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Centers for Disease Control and Prevention (CDC) Radiation Hazard Scale Data Product Review Feedback Report

A. Askin, B. Buddemeier, M. Alai, K. Yu

September 21, 2017

Disclaimer

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Lawrence Livermore National Laboratory

Centers for Disease Control and Prevention (CDC) Radiation Hazard Scale Data Product Review Feedback Report

Unclassified

September 12, 2017

Amy Askin
Brooke Buddemeier
Maureen Alai
Kristen Yu

Disclaimer

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Table of Contents

Section 1

Introduction

In support of the Department of Energy (DOE) National nuclear Security Administration (NNSA) and the Centers for Disease Control and Prevention (CDC), Lawrence Livermore National Laboratory (LLNL) assisted in the development of new data templates for disseminating and communicating FRMAC[1] data products using the CDC Radiation Hazard Scale communication tool. To ensure these data products will be useful to stakeholders during a radiological emergency, LLNL facilitated opportunities for product socialization and review. LLNL used two mechanisms for socialization and review:

1. A full-day workshop with state and local stakeholders hosted at the Middlesex Fire Training Academy in Sayreville, New Jersey
2. An online survey disseminated to Radiological Operations Support Specialist (ROSS)-trained experts, participants in the 2016 Northern Lights Nuclear Power Plant emergency exercise, and others in the radiological response community

Full-Day Workshop

The Full-Day Workshop provided an opportunity to introduce stakeholders to the products and understand how stakeholders would use the data products to communicate during a radiological emergency. The 26 workshop participants were selected and invited by the New Jersey Department of Environmental Protection. The workshop began with an overview of radiological incidents and data products to support response, communication challenges, and an introduction to the CDC Radiation Hazard Scale. Following these introductory presentations, participants broke into three groups to decide how to use the CDC Radiation Hazard Scale Data Products to communicate information to their respective audiences (public/media, emergency responders, or decision makers/elected officials) during an improvised nuclear device (IND) incident. Each group selected a spokesperson to deliver their messages using the products in front of the whole group to seed a feedback discussion about what messages, for which audiences, are effectively supported by the products. Participants repeated this process with products for a radiological dispersal device (RDD) scenario. In the final feedback session, participants also reviewed products for a Nuclear Power Plant (NPP) incident. This report presents the results of these feedback discussions as well as results from written surveys completed by the participants. The written surveys were identical to the online survey described in the next section.

Survey

The survey provided an opportunity to reach out to a broader set of stakeholders to socialize the products and get stakeholder feedback on the content and format of the data products. The primary

[1] Federal Radiological Monitoring and Assessment Center

survey used the same three radiological incidents (IND, RDD, and NPP) as the workshop to assess how these products support a breadth of incident responses. LLNL developed a second survey to specifically request feedback from participants in the 2016 Northern Lights Nuclear Power Plant emergency exercise. This second survey asked the same questions as the primary survey but only used data products related to the NPP scenario. Survey questions addressed the product wording, map scaling and coloring, and usefulness in supporting communication during a radiological incident.

This report presents the results from these reviews. Section 2 describes the stakeholders who participated in the review and the key feedback gleaned. Section 3 provides recommended next steps for improving the use of the Radiation Hazard Scale products and additional opportunities for socialization and review. Appendices A, B, and C provide more detail on the feedback, images of the products as reviewed, and a list of individuals who provided feedback, respectively.

Section 2

Feedback Summary

This section provides a summary of feedback from the workshop and the survey, including a description of the stakeholders who participated in providing feedback.

Participating Stakeholders

Workshop Participants

The workshop included 26 participants from several New Jersey agencies, including:

- Essex Regional Health Commission
- Hudson Regional Health Commission
- Middlesex County Department of Public Safety and Health
- Morris County Office of Emergency Management
- Morris County Office of Health Management
- New Jersey Department of Environmental Protection
- New Jersey Department of Human Services
- New Jersey Department of Public Health
- New Jersey State Police
- New Jersey Voluntary Organizations Active in Disaster
- Rutgers New Jersey Medical School

The written survey handed out at the workshop requested that participants indicate their response background. Figure 1 shows the percentage of participants who self-identified as having each type of background expertise. Free responses from those marking “Other” included: emergency response coordinator, state agency, disaster mental health/mass care planning and response, behavioral health, social media coordinator, and Voluntary Organizations Active in Disaster.

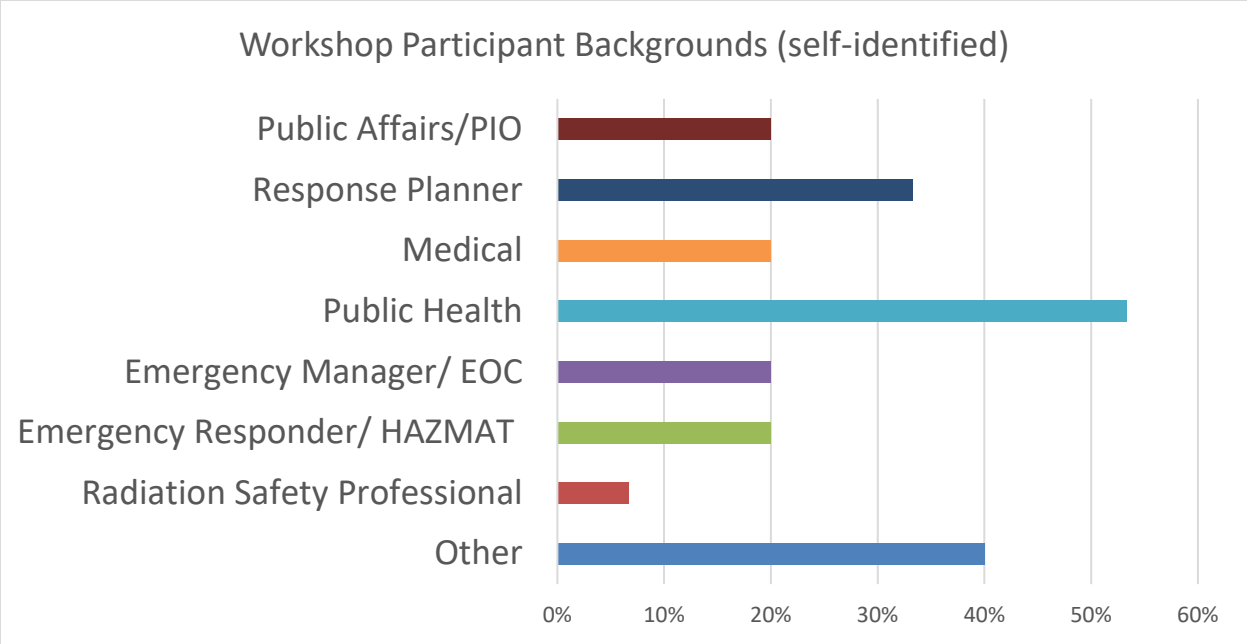


Figure 1: Workshop participant backgrounds as identified in responses to the written survey. Note: this question was optional and participants could select as many areas as they wanted. (EOC-Emergency Operations Center, PIO-Public Information Officer)

Survey Participants

A total of 10 people responded to the electronic survey, including both the full survey as well as the 2016 Northern Lights scenario-specific survey. Figure 2 shows the backgrounds of those who responded to the survey as self-identified. “Other” responses included: program manager, incident response and supervision of onsite NPP safety oversight, educator, and state radiation control program.

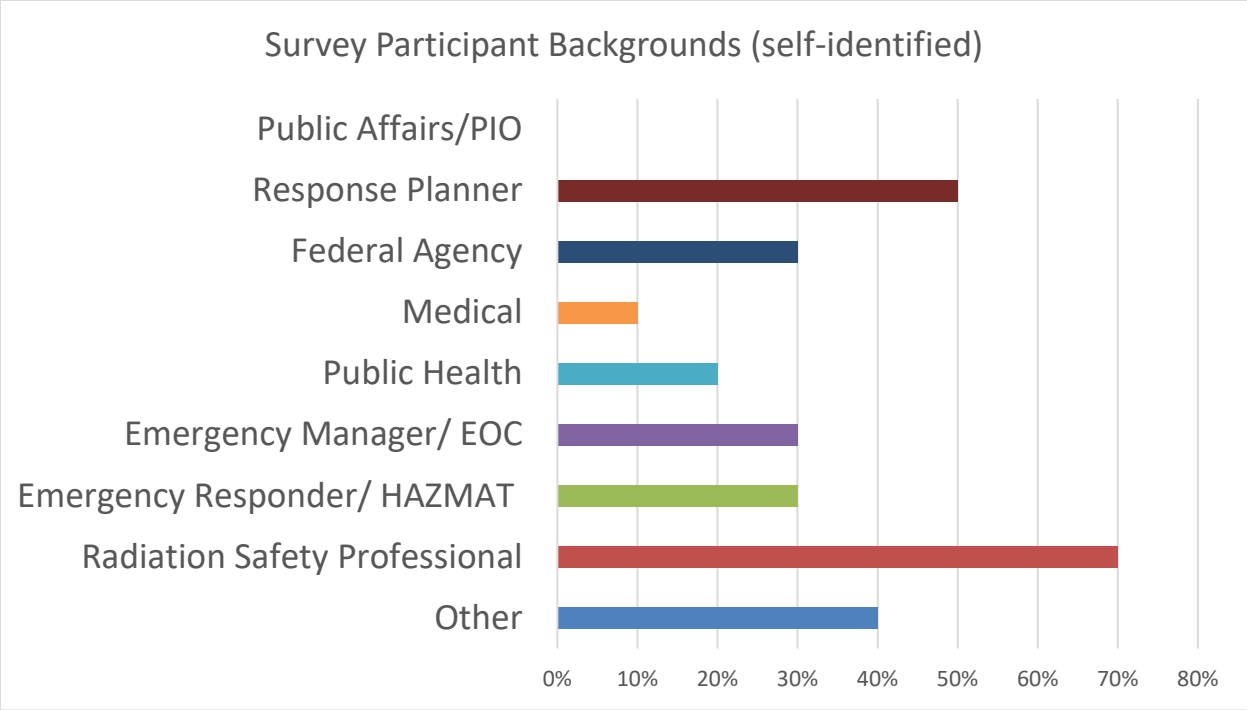


Figure 2: Survey participant backgrounds as identified in responses to the electronic survey. Note: this question was optional and participants could select as many areas as they wanted. (EOC-Emergency Operations Center, PIO-Public Information Officer)

Key Feedback Themes

Roughly two thirds of participants thought that the data products would be very useful to them in their roles as shown in Figure 3. All participants thought the products would be at least slightly useful. Participants also thought these products would be useful for a variety of purposes as shown in Figure 4.

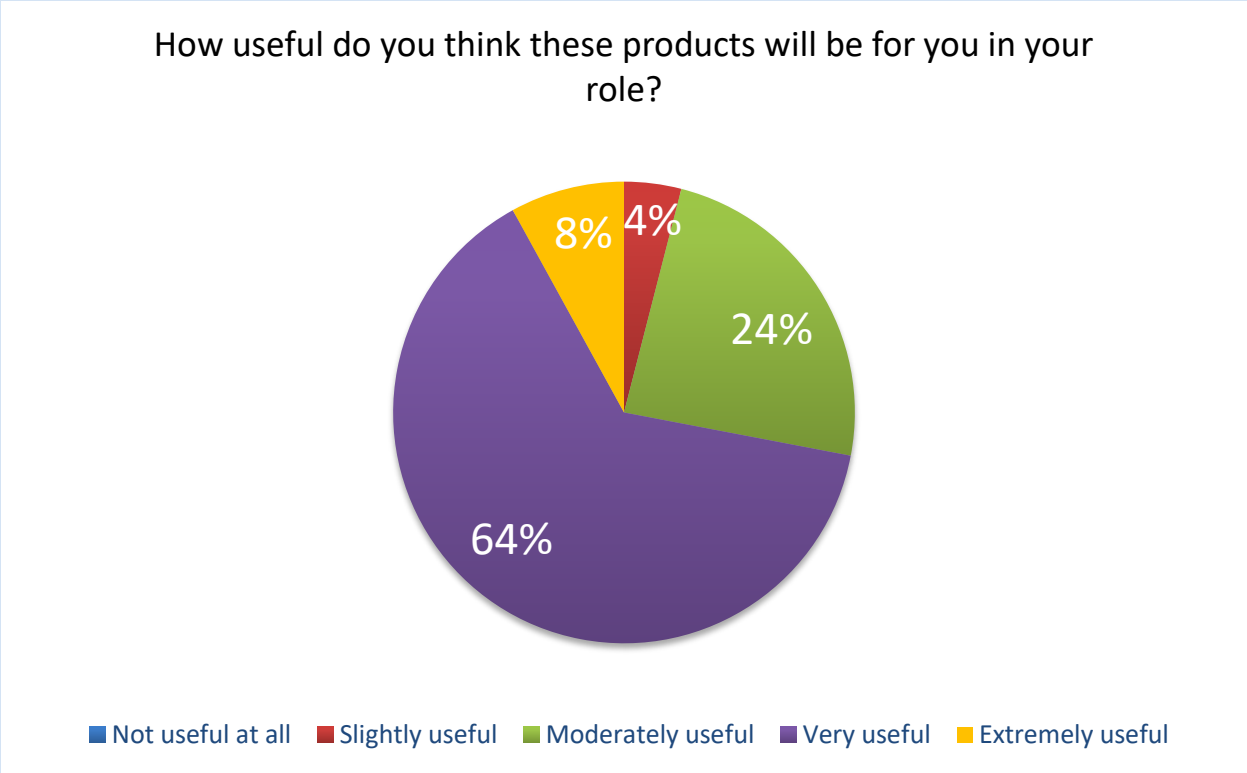


Figure 3: Participant ratings of product usefulness.

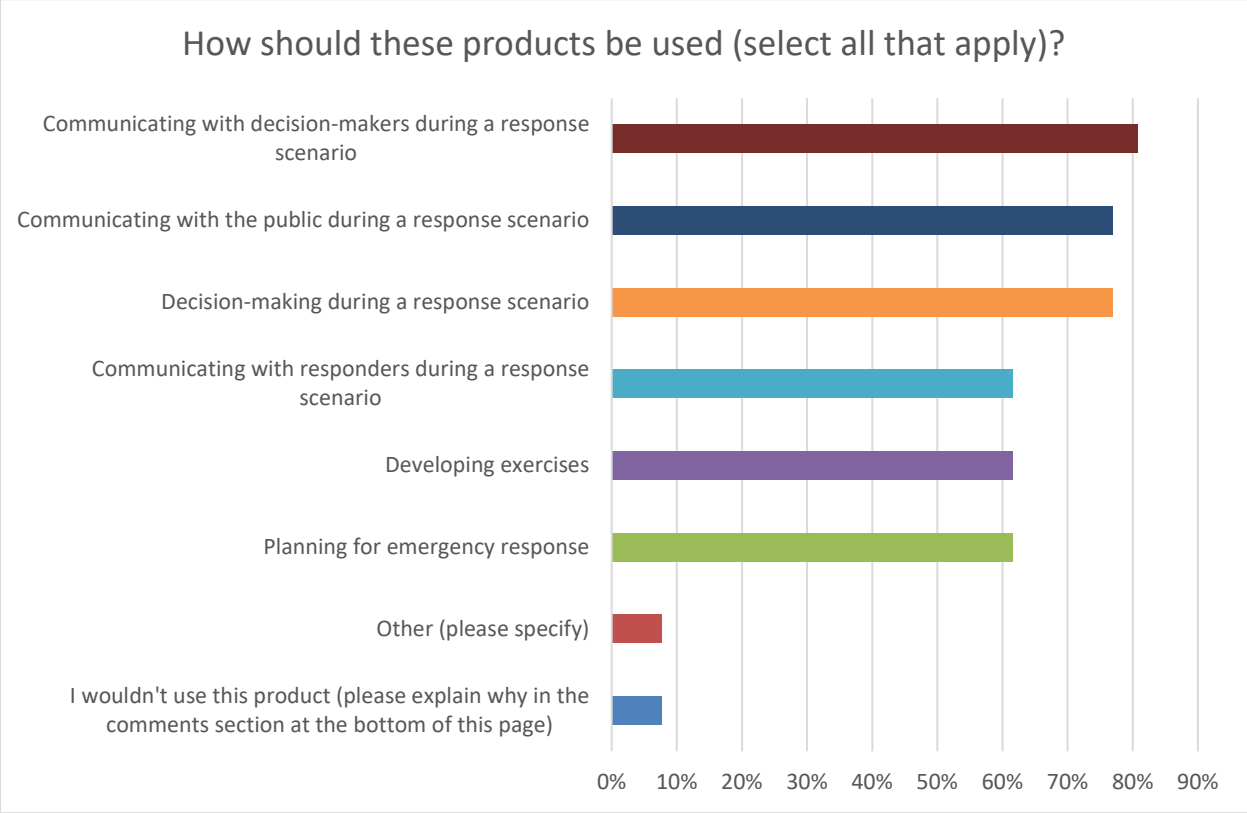


Figure 4: Participant feedback on how products should be used.

