Resource Requirements	Products Needed	Date/Time Needed
Health Physics Support			
AMS Flyover Support			

Appendix D
Data Package Acceptance Form

Ingestion Pathway Exercise Data Initiation Request

Site Name:	
IPX Date:	
FEMA Deadline: (60 days prior to IPX)	
FRMAC Deadline: (120 days prior to IPX)	

Approvals

_____ *Date:* _____
State Planner

_____ *Date:* _____
Utility Planner

_____ *Date:* _____
FRMAC Planner

Appendix E
Definitions

Advisory Team for Environment, Food, and Health (Advisory Team or A-Team) – a radiological response ground tasked with providing protective action recommendations to state and local governments on behalf of its member agencies. The permanent membership includes representatives from the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), and the U.S. Department of Agriculture (USDA). The permanent members may invite other agencies to participate in Advisory Team activities. CRCPD, *http://www.crcpd.org/ATeam/Ateam.htm*, Accessed 3/26/2012.

Consequence Management Home Team (CMHT) – a virtual extension of the deployed FRMAC asset. Responders from across the DOE complex along with support from the Advisory Team work, by phone, to provide technical assistance to local, tribal, and state responders and decision makers. The atmospheric modeling, dose assessment, GIS, and laboratory support provided by a fielded FRMAC can also be reasonably achieved within the CMHT.

Extent of Play Agreement – a document required by FEMA during the IPX planning process. This document outlines such requirements as: affected counties, which objectives require demonstration, etc. The document is the responsibility of the state with input from the licensee.

Functional Exercise – an exercise that examines and/or validates the coordination, command, and control between multi-agency coordination centers (e.g., emergency operation center, joint field office, etc.). A functional exercise does not involve any "boots on the ground" (i.e., first responders or emergency officials responding to an incident in real time).
FEMA, https://hseep.dhs.gov/pages/1001_about.aspx, Accessed 3/26/12.

Offsite Response Organization (ORO) – term used to describe the collective of response organizations (typically local, tribal, and state) who have some responsibilities during a response beyond those of the nuclear generating station licensee. Therefore, "offsite" refers to those who are responsible for responding to everything outside of the boundaries of the nuclear power plant.

Scenario Package – the full set of documents which must be submitted to FEMA at least 60 days prior to the graded exercise. It may include the Extent of Play Agreement, notional timeline of events, all data to be used by players to take an action during the exercise, injects, and any other supporting documentation.