



*United States Preparedness and Response  
Activities for Space Exploration Missions  
Involving Nuclear Power Sources*

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Reed Wilcox

Jet Propulsion Laboratory, California Institute of Technology

National Aeronautics and Space Administration  
United States of America

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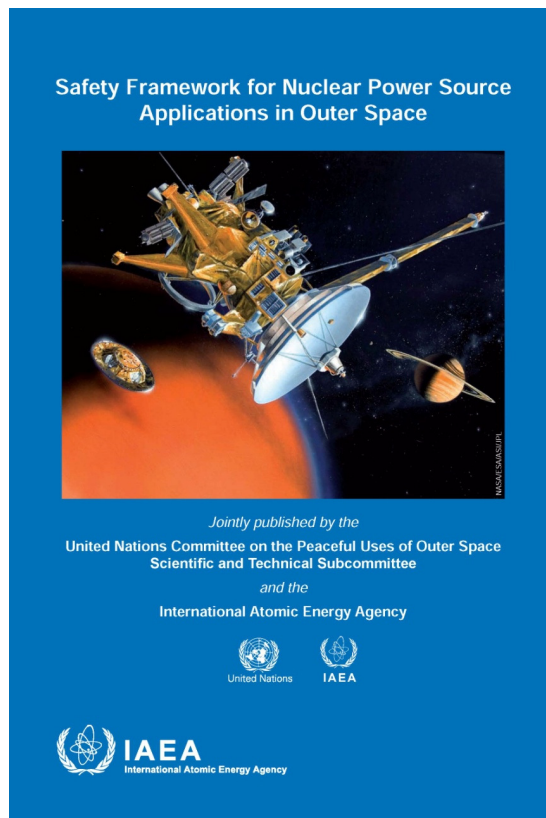


## *Topics*

- ◆ Elements of Model UN/IAEA Safety Framework Relevant to Emergency Preparedness and Response
- ◆ Comparison of UN/IAEA Safety Framework with NASA's Nuclear Safety Implementation for Space Radioisotope Power System (RPS) Applications
- ◆ USA Preparedness and Response Requirements for Space Radioisotope Power Systems (RPS) Applications
- ◆ Processes for Satisfaction of Preparedness and Response Requirements
- ◆ Lessons Learned from NASA Space RPS Applications



# *Elements of Model UN/IAEA Safety Framework Relevant to Emergency Preparedness and Response*



## Governmental Guidance

- 3.1 Safety policies, requirements and processes
- 3.3 Mission launch authorization
- 3.4 Emergency preparedness and response