The feedback from the workshop and the survey also highlights several key themes regarding the Radiation Hazard Scale, the format of the data products, the content of the data products, and potential uses of the data products.

Radiation Hazard Scale Feedback

- The fuzzy boundaries between the levels are helpful in communicating that there is not a defined, sharp transition between the levels of the hazard spectrum.

Radiation Hazard Scale Data Product Format

- Overlay needs more transparency so the map can be seen underneath. This should be checked for display on a screen, on a projector, and as printed as the level of opacity may vary depending on the medium.
- Using the same fuzzy boundaries on the map between zones as are shown in on the Radiation Hazard Scale would be useful in conveying the spectrum of hazard.
- Measurements should be in miles/feet as opposed to kilometers/meters.
- Local time should be used instead of UTC.
- Visual indication that the map on the right is a zoomed-in version of the map on the left needs to be clearer.

Radiation Hazard Scale Data Product Content

The content is useful because:

- The CDC Radiation Hazard Scale avoids technical jargon.
- The colors clearly indicate areas of concern.
- The scaleshows the “orders of magnitude” extent of the hazard spectrum.

Suggestions to make the products more useful:

- Avoid technical jargon such as “shelter,” “dose,” “fallout,” “vanishingly small,” and “source term” in product titles and information.
- Suggestion to use “risk” instead of “dose”
- Make the titles more concise and clear for a non-technical audience.
- Make the titles and other text fields editable.
- Overlay an exclusion zone on the map for a nuclear power plant release.
- Clarify for a non-technical audience that the data shows outdoor exposure with no protective actions.
- Add an indoor exposure map to compare to the outdoor exposure to demonstrate the benefits of taking shelter.
- Highlight the data generation time and time interval for which the product is valid.
- (mixed feedback) Include protective actions with the product. This comment was not consistent across all stakeholders. Some stakeholders wanted general recommendations included to help guide communication while others want those recommendations to be the responsibility of the state/local agency using the product. One suggestion was to include editable recommendations.
- Clearly indicate whether the data is based solely on modeling or if measurements have been incorporated.

- Incorporate simplified hazard category descriptions on the first page.
- Time stamp the products more clearly, suggest also providing an “update expected” timestamp and issuing agency information.

Radiation Hazard Scale Data Product Use

Appropriate audiences for use:

- The data products are most effectively used with the public, the media, and decision-makers. Avoidance of units and technical jargon is helpful in interacting with these communities.
- Public health responders and hospitals may find these products useful to understand generally the levels of exposure people may have received.
- These data products are not appropriate for communicating with incident responders, except to help them to understand the potential risks to their families.

Accompanying messages, i.e. what these products can help to explain:

- Protective actions for specific areas, i.e. “Get inside, stay inside, stay tuned”
- Areas for the public to avoid if they are outside of the impacted zone
- Event context and the boundaries of the impacted zone

General comments

This product is useful because:

- It avoids using units, which can be confusing to a non-technical audience.
- The colors are clear in indicating which regions are affected and how the scale escalates.

Suggestions to make the products more useful:

- Clarify which specific, recognizable geographic areas were impacted, e.g., by county boundary lines.
- Clarify for stakeholders how to interpret FRMAC colors versus the colors for this product.
- Familiarize stakeholders with the product template in advance so they do not have to interpret in real time. Introduce the products to the community that works on NPP preparedness and at exercise dress rehearsals where appropriate.
- Allow stakeholders to scale and zoom the maps to their particular areas of interest.
- Develop a product that shows a comparison of sheltered versus unsheltered exposures (or other protective actions) side-by-side.
- Integrate the CDC/EPA infographics into the categories to inform protective actions.
- Provide training materials such as a user guide, job aid, and presentation slides.
- Providing shapefiles for the maps could be useful to some of the end users.
- The 24-hour exposure map does not line up with any of the FRMAC Briefing Products, there is no 24-hour exposure Briefing Product. It would help to have the CDC product match a FRMAC product.
- Consider using a 4-day exposure period to make the exposures comparable to the EPA Early Phase PAG values.

Other comments:

- It is essential that only one, consistent version of the maps is released to the public to avoid confusion.
- Responders should be familiarized in advance to understand why their actions are based on one set of graphics while another is used to communicate with the public.
- There is a concern about the wide extent of the green area and uncertainty about what the accompanying message should be.
- Many were concerned that the large “above background” green area may cause unnecessary concern if used early in the event
- During the group brief outs, the participants were focused on using the product in the first hour of an event which is unlikely to happen in a real-world event.

Section 3

Next Steps

Potential next steps for enhancing the data products, socializing them, and supporting their use by stakeholders include:

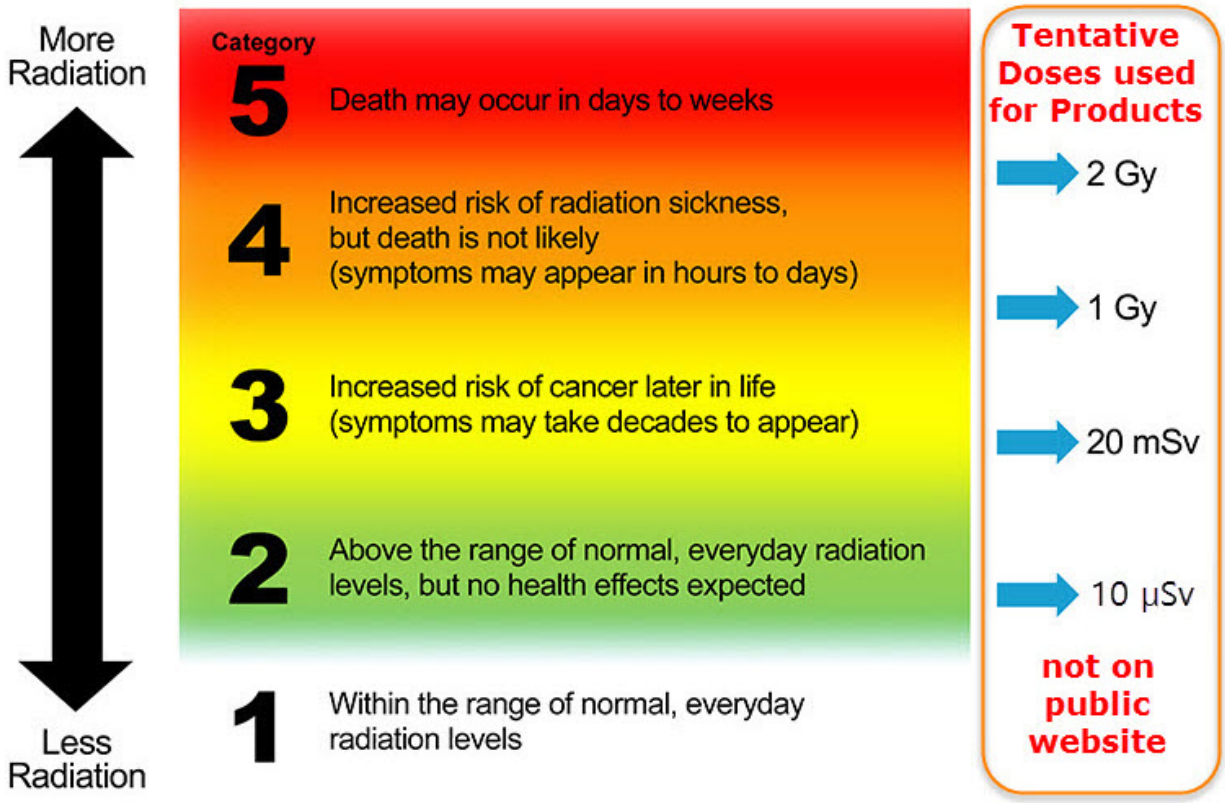
1. Revising the product templates based on the feedback documented in this report, with input and review by CDC and DOE/NNSA
2. Conducting a second workshop to review the updated products and further socialize the use of the CDC Radiation Hazard Scale
3. Developing user guides and/or reference material to support stakeholders in familiarizing themselves with these products and using them to communicate key messages
4. Develop an interactive app or tool that would allow users to modify text and scale maps appropriately for their needs

Appendix A

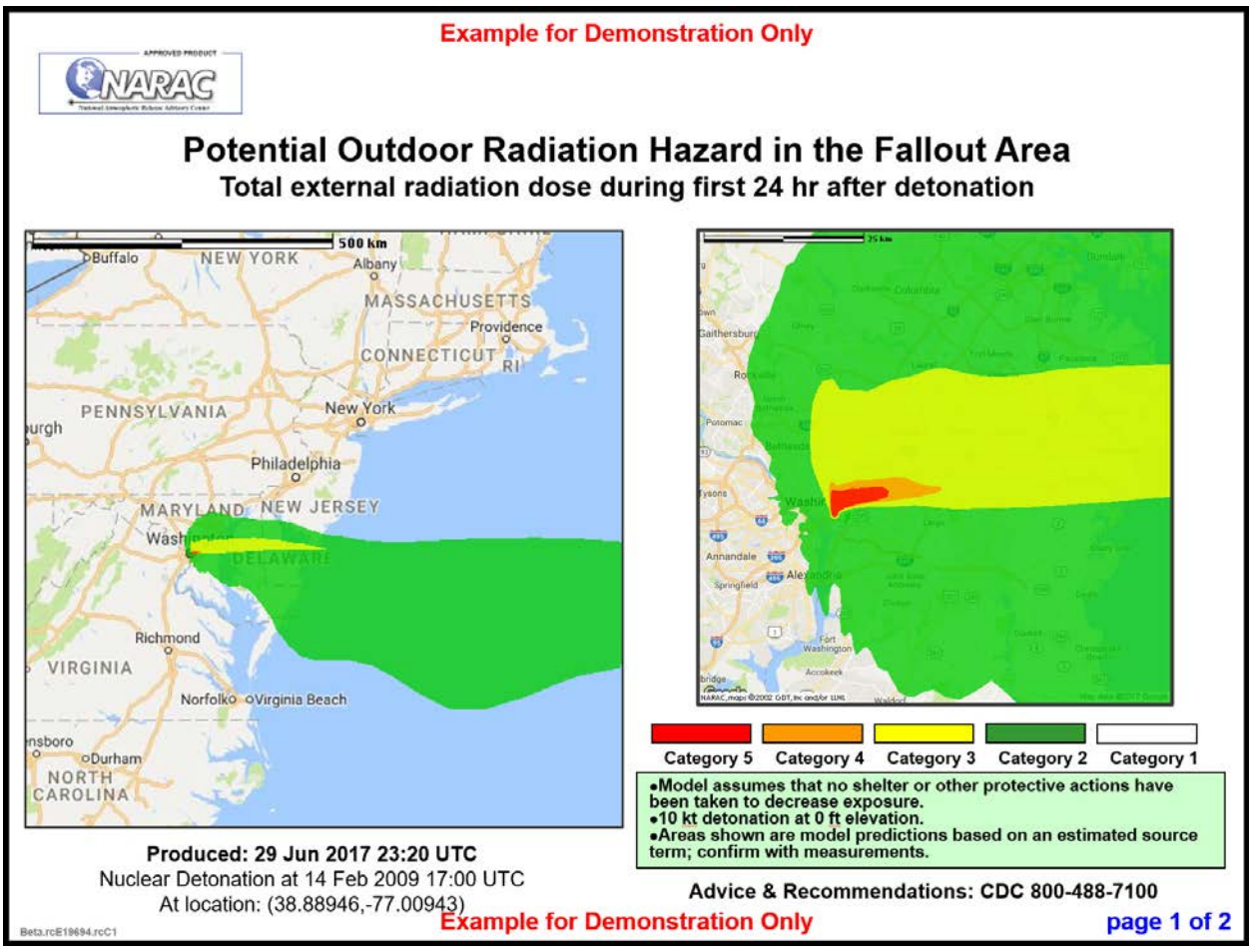
Data Products as Reviewed

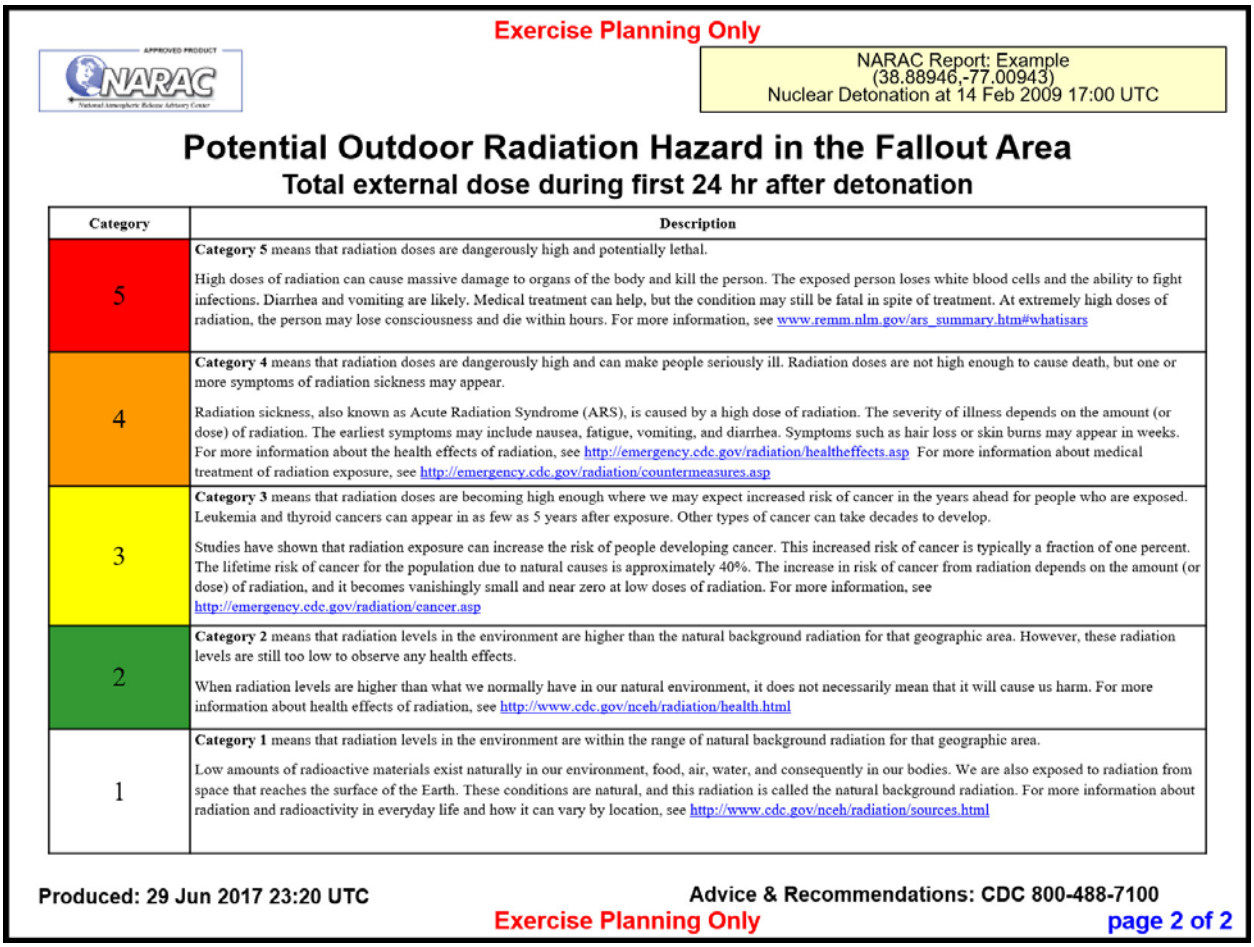
This Appendix shows the Radiation Hazard Scale and the Data Products as they are at the time of review.