## Management Guidance

- 4.1 Responsibility for safety
- 4.2 Leadership and management for safety

## Technical Guidance

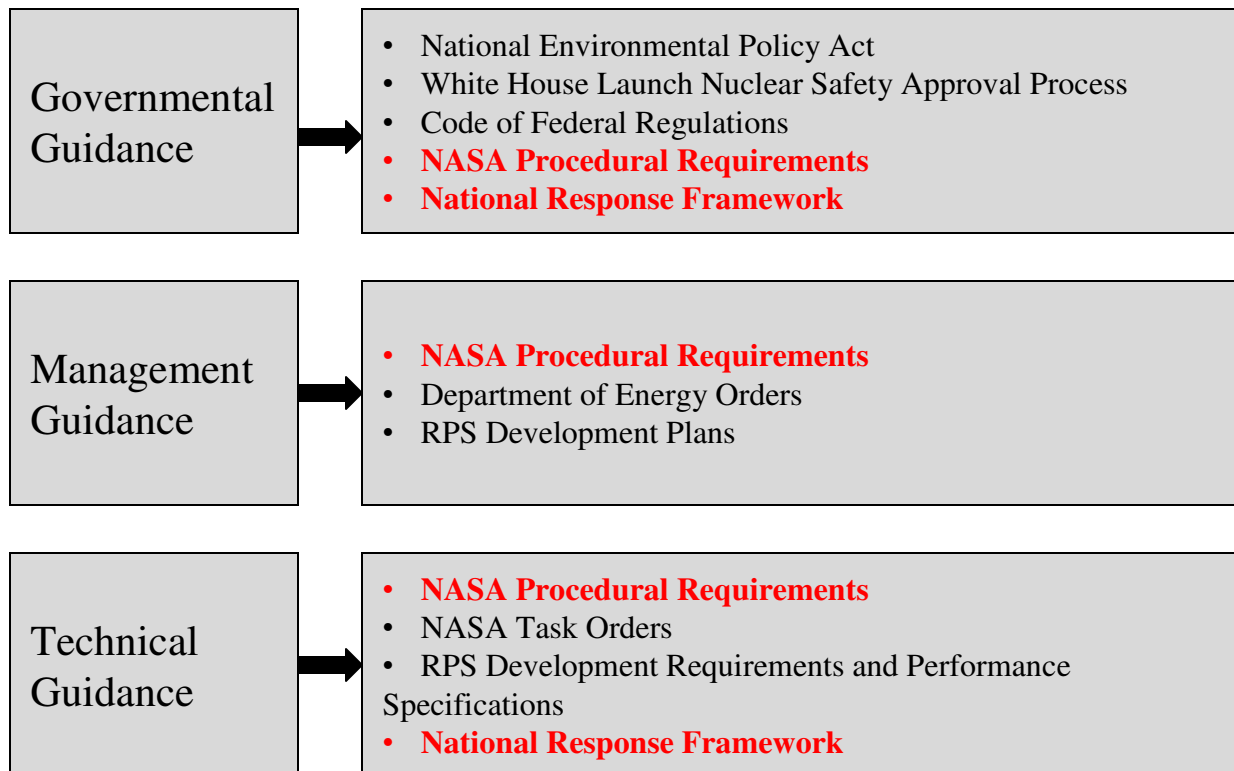
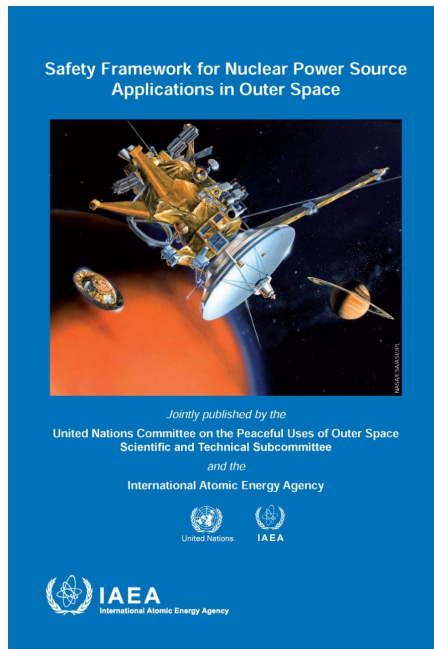
- 5.1 Technical competence in nuclear safety
- 5.3 Risk assessments
- 5.4 Accident consequence mitigation



# Comparison of Model UN/IAEA Safety Framework with NASA's Nuclear Safety Implementation for Space NPS Applications: Focus on Emergency Preparedness and Response

## UN/IAEA Safety Framework

## United States Federal Law/Guidance





# National Response Framework



## National Response Framework

January 2008



Homeland Security

- ◆ Guide to how U.S. responds to all hazards
- ◆ Provides a consistent framework for preparing and implementing emergency preparedness and response plans
- ◆ Links all levels of government
- ◆ Describes national response and preparedness policies, roles, responsibilities, response actions, response organizations and planning requirements
- ◆ Contains *Nuclear/Radiological Incident Annex* that specifically addresses release of nuclear/radiological materials from space vehicles



## Nuclear/Radiological Incident Annex

- ◆ Designates National Aeronautics and Space Administration (NASA) as the coordinating agency for the Federal response to incidents involving the release of nuclear/radioactive materials from NASA space vehicles or joint space vehicles with significant NASA involvement
  - “Coordinating agency” provides response leadership, expertise and assets
- ◆ Involves cooperating agencies that provide response technical and resource support
  - Department of Energy, Department of Defense, Environmental Protection Agency, Department of Homeland Security, Department of State, Department of Transportation, Department of Health and Human Services, Department of Commerce, etc.



## *Top Level NASA Preparedness and Response Requirements for All Missions*

- ◆ Protect lives
- ◆ Protect environment
- ◆ Support local, state, and federal agencies and appropriate emergency response authorities
- ◆ Assist in mitigating hazards and the effects of technological emergencies
- ◆ Aid in recovery



## *NASA Preparedness and Response Requirements for Space RPS Mission Applications*

- ◆ Develop site-specific ground operations and radiological contingency plans commensurate with the risk represented by the planned launch of nuclear materials
- ◆ Include provisions for emergency response and support for source recovery efforts in radiological contingency plans
- ◆ Exercise contingency response capabilities as deemed necessary to ensure adequate readiness of participants and adequacy of planning to protect the public, site personnel, and facilities
- ◆ Ensure appropriate and timely coordination with regional Federal, State, territorial, and local emergency management authorities to provide for support to, and coordination with, offsite emergency response elements
- ◆ Make provisions for special offsite monitoring and assistance in recovery of radioactive materials that could spread into areas outside the geographical boundaries of the launch site





## *NASA Preparedness and Response Requirements for Space NPS Mission Applications (continued)*

- ◆ Establish a radiological control center (RADCC) for launches and landings with radioactive sources possessing a significant health or environmental risk, or having an activity of A2 mission multiple greater than 1,000 as determined per paragraph 6.3 of this NPR, or as specified in applicable interagency agreements
- ◆ Ensure, when required, that the RADCC provides technical support and coordination with other Federal, State, territorial, and local agencies in the case of a launch or landing accident that may result in the release of radioactive materials
- ◆ Ensure, when required, that the RADCC is operational during launch and landing phases anytime there is a potential for an accident that could release radioactive material
- ◆ Ensure, when required, that the RADCC is staffed commensurate with the risk associated with the radioactive materials present



## *Public Information Requirements*

- ◆ Gather, analyze, produce and distribute information approved by the Coordinating Agency Representative about the launch accident and government response to the accident;
- ◆ Ensure timely release of accurate information to the media and other audiences in the event of a launch accident;
- ◆ Coordinate with agencies represented in the Joint Information Center (JIC) on the content and release of public information developed in response to the accident;
- ◆ Develop, recommend, and execute public information products, plans and strategies in the event of a launch accident;
- ◆ Monitor and measure message delivery, media content and public perception of the launch accident.