Radiation Hazard Scale



Improvised Nuclear Device Data Product





Exercise Planning Only

NARAC Report: Example
(38.88946,-77.00943)
Nuclear Detonation at 14 Feb 2009 17:00 UTC

Potential Outdoor Radiation Hazard in the Fallout Area

Total external dose during first 24 hr after detonation

Category	Description
5	**Category 5** means that radiation doses are dangerously high and potentially lethal. High doses of radiation can cause massive damage to organs of the body and kill the person. The exposed person loses white blood cells and the ability to fight infections. Diarrhea and vomiting are likely. Medical treatment can help, but the condition may still be fatal in spite of treatment. At extremely high doses of radiation, the person may lose consciousness and die within hours. For more information, see www.remm.nlm.gov/ars_summary.htm#whatisars
4	**Category 4** means that radiation doses are dangerously high and can make people seriously ill. Radiation doses are not high enough to cause death, but one or more symptoms of radiation sickness may appear. Radiation sickness, also known as Acute Radiation Syndrome (ARS), is caused by a high dose of radiation. The severity of illness depends on the amount (or dose) of radiation. The earliest symptoms may include nausea, fatigue, vomiting, and diarrhea. Symptoms such as hair loss or skin burns may appear in weeks. For more information about the health effects of radiation, see http://emergency.cdc.gov/radiation/healtheffects.asp For more information about medical treatment of radiation exposure, see http://emergency.cdc.gov/radiation/countermeasures.asp
3	**Category 3** means that radiation doses are becoming high enough where we may expect increased risk of cancer in the years ahead for people who are exposed. Leukemia and thyroid cancers can appear in as few as 5 years after exposure. Other types of cancer can take decades to develop. Studies have shown that radiation exposure can increase the risk of people developing cancer. This increased risk of cancer is typically a fraction of one percent. The lifetime risk of cancer for the population due to natural causes is approximately 40%. The increase in risk of cancer from radiation depends on the amount (or dose) of radiation, and it becomes vanishingly small and near zero at low doses of radiation. For more information, see http://emergency.cdc.gov/radiation/cancer.asp
2	**Category 2** means that radiation levels in the environment are higher than the natural background radiation for that geographic area. However, these radiation levels are still too low to observe any health effects. When radiation levels are higher than what we normally have in our natural environment, it does not necessarily mean that it will cause us harm. For more information about health effects of radiation, see http://www.cdc.gov/nceh/radiation/health.html
1	**Category 1** means that radiation levels in the environment are within the range of natural background radiation for that geographic area. Low amounts of radioactive materials exist naturally in our environment, food, air, water, and consequently in our bodies. We are also exposed to radiation from space that reaches the surface of the Earth. These conditions are natural, and this radiation is called the natural background radiation. For more information about radiation and radioactivity in everyday life and how it can vary by location, see http://www.cdc.gov/nceh/radiation/sources.html

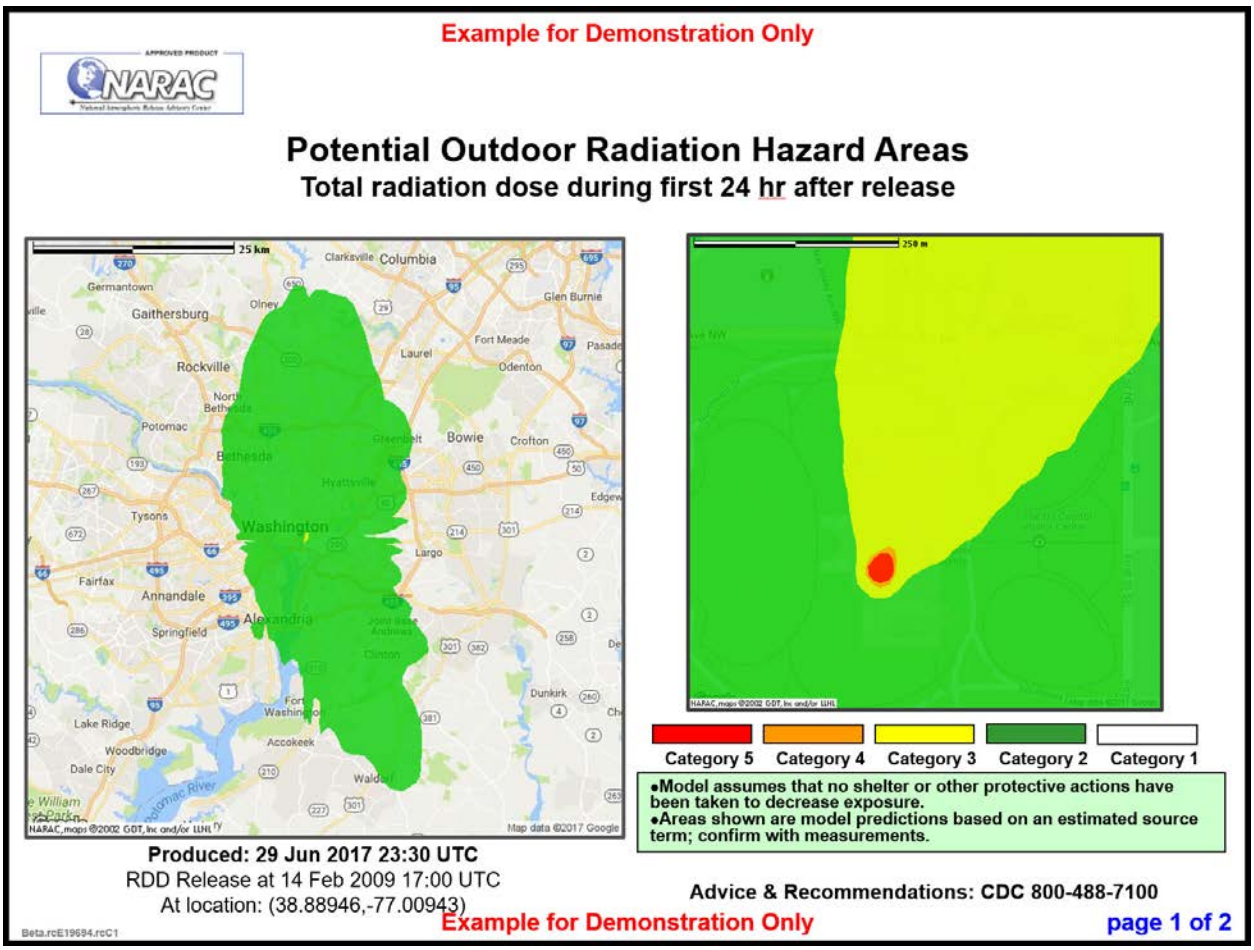
Produced: 29 Jun 2017 23:20 UTC

Advice & Recommendations: CDC 800-488-7100

Exercise Planning Only

page 2 of 2

Radiological Dispersal Device Data Product



Example for Demonstration Only

NARAC Report: Example
(38.88946,-77.00943)
RDD Release at 14 Feb 2009 17:00 UTC

Potential Outdoor Radiation Hazard Areas

Total radiation dose during first 24 hr after release

Category	Description
5	**Category 5** means that radiation doses are dangerously high and potentially lethal. High doses of radiation can cause massive damage to organs of the body and kill the person. The exposed person loses white blood cells and the ability to fight infections. Diarrhea and vomiting are likely. Medical treatment can help, but the condition may still be fatal in spite of treatment. At extremely high doses of radiation, the person may lose consciousness and die within hours. For more information, see www.remm.nlm.gov/ars_summary.htm#whatisars
4	**Category 4** means that radiation doses are dangerously high and can make people seriously ill. Radiation doses are not high enough to cause death, but one or more symptoms of radiation sickness may appear. Radiation sickness, also known as Acute Radiation Syndrome (ARS), is caused by a high dose of radiation. The severity of illness depends on the amount (or dose) of radiation. The earliest symptoms may include nausea, fatigue, vomiting, and diarrhea. Symptoms such as hair loss or skin burns may appear in weeks. For more information about the health effects of radiation, see http://emergency.cdc.gov/radiation/healtheffects.asp For more information about medical treatment of radiation exposure, see http://emergency.cdc.gov/radiation/countermeasures.asp
3	**Category 3** means that radiation doses are becoming high enough where we may expect increased risk of cancer in the years ahead for people who are exposed. Leukemia and thyroid cancers can appear in as few as 5 years after exposure. Other types of cancer can take decades to develop. Studies have shown that radiation exposure can increase the risk of people developing cancer. This increased risk of cancer is typically a fraction of one percent. The lifetime risk of cancer for the population due to natural causes is approximately 40%. The increase in risk of cancer from radiation depends on the amount (or dose) of radiation, and it becomes vanishingly small and near zero at low doses of radiation. For more information, see http://emergency.cdc.gov/radiation/cancer.asp
2	**Category 2** means that radiation levels in the environment are higher than the natural background radiation for that geographic area. However, these radiation levels are still too low to observe any health effects. When radiation levels are higher than what we normally have in our natural environment, it does not necessarily mean that it will cause us harm. For more information about health effects of radiation, see http://www.cdc.gov/nceh/radiation/health.html
1	**Category 1** means that radiation levels in the environment are within the range of natural background radiation for that geographic area. Low amounts of radioactive materials exist naturally in our environment, food, air, water, and consequently in our bodies. We are also exposed to radiation from space that reaches the surface of the Earth. These conditions are natural, and this radiation is called the natural background radiation. For more information about radiation and radioactivity in everyday life and how it can vary by location, see http://www.cdc.gov/nceh/radiation/sources.html

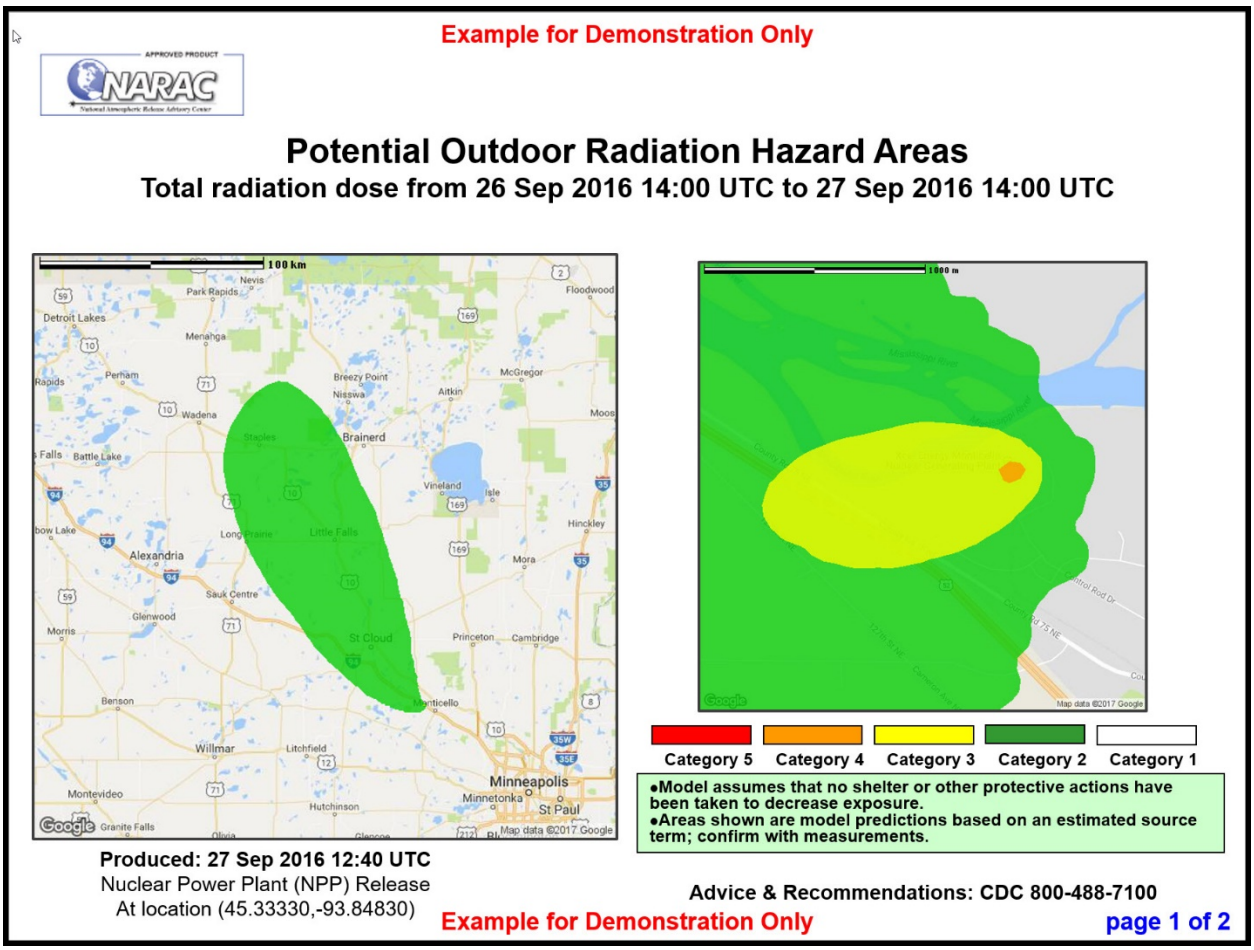
Produced: 29 Jun 2017 23:30 UTC

Advice & Recommendations: CDC 800-488-7100

Example for Demonstration Only

page 2 of 2

Nuclear Power Plant Release Data Product



Example for Demonstration Only

NARAC Report: Exercise
(45.33330,-93.84830)
NPP Release at 26 Sep 2016 14:00 UTC

Potential Outdoor Radiation Hazard Areas

Total radiation dose from 26 Sep 2016 14:00 UTC to 27 Sep 2016 14:00 UTC

Category	Description
5	**Category 5** means that radiation doses are dangerously high and potentially lethal. High doses of radiation can cause massive damage to organs of the body and kill the person. The exposed person loses white blood cells and the ability to fight infections. Diarrhea and vomiting are likely. Medical treatment can help, but the condition may still be fatal in spite of treatment. At extremely high doses of radiation, the person may lose consciousness and die within hours. For more information, see www.remm.nlm.gov/ars_summary.htm#whatisars
4	**Category 4** means that radiation doses are dangerously high and can make people seriously ill. Radiation doses are not high enough to cause death, but one or more symptoms of radiation sickness may appear. Radiation sickness, also known as Acute Radiation Syndrome (ARS), is caused by a high dose of radiation. The severity of illness depends on the amount (or dose) of radiation. The earliest symptoms may include nausea, fatigue, vomiting, and diarrhea. Symptoms such as hair loss or skin burns may appear in weeks. For more information about the health effects of radiation, see http://emergency.cdc.gov/radiation/healtheffects.asp For more information about medical treatment of radiation exposure, see http://emergency.cdc.gov/radiation/countermeasures.asp
3	**Category 3** means that radiation doses are becoming high enough where we may expect increased risk of cancer in the years ahead for people who are exposed. Leukemia and thyroid cancers can appear in as few as 5 years after exposure. Other types of cancer can take decades to develop. Studies have shown that radiation exposure can increase the risk of people developing cancer. This increased risk of cancer is typically a fraction of one percent. The lifetime risk of cancer for the population due to natural causes is approximately 40%. The increase in risk of cancer from radiation depends on the amount (or dose) of radiation, and it becomes vanishingly small and near zero at low doses of radiation. For more information, see http://emergency.cdc.gov/radiation/cancer.asp
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1	**Category 1** means that radiation levels in the environment are within the range of natural background radiation for that geographic area. Low amounts of radioactive materials exist naturally in our environment, food, air, water, and consequently in our bodies. We are also exposed to radiation from space that reaches the surface of the Earth. These conditions are natural, and this radiation is called the natural background radiation. For more information about radiation and radioactivity in everyday life and how it can vary by location, see http://www.cdc.gov/nceh/radiation/sources.html

Produced: 27 Sep 2016 12:40 UTC

Advice & Recommendations: CDC 800-488-7100

Example for Demonstration Only

page 2 of 2

Appendix B

Workshop and Survey Participants

Workshop Attendees

September 7, 2017 workshop at the Middlesex County Fire Training Academy in Sayreville, New Jersey