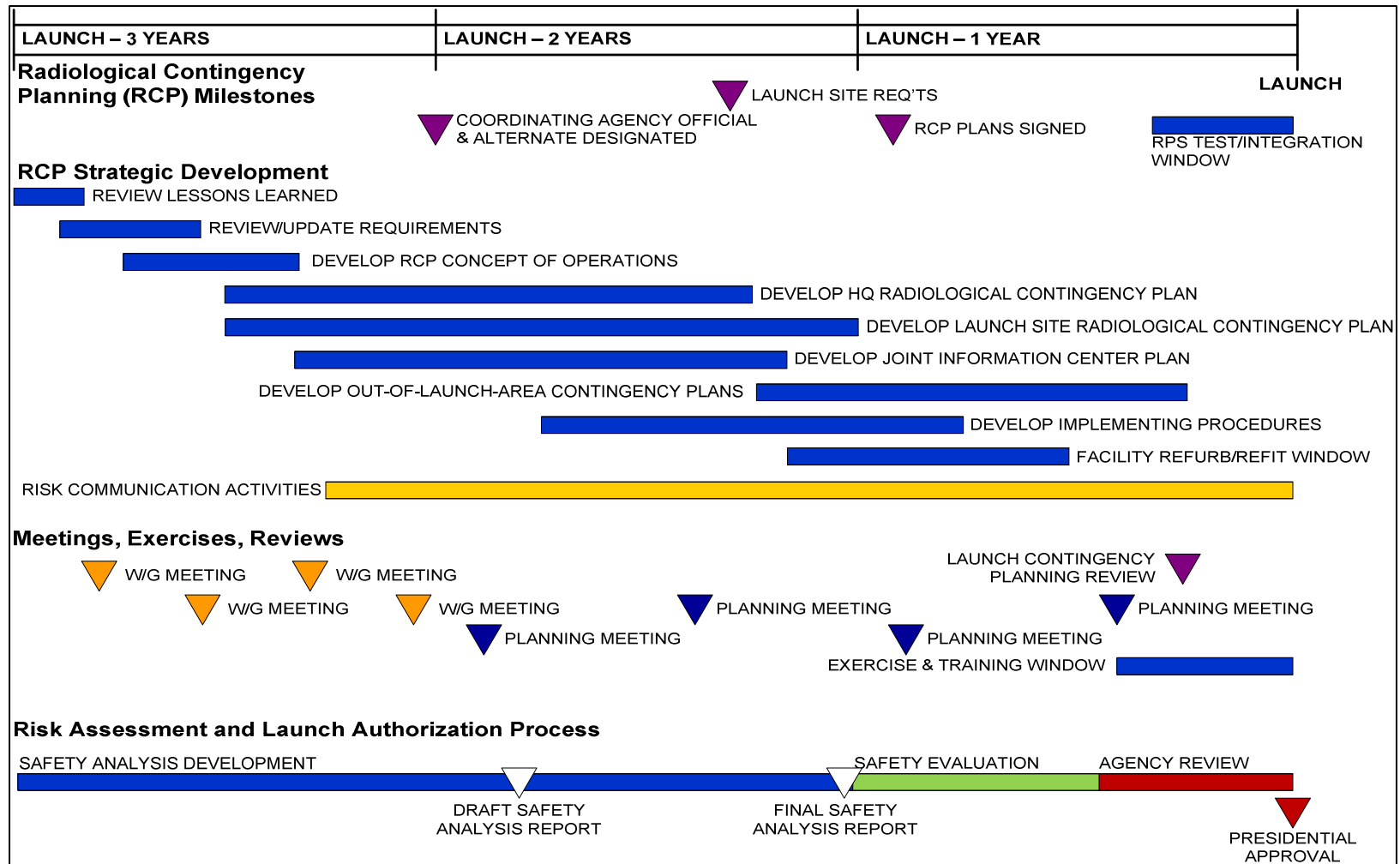


## *Processes for Satisfaction of Preparedness and Response Requirements*

- ◆ Radiological Contingency Planning (RCP) process requirements
  - Begin planning early with staff commitment and involvement of all agencies (i.e. federal, state and local)
  - Develop required tasks based upon an integrated schedule
  - Complete preparedness and response documentation early to provide time for exercise and training
- ◆ Related/Supporting Process Requirements
  - Use risk analysis results as a basis for scoping emergency preparedness and response plans
  - Include emergency preparedness and response plans in launch authorization process reviews



# Processes for Satisfaction of Preparedness and Response Requirements (continued)





# *Planning Elements*

- ◆ Plans
  - NASA HQ Contingency Plan
  - Launch site contingency plan
  - Out-of-orbit contingency plan
- ◆ Procedures Development
  - Detector operations
  - Environmental sampling
  - Decontamination
  - Contingency response facility operations
- ◆ Training/Rehearsals
  - Procedural 'walkthroughs'
  - Launch site exercises
  - Concept of Operations instruction
  - Field team training
  - Console operations
- ◆ Communication Protocols
  - Inter-governmental information sharing and decisionmaking
  - Potential accident notifications
  - Protective action recommendations



## *Preparedness and Response Lessons Learned from NASA Space RPS Applications*

- ◆ Exercises and training identify gaps
- ◆ Integrate RCP into standard emergency response management structures and contingency plans; build on existing infrastructure
- ◆ Co-locate (physically or 'virtually') the technical, management and public information elements of the emergency response organizations
- ◆ Include emergency preparedness reviews for all levels of government as part of the launch authorization process
  - Ensures 'buy-in' from the top down
- ◆ Recognize that the emergency preparedness function includes not only determining and implementing the appropriate protective actions in the event of an accident, but also includes the capability to verify that a release of radioactive material has not occurred
  - Can't just plan for the worst case and implement protective actions assuming the worst
    - » Protective actions can involve public risks



## *Summary*

- ◆ US requires detailed multi-agency emergency preparedness and response plans
- ◆ Plans built on foundation of a national emergency framework
- ◆ Plans encompass potential small and larger releases
- ◆ Success in ensuring mission nuclear safety has not diminished rigor and scope of emergency preparedness and response plans
- ◆ Multi-year efforts entailed in developing and verifying procedures, communication protocols, pre-scripted notifications, multiple exercises and rehearsals for each NPS launched
- ◆ US approach assures public safety and builds public trust and support for safe conduct of future US space NPS applications