Name	Affiliation	Email	Phone
Alai, Maureen	Lawrence Livermore National Laboratory	alai1@llnl.gov	925-423-2733
Ansari, Armin	Centers for Disease Control and Prevention	asa4@cdc.gov	770-488-3654
Askin, Amanda	Lawrence Livermore National Laboratory	askin1@llnl.gov	925-423-3605
Bella, Cynthia	Morris County Office of Health Management	cbella@co.morris.nj.us	973-631-5491
Buddemeier, Brooke	Lawrence Livermore National Laboratory	buddemeier1@llnl.gov	925-423-2627
Carvalho, Sgt. Lee	New Jersey State Police	lpp6494@gw.njsp.org	609-468-5141
Davis, Monique	Hudson Regional Health	mdavis@hudsonregionalhealth.org	201-223-1133
Dowd, John	Middlesex County Department of Public Safety and Health	john.dowd@co.middlesex.nj.us	732-745-3135
Fessler-Belli, Ph.D., Adrienne	New Jersey Department of Human Services, Disaster and Terrorism Branch	Adrienne.Fessler-Belli@dhs.state.nj.us	609-777-0722
Garetano, Gary	Essex Regional Health Commission	ggaretano@essexregional.org	973-445-2460
Geleta, Joe	New Jersey Department of Human Services, Disaster and Terrorism Branch	joseph.geleta@dhs.state.nj.us	609-273-9282
Goodman, Jenny	New Jersey Department of Environmental Protection	jenny.goodman@dep.nj.gov	609-984-5498
Higgs, Kelly	New Jersey Voluntary Organizations Active in Disaster	khiggs@njvoad.org	609-412-9039
Howell, Ph.D., Roger	Rutgers New Jersey Medical School	rhowell@njms.rutgers.edu	973-972-5067

Name	Affiliation	Email	Phone
Johnson, Carrie	Middlesex County Department of Public Safety and Health	carrie.johnson@co.middlesex.nj.us	732-745-8923
Kaiura, Mitzi	New Jersey Department of Environmental Protection	mitzi.kaiura@dep.nj.gov	609-422-7236
Kirgan, Nicole	New Jersey Department of Health	Nicole.Kirgan@doh.nj.gov	732-691-3326
Kozub, Rich	Middlesex County Department of Public Safety and Health	rich.kozub@co.middlesex.nj.us	732-558-1053
Marcinczyk, Eileen	Middlesex County	eileen.marcinczyk@co.middlesex.nj.us	732-745-3100
McCluskey, Brendan	New Jersey Department of Public Health	brendan.mccluskey@doh.nj.gov	609-331-1432
Mulligan, Patrick	New Jersey Department of Environmental Protection	patrick.mulligan@dep.nj.gov	609-98-7711
Orlando, Paul	New Jersey Department of Environmental Protection	paul.orlando@dep.nj.gov	609-984-5520
Paul, Jeff	Morris County Office of Emergency Management	jpaul@co.morris.nj.us	973-829-8600
Pfaff, Ann	New Jersey Department of Environmental Protection	ann.pfaff@dep.nj.gov	609-984-7451
Salame-Alfie, Adela	Centers for Disease Control and Prevention	yta1@cdc.gov	
Stanley, Nancy	New Jersey Department of Environmental Protection	nancy.stanley@dep.nj.gov	609-984-5452
Stephens, Neal	New Jersey Department of Human Services, Disaster and Terrorism Branch	neal.stephens@dhs.state.nj.us	609-980-9973
Sullivan, Megan	New Jersey Department of Human Services, Disaster and Terrorism Branch	megan.sullivan@dhs.state.nj.us	609-273-9299
Truskowski, Ed	New Jersey Department of Environmental Protection	ed.truskowski@dep.nj.gov	609-984-5542
Tuccillo, Karen	New Jersey Department of Environmental Protection	karen.tuccillo@dep.nj.gov	
Wieder, Jessica	US Environmental Protection Agency	Wieder.Jessica@epa.gov	202-343-9201
Wolpert, Sherie	Middlesex County Department of Public Safety and Health	sherie.wolpert@co.middlesex.nj.us	732-745-3146

Survey Participants

(note: providing contact information was optional for survey participants, this list reflects those who chose to provide contact information.)

Name	Affiliation	Email	Phone
Bickford, Erica	Transportation Program Manager, US Department of Energy Office of Nuclear Energy	erica.bickford@nuclear.energy.gov	
Milligan, Patricia	US Nuclear Regulatory Commission	patricia.milligan@nrc.gov	
Williams, Katherine	Assistant Radiation Safety Officer, Naval Surface Warfare Center Crane Division	Katherine.a.williams@navy.mil	
Irwin, Bill	Vermont Department of Health	william.irwin@vermont.gov	

Appendix C

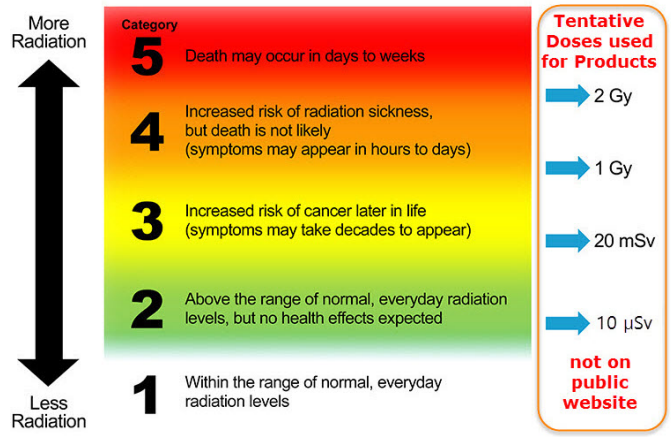
Detailed Survey Results for Centers for Disease Control and Prevention (CDC) Radiation Hazard Scale Data Product Review

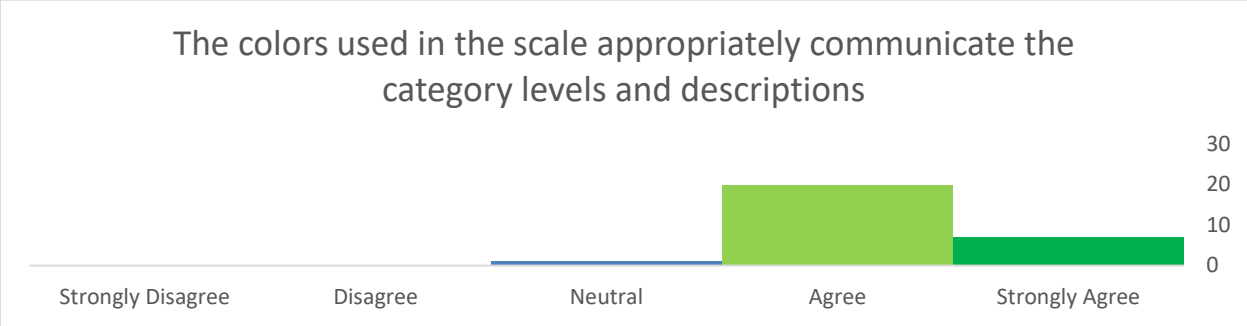
The following provides the detailed results of the Survey Monkey used to collect feedback on the CDC Radiation Hazard Scale. The Survey has been active since August 24, 2017, but most of the feedback was associated with the NJ workshop held on September 7, 2017. The 26 workshop participants were selected and invited by the New Jersey Department of Environmental Protection. The workshop began with an overview of radiological incidents and data products to support response, communication challenges, and an introduction to the CDC Radiation Hazard Scale. Following these introductory presentations, participants broke into three groups to decide how to use the CDC Radiation Hazard Scale Data Products to communicate information to their respective audiences (public/media, emergency responders, or decision makers/elected officials) during an improvised nuclear device (IND) incident. Each group selected a spokesperson to deliver their messages using the products in front of the whole group to seed a feedback discussion about what messages, for which audiences, are effectively supported by the products. Participants repeated this process with products for a radiological dispersal device (RDD) scenario. In the final feedback session, participants also reviewed products for a Nuclear Power Plant (NPP) incident. This report presents the results of these feedback discussions as well as results from written surveys completed by the participants. The written surveys were identical to the online survey described in the next section. Written feedback was entered into the electronic survey. There were 24 survey entries over a 12 month period).

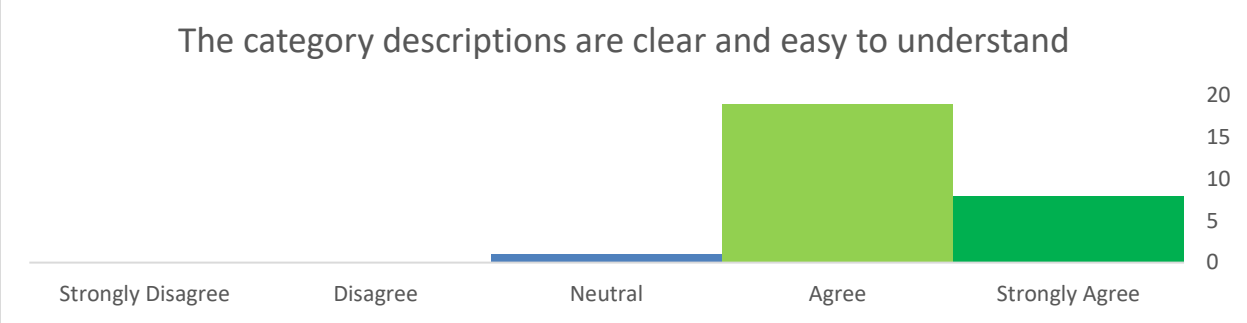
In addition to the Workshop, participants from a recent Michigan nuclear power plant (NPP)accident exercise (Northern Lights) were surveyed about the NPP product that was developed based on the exercise scenario. Five survey responses were received. Their general and NPP scenario specific feedback was included in the results below.

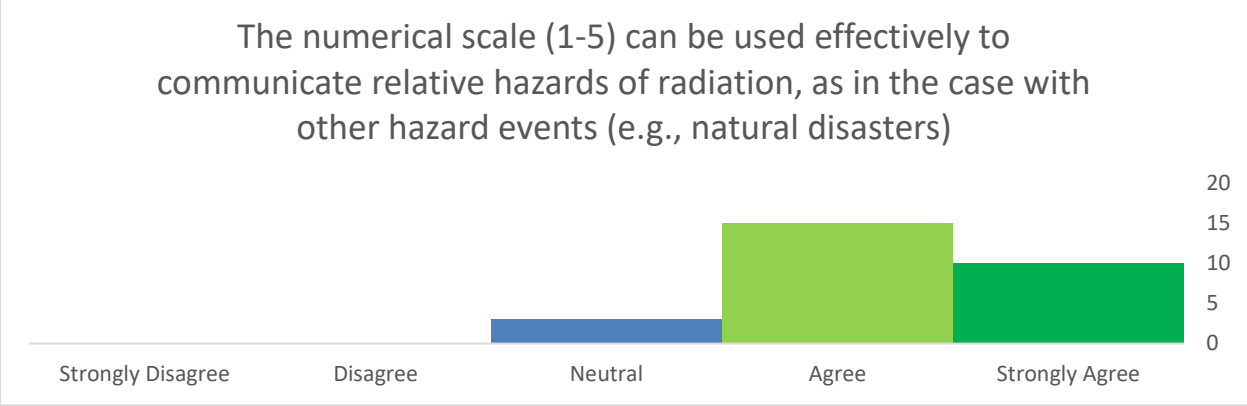
Radiation Hazard Scale

The first set of questions was pertaining to the scale itself:



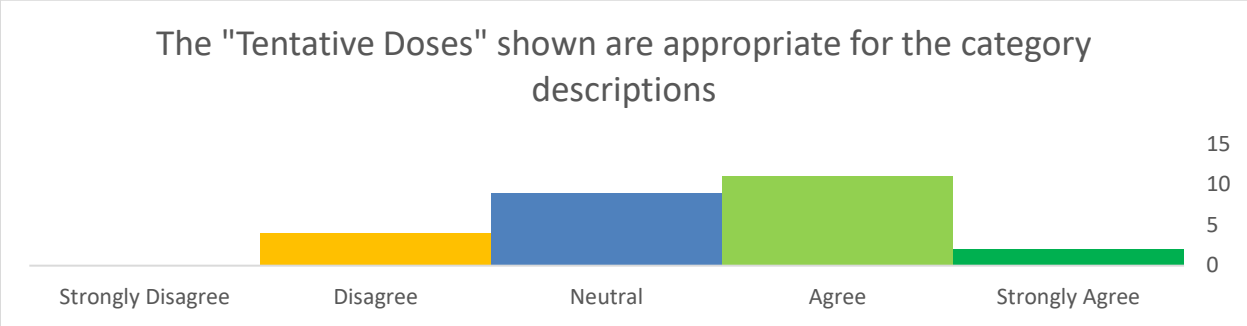






Written Comments:

- wording is clear; fuzzy lines makes it look less intimidating; examples in each category that public can relate to; what should the public be doing in category (i.e. normal activities, stay inside, etc.)
- Is the bottom arrow needed (less radiation) on the black arrow to the left? [meaning: could the arrow just go up]
- Agree with comments that ppl read from top to bottom, and starting with worst outcome may be too much
- easy to understand
- map colors need to be more transparent so cities can be seen
- Does color scale work for people who are colorblind or confuse them?
- This graphic is in-line with other government hazard scales, such as the EPA's Air Quality Index, or DHS's Homeland Security Advisory system. However in both of those scales, the lowest value on the scale is colored "green." You might consider doing the same thing here, keeping with the "Green is ok" baseline that many people might already have from these other scales. You could make 1 a dark or kelly green, then make 2 a yellow-green.
- Suggest doing away with category 2, and combining it with 1. This would send a message that the public need not be concerned until 20 mSV, which is consistent with current PAGs.
- Typically, green means good or go. Suggest that 1-Green and 2-be White or another color. For reference: https://www.nrc.gov/reactors/operating/oversight/rop-description.html

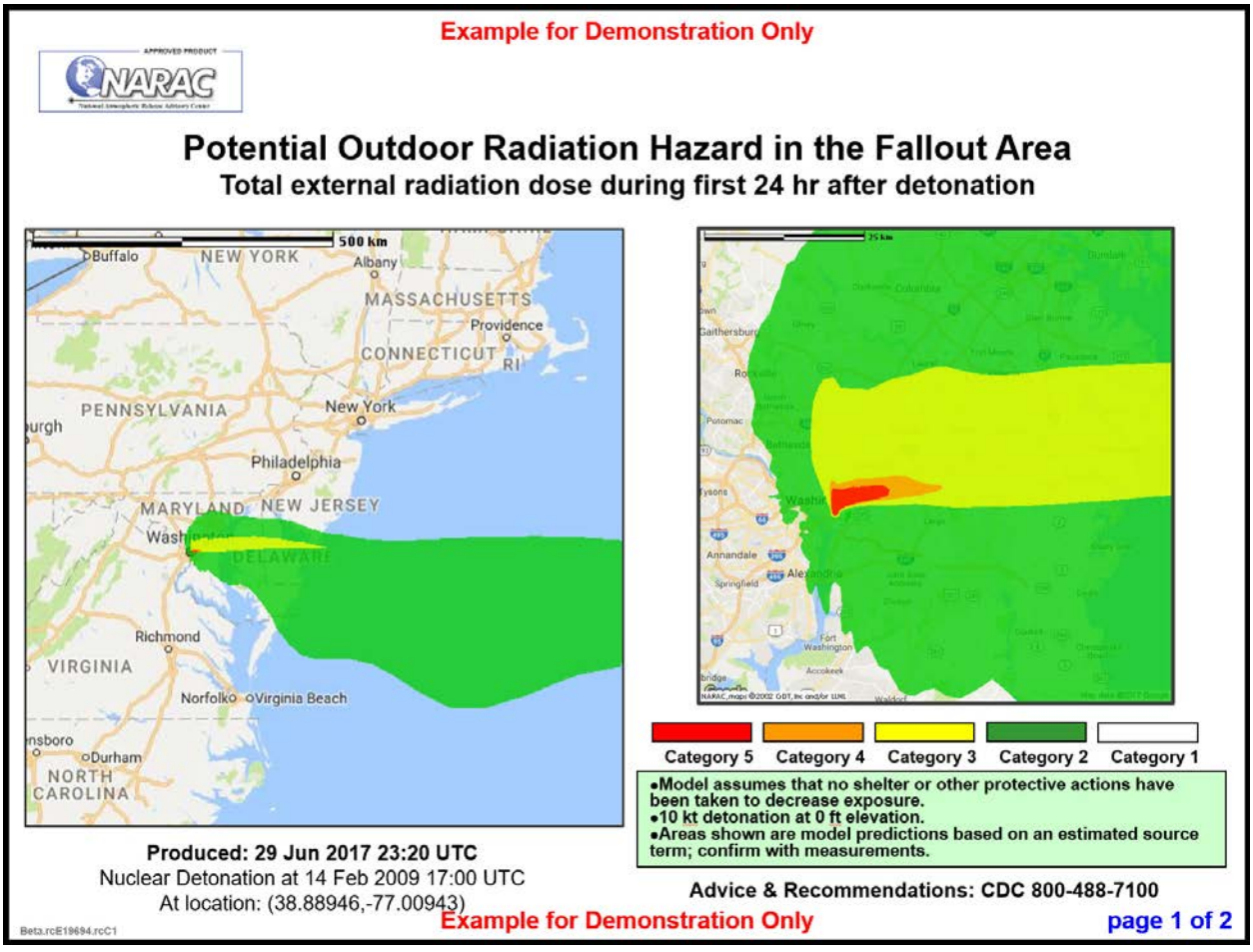


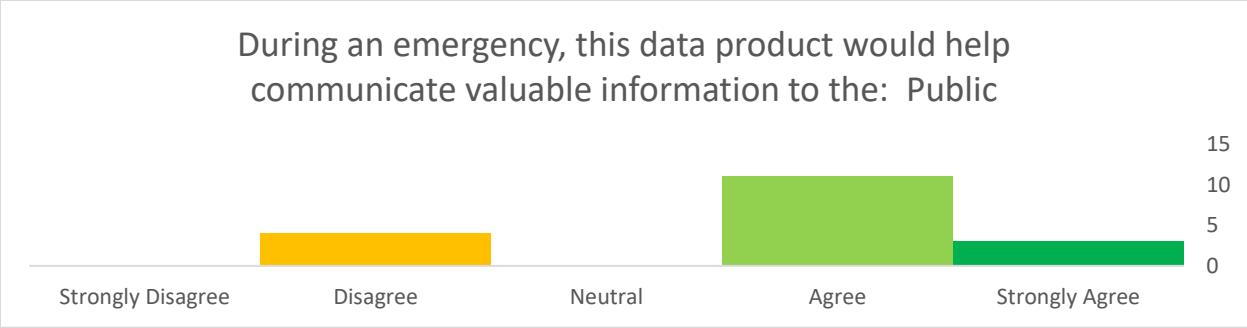
Written Comments:

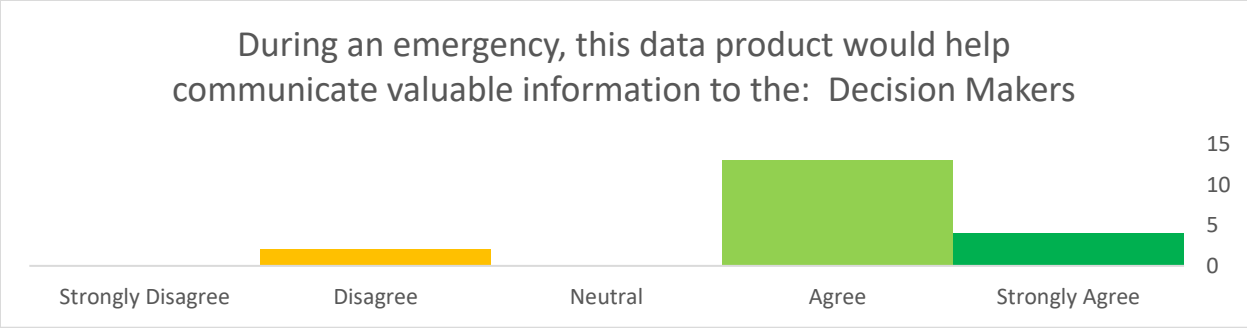
- US professional could use standard units.
- Would prefer to have the tentative doses provided in US and International units.
- written on scale: Gray, micro Sievert, Location Specific; contamination footprints NOT plume; over 2 REM-relocation; Comments: How is this to be rolled out to the public? when is it to be rolled out? We want to be sure Govt/OEM members are aware of this new scale system
- Tentative doses in different units; units are not clear to non-technical people

- Not a scientist so I think more in terms of exposure or potential harm than "doses"
- Tentative doses-I think in terms of REM
- suggest the dose levels be adjusted upwards, they are too low
- 100 mSv is a known dose (epidemiological studies) associated with cancer induction. 10 uSv is a daily dose from natural background.
- I would not use 20 mSv for 3. I would use 100 mSv. 20 is the annual limit some places, and only if accumulated for several years does data suggest a measurable increase in cancer risk is likely. 100 mSv is generally accepted (and being used for CC-1) for a lifetime value where this measurable association might occur.

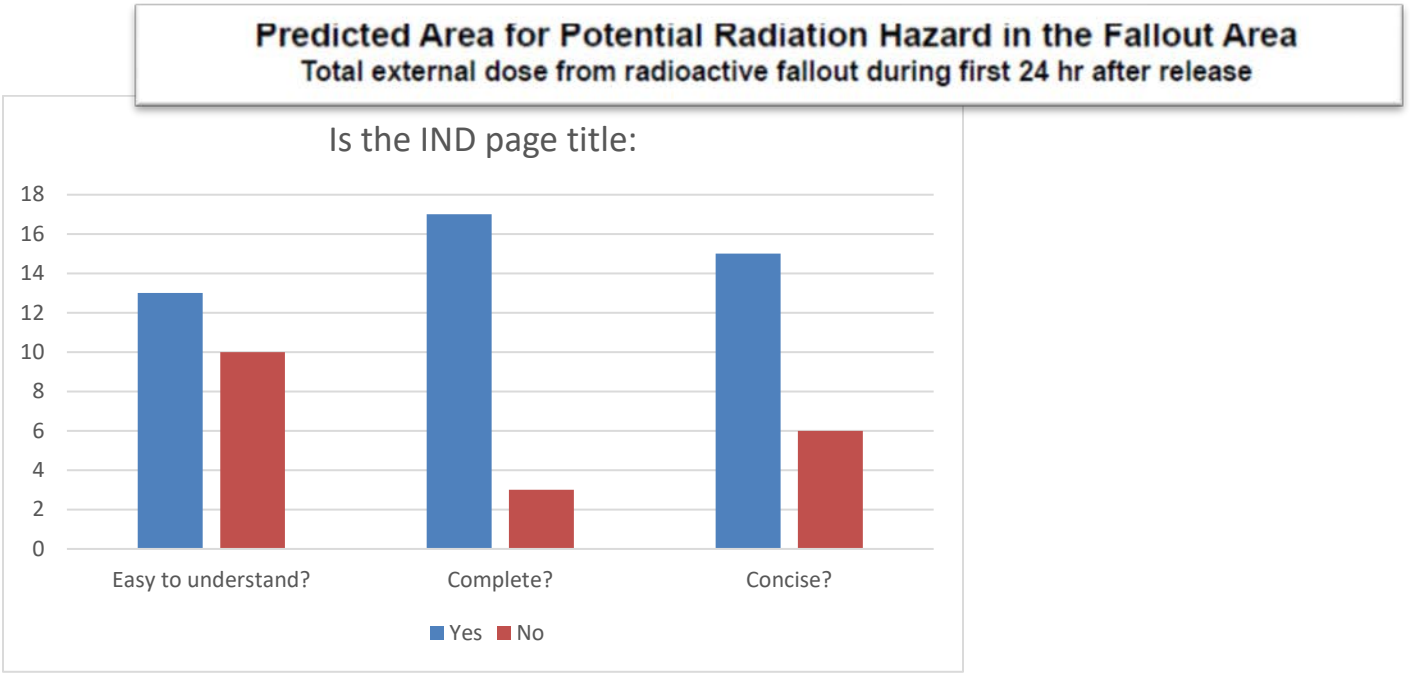
Improvised Nuclear Device Data Product



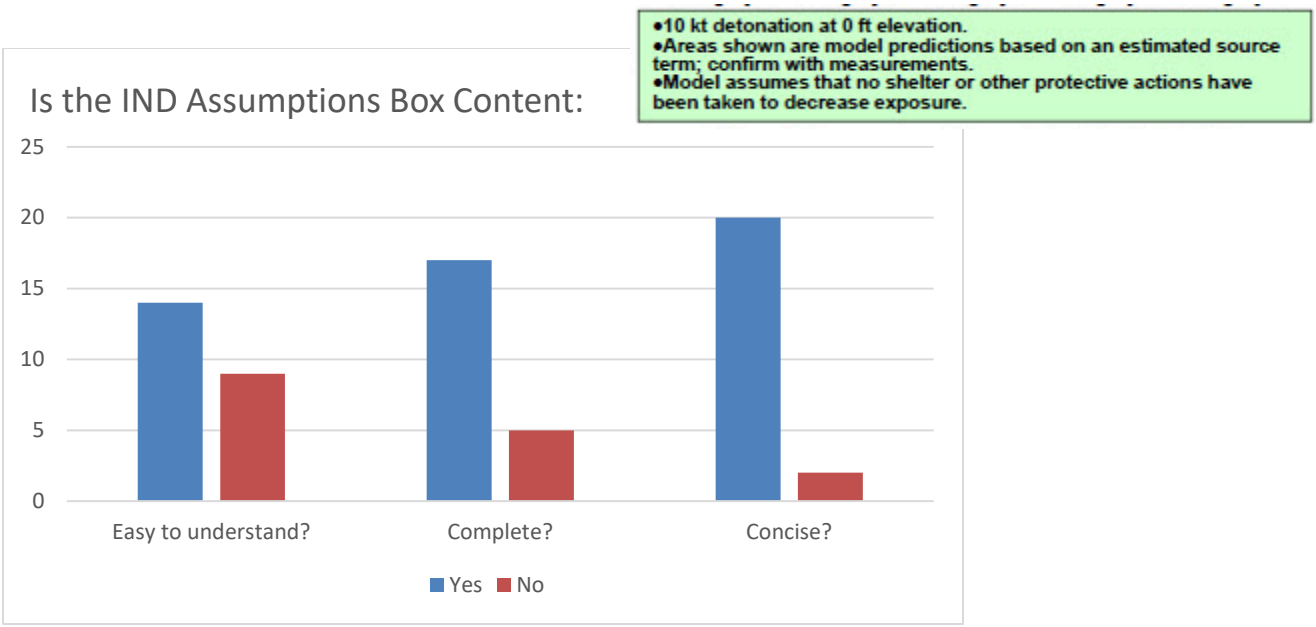




- hard to read map in second map. public will assume that if not in "projected" green they receive "no" fallout or exposure.
- public would need to be informed about this and exposure to radiation
- More transparency to see impacted areas. Scale should be in miles as opposed to kilometers
- shading is too dark, can't see the map
- again-exact impact areas difficult to see as presented. Please make overlay more transparent-hard to define impact zone
- Depends on which decisions the decision-makers are making
- model assumptions might confuse some
- not enough info and key bullet points about incident. Map scaled in km-should be miles or ft
- I think the green might convey that it's OK in these areas. Discussion about sticking to numbers and not colors
- By eliminating Category 2 and the green shading, the messages would be a bit simpler - if you are in one of the colored areas, you need to do something (and those details would be provided) to protect yourself.
- always concerned when information is released to the public as this means the media will interpret it and spread its version of such material. Not sure how we deal with this
- I am a big fan of this for communications. I liken it to the hurricane scale.
- Suggest adding an indicator for wind: direction and speed plus measurement elevation. Likelihood of wind shifts?

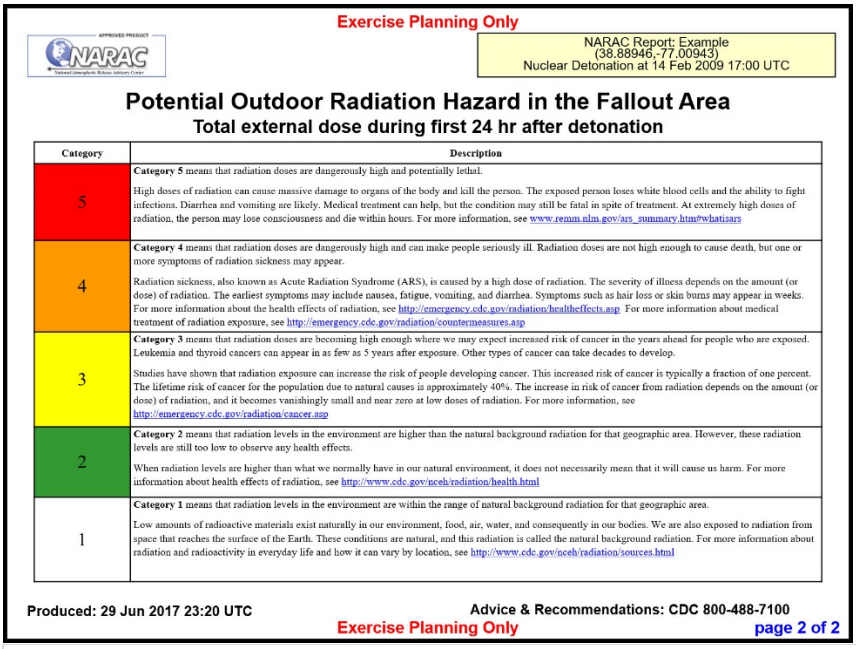


- colors too dark and should be translucent
- dose/hazard
- should be a little more concise, remove words like "dose" and "outdoor"
- people may not know what a "dose" means
- need to have time to show visually the impact of the radiation
- Title doesn't read easily-suggestion: "Potential outdoor radiation hazard" date/time at top and eliminate subtitle
- take out "in the fallout area"
- to the public what is a fallout area
- substitute "Level of Hazard Associated without Taking any protective actions within first 24 hrs"
- not clear how "radiation dose" has meaning for this product since the map shows categories, perhaps just leave it at radiation hazard and get rid of dose
- potential...area during the 1st 24hr after detonation
- for public messaging "total external radiation dose" is too complex->perhaps: radiation exposure during first 24 hrs
- potential outdoor radiation hazard within first 24 hr after detonation
- simplify fallout area: potential radiation hazard
- Raises many other questions - how does sheltering help, if at all, in the red or orange areas? What happens after 24 hours?
- Consider adding RDD or IND before the word "detonation" Consider substituting release for detonation for a NPP event?



- last phrase could be replaced with: "will be updated as direct measurements are made."
- 10 k needs to be explained
- good as supporting info but must state "w/o protective actions" in the title itself; do not understand what is meant by "estimated source term"; consider changing "decrease exposure" to "reduce risk"
- Easy after spending day w/ physicists maybe not for general public
- Fine for me but not public; assumptions need to be available but perhaps not as prominent on the graphic
- Yes for bullets 1 and 2, no for bullet 3. Need more context to put into lay terms.
- I think the product assumes that a radiation SME is looking at it/interpreting it. While this is often the case, sometimes there will be others who may not understand some of the terminology.
- "confirm with measurements" should more clearly be a direction to do so
- Again, raises many other questions - how does sheltering help, if at all, in the orange and red areas? What happens after 24 hours, do the levels change, will the areas change? Who will be doing the measurements - it is almost worded as a directive to the reader (You) confirm with measurements. Would be clearer if it explained who would be doing that and over what period of time.
- if this is for the public then no it is not easy to understand
- the abbreviation for kiloton isn't widely known. I would replace kt with kiloton.
- 10 kT requires correct spelling and it might benefit from some definition.
- Add IND between 10 kt and detonation? Provide some indication of model uncertainty/error potential?

IND Product Back Page



Exercise Planning Only

NARAC Report: Example
(38.88946,-77.00943)
Nuclear Detonation at 14 Feb 2009 17:00 UTC

Potential Outdoor Radiation Hazard in the Fallout Area

Total external dose during first 24 hr after detonation

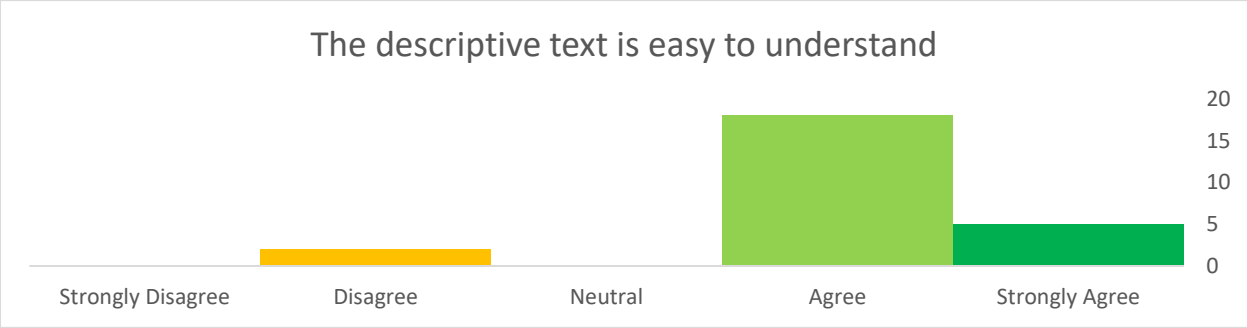
Category	Description
5	**Category 5** means that radiation doses are dangerously high and potentially lethal. High doses of radiation can cause massive damage to organs of the body and kill the person. The exposed person loses white blood cells and the ability to fight infections. Diarrhea and vomiting are likely. Medical treatment can help, but the condition may still be fatal in spite of treatment. At extremely high doses of radiation, the person may lose consciousness and die within hours. For more information, see www.remm.nlm.gov/ars_summary.htm#whatisars
4	**Category 4** means that radiation doses are dangerously high and can make people seriously ill. Radiation doses are not high enough to cause death, but one or more symptoms of radiation sickness may appear. Radiation sickness, also known as Acute Radiation Syndrome (ARS), is caused by a high dose of radiation. The severity of illness depends on the amount (or dose) of radiation. The earliest symptoms may include nausea, fatigue, vomiting, and diarrhea. Symptoms such as hair loss or skin burns may appear in weeks. For more information about the health effects of radiation, see http://emergency.cdc.gov/radiation/healtheffects.asp For more information about medical treatment of radiation exposure, see http://emergency.cdc.gov/radiation/countermeasures.asp
3	**Category 3** means that radiation doses are becoming high enough where we may expect increased risk of cancer in the years ahead for people who are exposed. Leukemia and thyroid cancers can appear in as few as 5 years after exposure. Other types of cancer can take decades to develop. Studies have shown that radiation exposure can increase the risk of people developing cancer. This increased risk of cancer is typically a fraction of one percent. The lifetime risk of cancer for the population due to natural causes is approximately 40%. The increase in risk of cancer from radiation depends on the amount (or dose) of radiation, and it becomes vanishingly small and near zero at low doses of radiation. For more information, see http://emergency.cdc.gov/radiation/cancer.asp
2	**Category 2** means that radiation levels in the environment are higher than the natural background radiation for that geographic area. However, these radiation levels are still too low to observe any health effects. When radiation levels are higher than what we normally have in our natural environment, it does not necessarily mean that it will cause us harm. For more information about health effects of radiation, see http://www.cdc.gov/nceh/radiation/health.html
1	**Category 1** means that radiation levels in the environment are within the range of natural background radiation for that geographic area. Low amounts of radioactive materials exist naturally in our environment, food, air, water, and consequently in our bodies. We are also exposed to radiation from space that reaches the surface of the Earth. These conditions are natural, and this radiation is called the natural background radiation. For more information about radiation and radioactivity in everyday life and how it can vary by location, see http://www.cdc.gov/nceh/radiation/sources.html

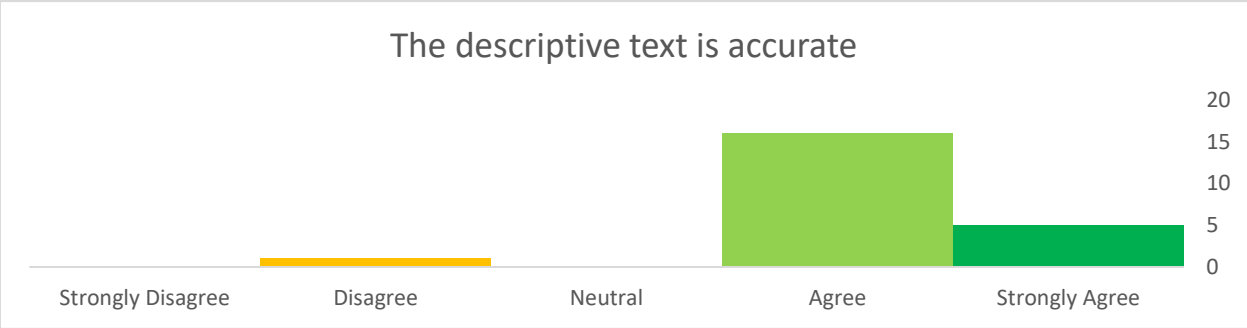
Produced: 29 Jun 2017 23:20 UTC

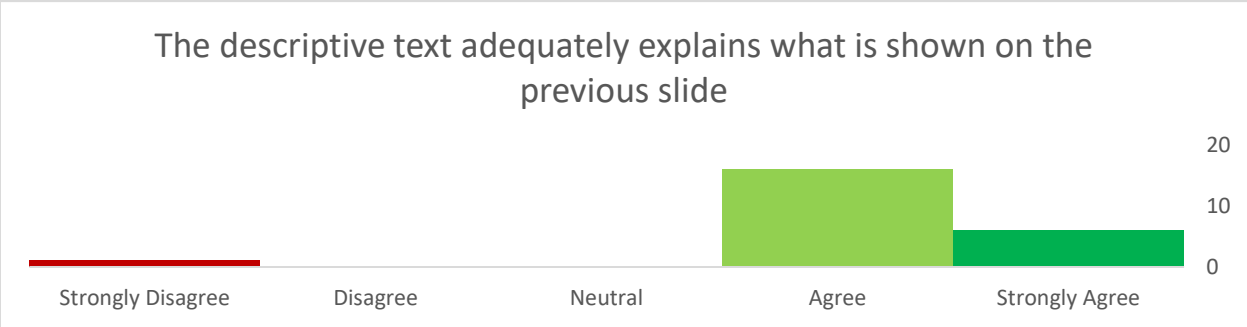
Advice & Recommendations: CDC 800-488-7100

Exercise Planning Only

page 2 of 2







Written Comments on "Back Page":

- Perhaps have title be same as other..."CDC Radiation Hazard Scale"
- somewhat-it can be tweaked a little. Remember this is a basic scale with colors presenting seriousness
- subtitle should be simpler
- #3 is too much detail for initial message to general public
- If this is being used for an audience other than HPs, "dose" as it is used in the radiation world might need to be defined
- Too much detail in these descriptions. Should be pared back a bit. As examples, in Level 5, delete "Diarrhea and vomiting" sentence and the "At extremely high doses of radiation" sentence.
- what does "vanishingly small" mean to a member of the public? they believe that all radiation is harmful no matter how low the dose. We should discuss briefly the hypothetical nature of those assumptions indicated in group 3
- Cat 3: change to "where there is the potential for slight increase in the risk of cancer." I would also but the latency information in the next paragraph, so the cancers seem less deterministic. In Cat 4: add "in a short time" to definition "...a high dose of radiation..."
- Level 4, 2nd paragraph suggested wording...change "in weeks" to "weeks later." Level 3, second paragraph suggested wording - delete second sentence. Change 4th sentence to read "...of radiation, and is typically only a fraction of one percent." Level 2, 2nd paragraph - delete first sentence. It's redundant.
- Cat 3: Place quantitative description of increased risk compared to baseline risk in the first sentence as few will read past first line.

What additional information would make the IND product more useful to you?

- More info would help, but it would make the document too big.
- map with streets (GIS) 2nd map (right) side
- What to do in each category
- Indicated decreased hazards when protective actions are taken
- level of opacity
- Interactive, dynamic map would be better...something like NHC site, or even better, something like the Hurrevac Product
- sharing this product different agencies
- none-suggested actions should come from state/local
- County boundary lines, more transparent overlays, add a simple protective guidance for each i.e. Cat 1&2 no PAG needed, Cat3 SIP etc.
- actions to take during different categories
- You might consider making both short and long versions of the scale description graphic. The short one would be the one or two lines of text at the top of each box, the longer one would include the whole thing.

- better explanation of the yellow band and the link to cdc.gov/radiation/cancer.asp doesn't work. check the link - I am very interested in the studies that show LNT is valid.
- for this product, why not make it clear that the concern is the dose from the initial detonation and exposure to the fallout afterwards. This is versus the RDD concern of dose from the dispersed contamination only?

What information, if any, should be removed from this product?

- what to do within the category
- Change title
- Radiation dose from title
- Eliminate subtitle-if needed move "during 1st 24 hr" to title
- If this was to go out to the public, remove "dose" language
- See comment 7 above recommending using short and long versions.
- See answer 6 above

If someone handed you this product to use during an emergency response, what questions would you have about this data product?

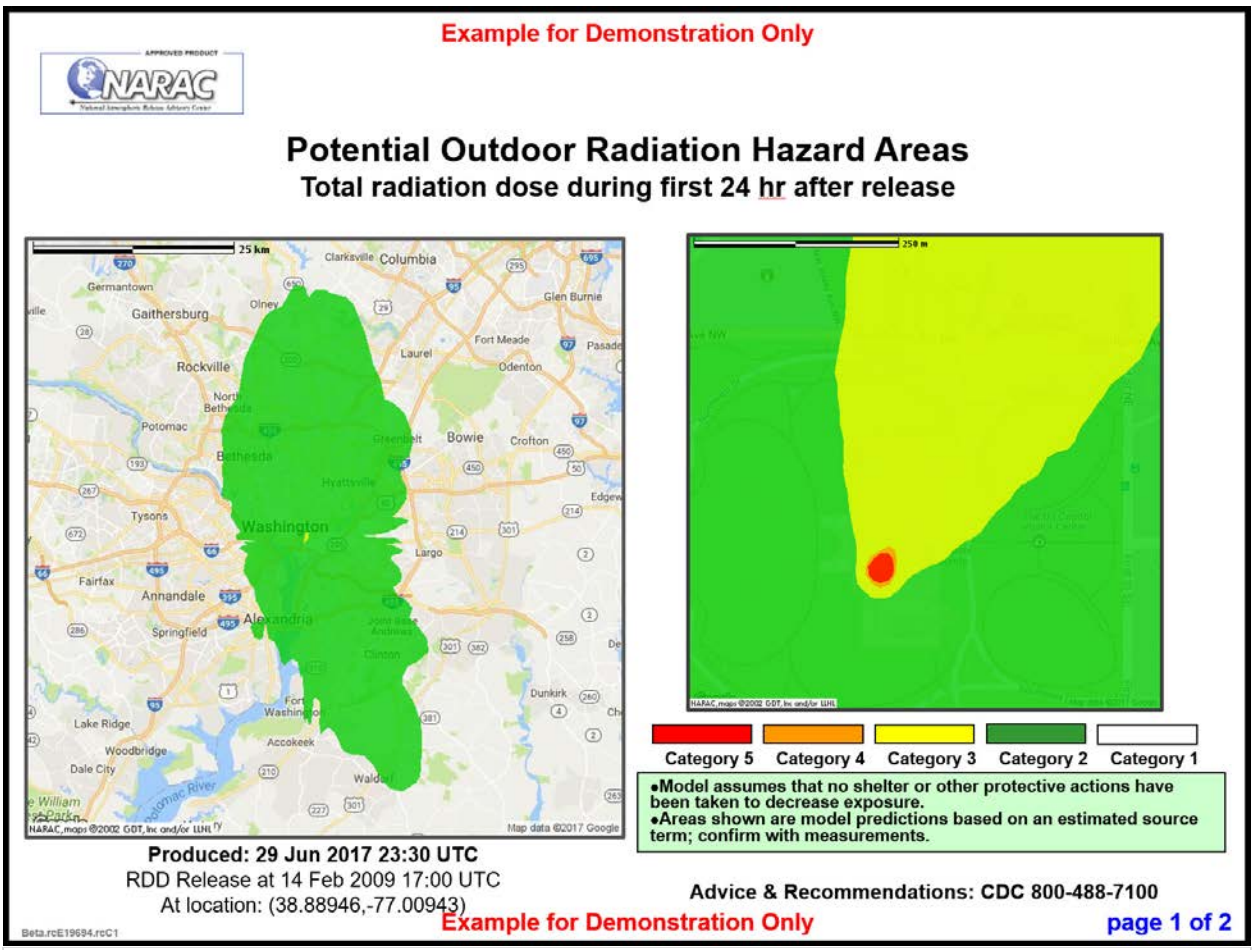
- Does it match with colors on a map?
- what street/county (specific area)
- many, what does it mean, explain radiation, people need to be aware of this tool
- what actions should be taken for each category
- if first time-would ask what agency published and if used by whom?
- Is it the most current version? When is the next update? Is it pure model or is some monitoring data considered?
- what actions should individuals take based on the category
- I would want to know where I go for updated exposure maps and measurements to use the dose scale to make decisions about where to send resources and personnel.
- What could I do to protect myself?
- Are there other references besides the CDC that provide more clarification? Theirs sometimes seems to lack detail for some users like a ROSS.

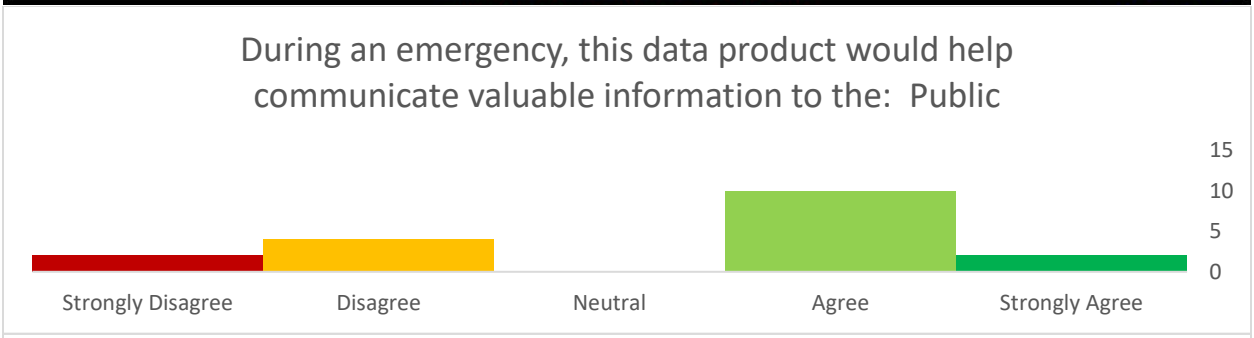
Additional comments on the IND product content:

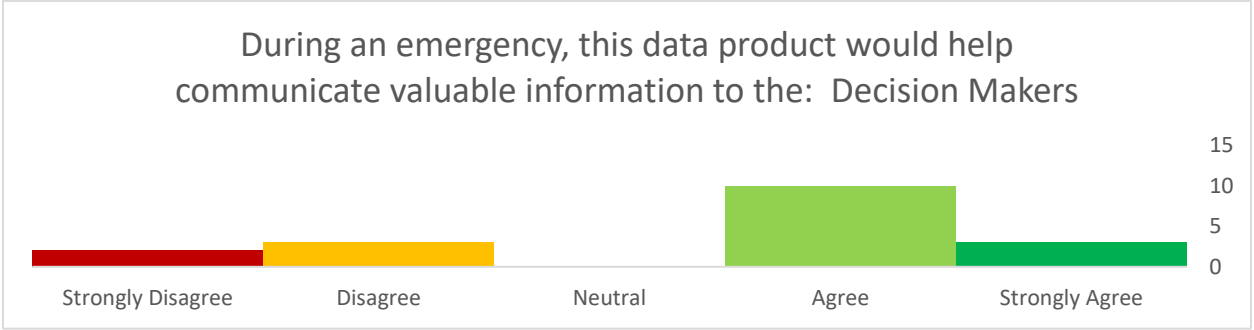
- Public will still ask the question: "Will I be safe?"
- time stamp; feet and miles instead of km
- Title should be short and clear, easy for public to understand
- product is easy to understand and not overloaded with information
- color overlays need to be more transparent. Change km and m to miles and feet.
- need to educate agencies (emergency response, public health, health care)

- Just have to drive home this is level IF you are exposed for 24 hours-not 10 minutes
- turn into interactive tool and add map, hazard scale, actions

Radiological Dispersal Device Data Product



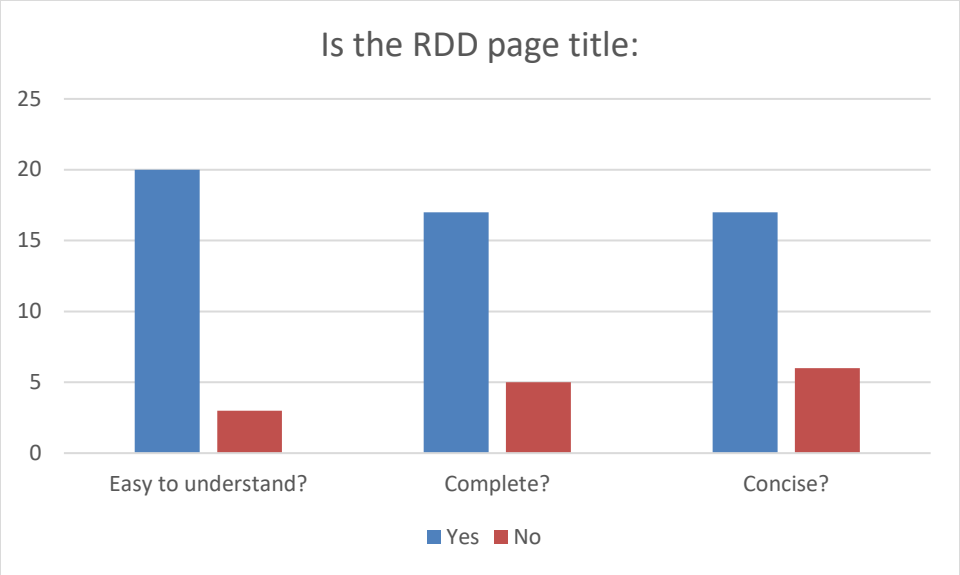




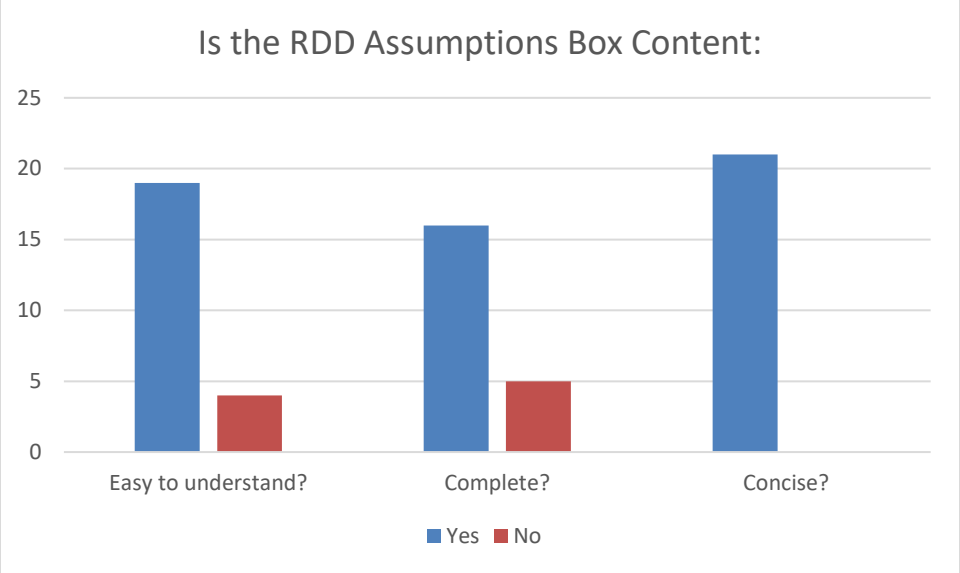
Additional Comments:

- Public would consider green as contaminated and outside green as "safe". Decision makers need to see map on right diagram.
- it's good information when presented in context
- used in a way that would not cause panic
- could give public false sense of security
- this map may cause panic in the public. This map would work if decision makers had knowledge of the product beforehand
- please use ft/miles instead of m/km
- same comments as previous
- Helps people calm to see how they fit
- RDD scale is small for high hazard area. Product has insufficient granularity for decision-making or 1st responder guidance
- map scale should be in miles/ft and more transparent. need point of origin (blast) better defined. Not enough info, need bullet points about incident
- Based on this graphic, I would assume anyone in the green area or higher needs to evacuate or seek medical attention - is that the message you want to send with this? If so, then it's fine, but based on the green scale indicating only slightly higher radiation levels, then in most cases people should be able to stay where they are. Red/orange/yellow areas should be prioritized for evacuation.
- If we could see some detail under the green in the box on the right, it would be much better. Especially after reproduction, the fain mapping under the colors becomes even more opaque.
- Suggest language be more similar between products. For example: "Predicted Area for Potential Radiation Hazard in the Dispersed Contamination Area "Total external dose from dispersed contamination radiation during first 24 hr after RDD dispersal" ?

Potential Outdoor Radiation Hazard Areas
Total radiation dose during first 24 hr after release



•Model assumes that no shelter or other protective actions have been taken to decrease exposure.
•Areas shown are model predictions based on an estimated source term; confirm with measurements.



- same response in previous section: last phrase could be replaced with: "will be updated after direct measurements are taken."
- again-"estimated source term" public will not understand
- same comment as earlier
- Yes for bullet 1, no for bullet 2

- As an HP, I understand what modeling means; others may not (I don't mention this as a huge issue)
- "confirm with measurements" needs to be a clearer direction to take. Right now it just hangs out there and a lay person might not know what it means, or where to find measurement information.
- See previous answers from first scenario
- if this is for the public then this text doesn't mean much
- Source term is too technical. Shelter may need better definition, e.g., sheltering-in-place
- Make it clear that this is for a RDD

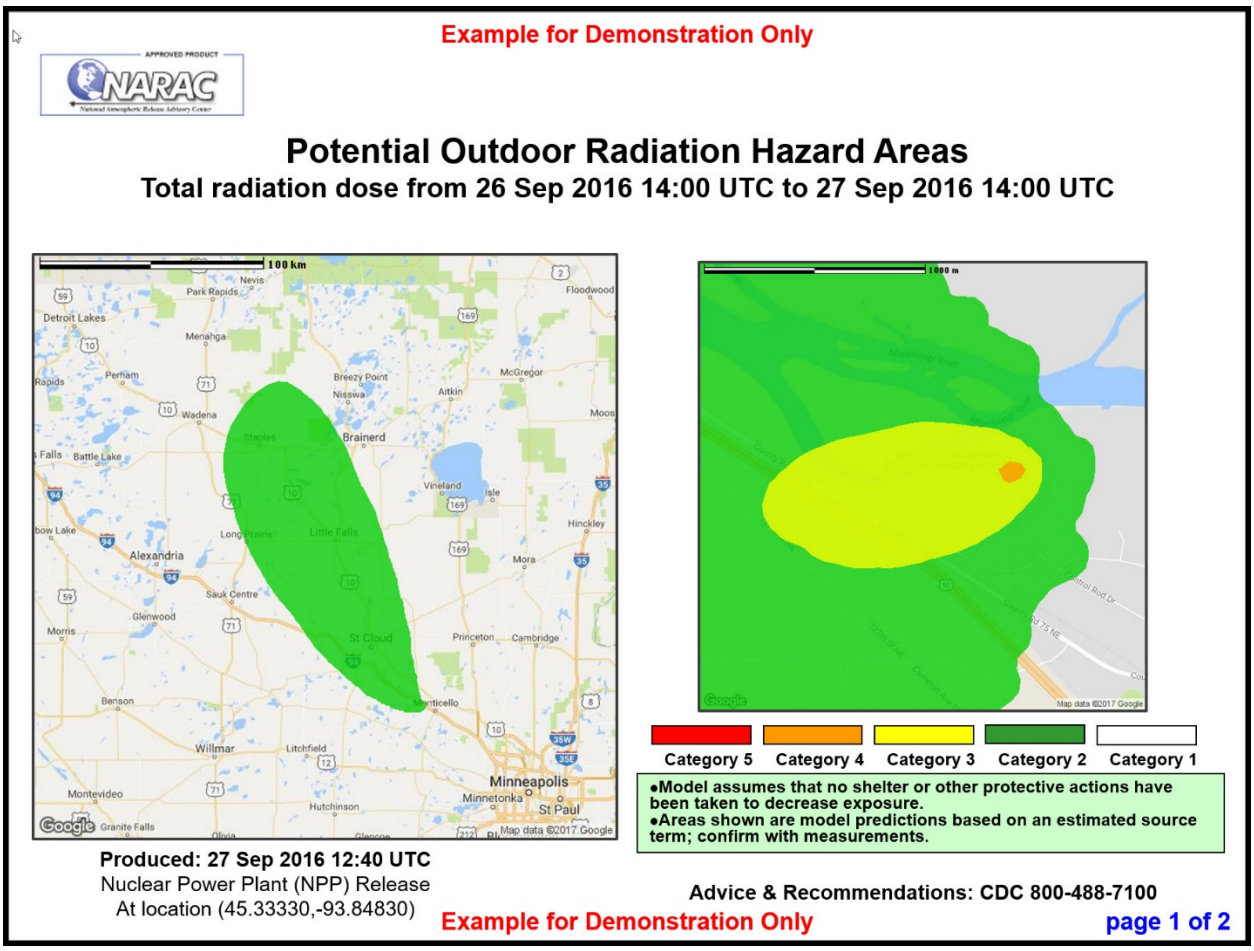
What additional information would make this product more useful to you?

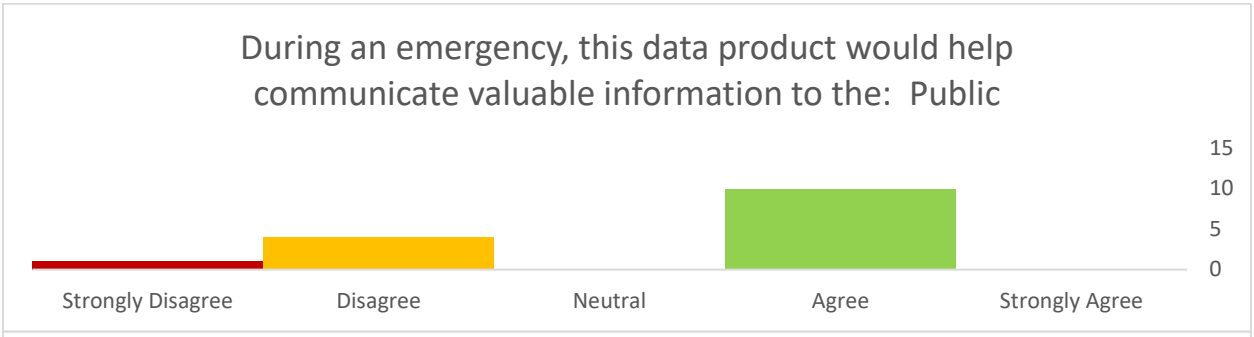
- Streets GIS
- more clearer picture
- explain more simply-what's a "source term" etc?
- same as previous regarding transparency. Doesn't allow identification (location) at category 3
- action steps
- A link to find real-time measurement data (if available)
- explain the assumptions
- An inset in the box on the right with a zoom into immediate scene to show the Category 3, 4 and 5.

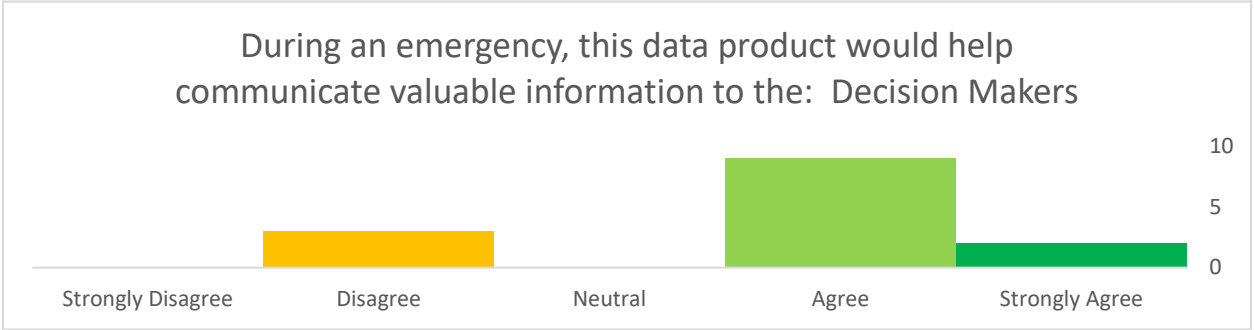
What information, if any, should be removed from this product?

- What to do during category
- subtitle-as discussed earlier

Nuclear Power Plant Release Data Product

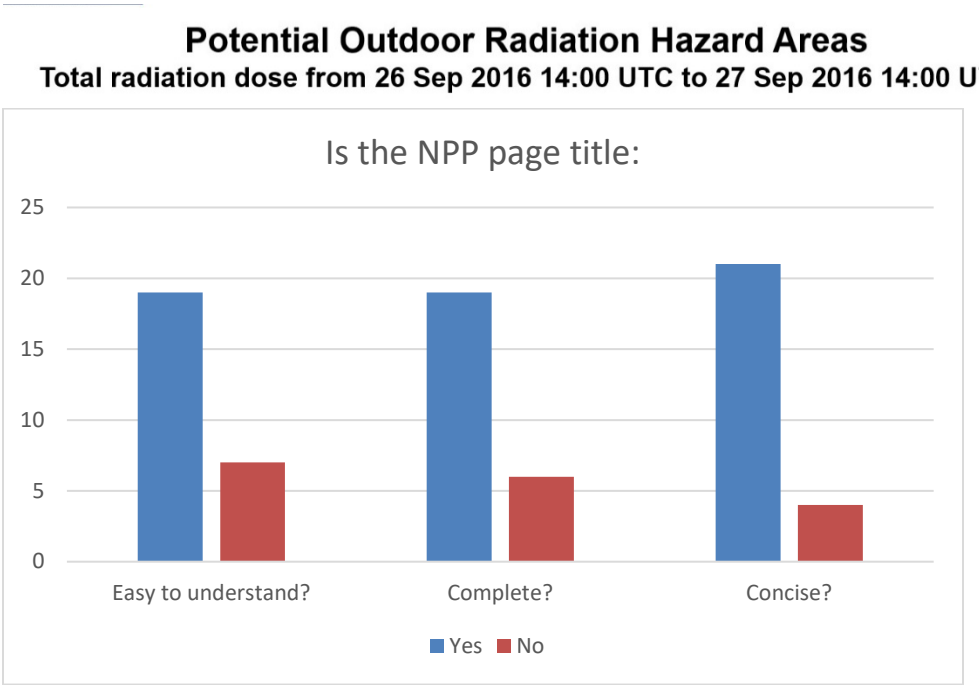






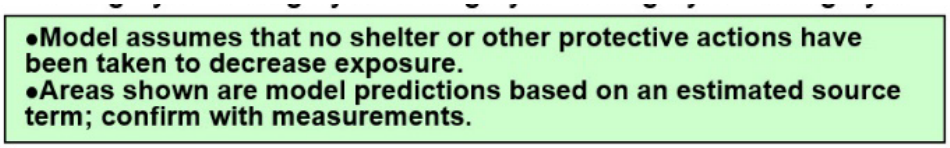
Written Comments

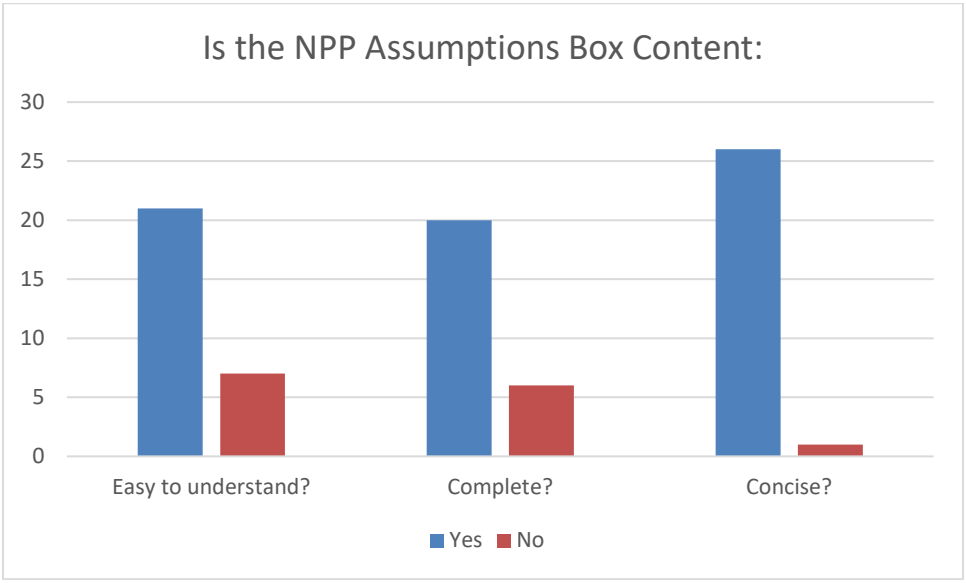
- The public does not need to make an evacuation decision. This might confuse them and give them reason to disobey the orders of the governor which are implemented by local police officials. What information do you have that the utility and the State do not have. Are you running RASCAL? Could this be compared to the utility and State computer runs? Can your runs be updated with direct data?
- it may-our NJ nuke plant communities utilize a system currently-education would need to occur
- coloring of the map
- Not being able to see yellow section on 1st really bothers me
- display of only "non hazardous" area is confusing
- not enough info, need bullet points about incident. Map scale should be miles/ft. need better marking for blast point
- Since the yellow isn't visible on the larger scale map the zoomed in version doesn't help too much. I think this would confuse the public.
- The color green remains too opaque, and an inset to show the closer scene would be nice.
- Should list/show wind speed, direction and measurement elevation. Expected change in winds? Release in progress or terminated?



- Again, decision makers would want to know from what data source these projections were made, i.e. duration of release, projection or direct measurements or both, assumptions on plant conditions if solely a projection.
- dose/hazard; cannot see orange dot on left
- this is too technical for general public
- In addition to current info data

- don't use military time and agencies should use own time zone; change format to Sept 26, 2016; subtitle should be a customizable fillable field when issued
- most public doesn't understand UTC
- Like the specific time frame
- simplify same as ind and rdd titles
- See previous answers on first scenario
- Predicted Area for Potential Outdoor Radiation Hazard from Unplanned Release; Total predicted dose from (ongoing or terminated) unplanned radioactive release from NPP during next 24 hrs
- Most folks won't know how UTC relates to the time in their area. Maybe add a subtitle for time in the time zone where the incident is occurring. I would suggest saying "predicted" vs. "potential"; remove "outdoor" from the title - there is a note that says that no shelter is assumed; Suggested title "Predicted Radiation Hazard Areas based on total radiation dose accumulated from Local Time A to Local Time B (UTC Time to UTC time)"





- "estimated source term" not easily understood by others outside of rad field
- same as last time with language
- yes bullet 1, no bullet 2
- For a general audience, it would be difficult to understand
- perhaps "confirm with measurements" should be "modeled data is superseded by measurement data" or similar?
- See previous answers on first scenario

- Predicted Area for Potential Outdoor Radiation Hazard from Unplanned Release; Total predicted dose from (ongoing or terminated) unplanned radioactive release from NPP during next 24 hrs
- Reverse the order of the bullets. Suggested alternate wording " Model assumes that persons are outside during the specified time period; sheltering and other protective actions will decrease predicted radiation hazard." "Areas shown are model predictions based on the estimated amount of radioactive material released (source term); confirm with measurements."
- Change Estimated Source Term to Estimated Release, Joe Public and most Decision makers really don't understand what "Source Term" is.

What additional information would make this product more useful to you?

- As suggested during the workshop, a second set of maps assuming shelter in place would be helpful.
- streets area map 2 (right side)
- again...suggest actions to take in each category
- The ability to edit text in some titles and boxes
- explanation of the assumptions actually mean
- Source term needs replacement or definition. Sheltering in place might be better than shelter since some people get confused with shelter alone.
- Release in progress or terminated, ground level (containment bypass event) or elevated (controlled, monitored, filtered) release. Potential for plume to shift due to wind or weather. Potential impact on model from precipitation.
- O think distance rings away from the release point are useful for decision makers
- Add a sentence or 2 about protective actions to each hazard level on page 2...Red and Orange - protective actions should be initiated as soon as possible; Yellow - consider protective actions; Green - protective actions not necessary.
- As a decision maker I would like to see the PAGs referenced and put into context in the categories. Can't tell what is above or below PAG to make decisions or recommendations.

What information, if any, should be removed from this product?

- what to do in each category; action steps

If someone handed you this product to use during an emergency response, what questions would you have about this data product?

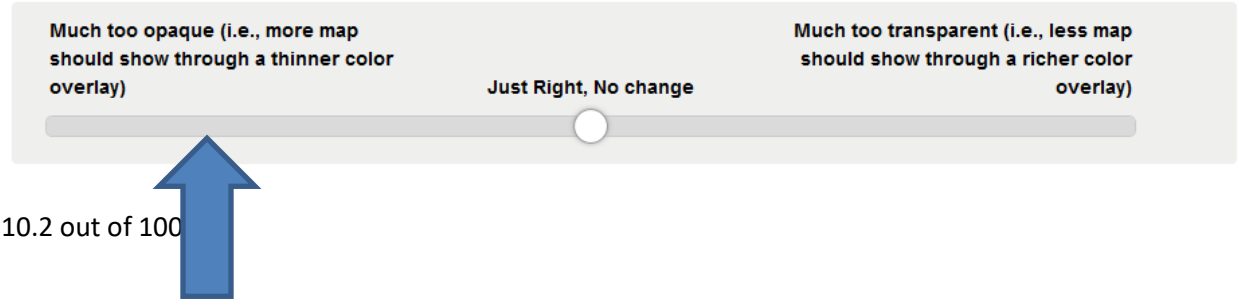
- (area) streets
- what is it? need education campaign
- same as before
- what actions should be taken based on category
- What can I do to protect myself?
- See above

- Release in progress or terminated, ground level (containment bypass event) or elevated (controlled, monitored, filtered) release. Potential for plume to shift due to wind or weather. Potential impact on model from precipitation. Likelihood for release to escalate or be mitigated/terminated.
- For an early phase map, I think it is good.
- As a technical person, I would want to know what radiation dose is associated with each hazard level.
- Is the green above or below the EPA PAGs? Is the Orange less than or greater than the life safety limits?

Additional comments on the NPP scenario product:

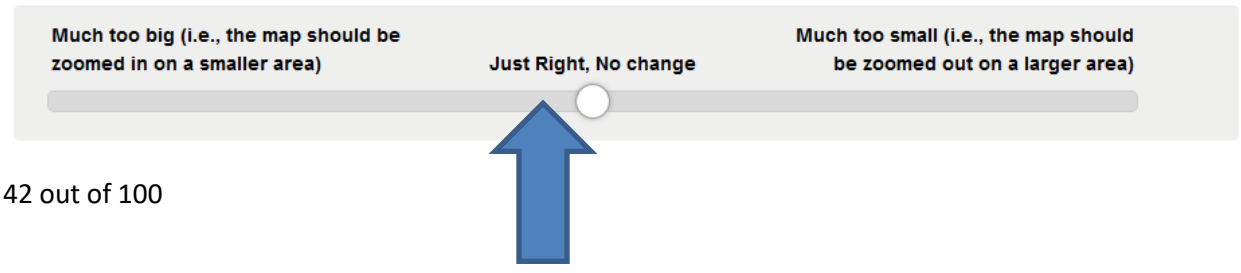
- Time stamp; feet and miles; source release; NPP has scripted activities/categories, would need to merge products
- would help support current awareness campaign of those communities by NPP
- hard to ID location of NPP on left hand side map
- cleared defined maps; transparent maps
- overall the CDC product seems to be < useful for events with a small category 3 footprint. seems to overly highlight a "no hazard area" since category 2 is the only area delineated->people will presume it is the impacted area.
- turn into interactive tool and app; map, hazard scale, actions
- See above
- I think these products are best suited for public information and as an accompaniment to the traditional dose-based map products when briefing decision-makers.

25. The color overlay on the maps is:



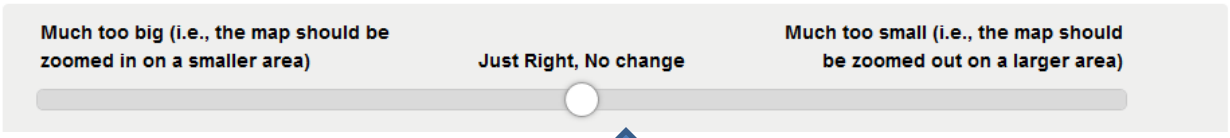
10.2 out of 100

26. The geographical areas shown in the maps on the left side of the products are:



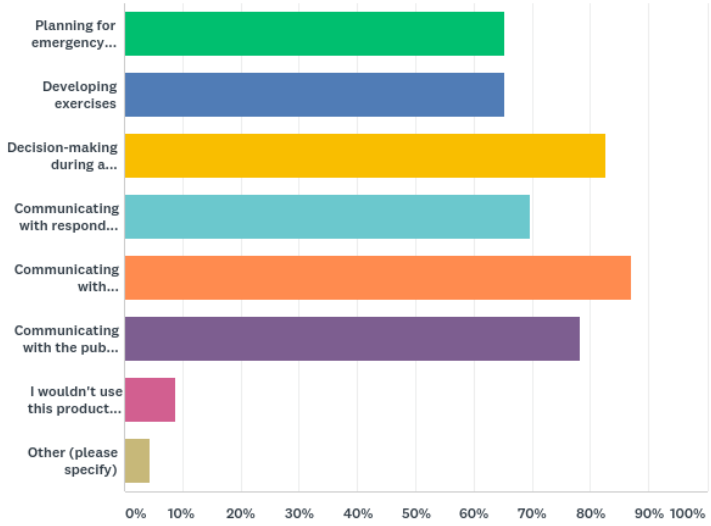
42 out of 100

27. The geographical areas shown in the map on the right side of the products are:



49 out of 100

Q28 How should these products be used? (please select all that apply)



What protective action recommendations or emergency messages should accompany these products? (note: to be used with the product, not to be included on the product itself)

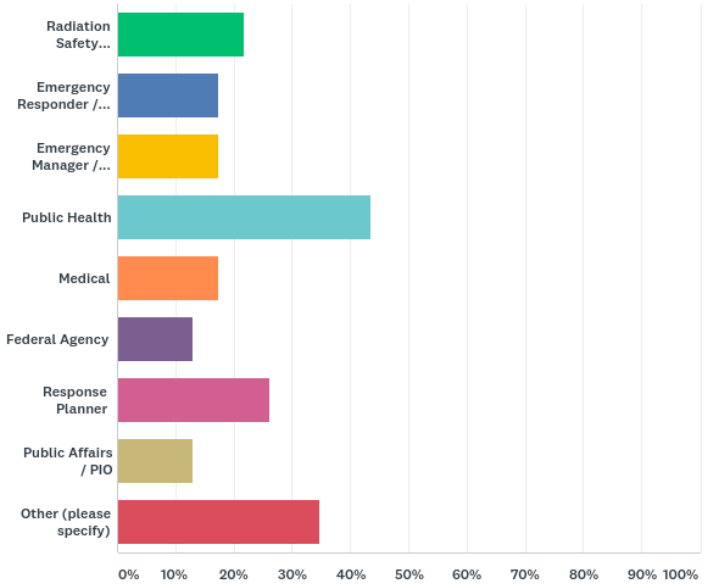
- Taking KI-feeding animals on stored feed
- PAG messaging
- guidelines for the scale
- PAGs or pre-scripted ESF15 messages
- used as a enhanced planning tool
- specific instructions for each category given by OEM/PIO
- Get in, stay tuned, (shelter?)
- boilerplate that would allow messages to be selected and tailored based on incident
- PPE recommended, sheltering recommendations (eg. basements, parking garages, etc.)
- What people can and should do to protect themselves
- those appropriate to the event
- I believe the description of the five categories would be used with this product.

- I would not include PARs on this. That is for others to make in other ways. I would make bold: Get Inside, Stay Inside and Stay Tuned for Further Instruction for all.

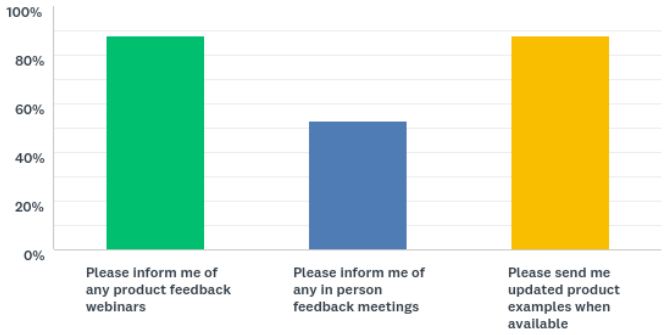
Please provide a description of your likely role in a Nuc/Rad Emergency

- dose assessment at the EOF
- Planner/responder
- Health Education and Population Monitoring at the CRC
- Emotional support
- coordination of communication with responding organizations
- RCRC
- Prepping spokespersons. Developing social media messaging
- ESF8 lead (state)
- Disaster mental health/Mass care. I am always thinking about how to present info to public to reduce panic
- formerly field response, current-local SME to public officials
- planning and preparing for the emotional/behavioral consequences in a nuc/rad emergency
- stats emergency operations center
- Depending on incident type (NPP, IND, RDD) either a Subject Matter Expert, or a lead of a state facility (forward Command Post, Tech Assess Ctr)
- Programmatic support to federal response.
- I am basically the incident commander for an ingestion state
- Responder
- I will likely be a technical assist in a Nuc/Rad Emergency to convey radiation risks to my commanding officer.
- ROSS, Rad Control Program Director, Advisor to Governor and other leadership.
- Responder and technical adviser (remote or near/onsite) for federal regulator during NPP events.

Q32 Please tell us a little about your background (check all that apply)



Q34 In 2017, the there will be several events where these products will be presented and discussed (requires that you provide your e-mail above)



Additional comments or feedback:

- app to fact sheets/videos/hazard scale map should include street names if possible or separate page to enlarge to show more detail
- Would like to be able to zoom in/out it's a great tool, and I see it to be very useful
- Great class and interaction. A good way to provide info to the public.
- Awesome opportunity to review and provide comments. Thank you!
- Love the simplicity of color coding and that they are graded-not sharp lines
- Thank you!
- Would not use as it is now, needs work; Don't give up!
- Thanks! **From paper survey

Survey Participants (optional):

- Sherie Wolpert, epidemiologist Middlesex County Office of Health Services sherie.wolpert@co.middlesex.nj.us
- Ed Truskowski Research Scientist, NJDEP, Bureau of Env. Radiation ed.truskowski@dep.nj.gov
- John Dowd Div Head Middlesex County Office of Health Services john.dowd@co.middlesex.nj.us
- Carrie Johnson 732-745-8923 Middlesex county office of health services carrie.johnson@co.middlesex.nj.us
- neal.stephens@dhs.state.nj.us
- Joe Geleta joseph.geleta@dhs.state.nj.us 609-273-9282
- Kelly Higgs; exec. Dir. NJVOAD, khiggs@njvoad.org
- Nicole Kirgan Risk comms specialist NJ DOH nicole.kirgan@doh.nj.gov
- Eileen Marcinczyk Special Operations Unit Middlesex County Office of Health Services eileen.marcinczyk@co.middlesex.nj.us
- Monique Davis, MPH, MCHES, CCPH Health Educator/Risk Communicator/Public Health Planner Hudson Regional Health Commission 595 County Ave, Bldg 1, Secaucus NJ 07094 mdavis@hudsonregionalhealth.org
- Brendan McCluskey Director, Emergency Preparedness and Operations New Jersey Department of Health brendan.mccluskey@doh.nj.gov
- megan.sullivan@dhs.state.nj.us
- Adrienne Fessler-Belli; Director NJDHS DTD; adrienne.fessler-belli@dhs.state.nj.us
- Mitzi Kaiura, Emergency Management, mitzi.kaiura@dep.nj.gov
- Nancy Stanley, Radiation physicist, NJ Dept Environmental Protection, nancy.stanley@dep.nj.gov
- Erica Bickford Transportation Program Manager US Department of Energy Office of Nuclear Energy erica.bickford@nuclear.energy.gov
- Patricia Milligan US NRC patricia.milligan@nrc.gov
- Katherine Williams, Assistant Radiation Safety Officer, Naval Surface Warfare Center Crane Division, katherine.a.williams@navy.mil
- William.irwin@vermont.gov
- 2017 Harvard Radiological Emergency Planning Class participant