

# **Emergency Response and Radiation Protection Plans for a Large Combined Sanitary/Storm Sewer and Wastewater Treatment Plant**

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# Today's Talk

- Background
- Approach to the Project
- Challenges and Solutions
- Overview of the Emergency Plan
- Lessons Learned
- Conclusions

# Approach to Project

- Assumptions and Technical Basis
- Build on Current Emergency Plan for Wastewater Treatment Facility
- Understand the Basic Operation of the Wastewater Treatment Facility and the Flow of Water from Downtown to the Facility
- Identify Scenarios to be Considered in the Plan
- Create a Simple Annex for Radiological Emergencies



# Challenges and Solutions

- 1 Working with management who did not understand radiological materials, detection and protection
- 2 Establishing appropriate protection standards
- 3 Determining when there would be radioactive material in the wastewater
- 4 Communicating with a worker population that did not understand radiation hazards

# Challenge 1

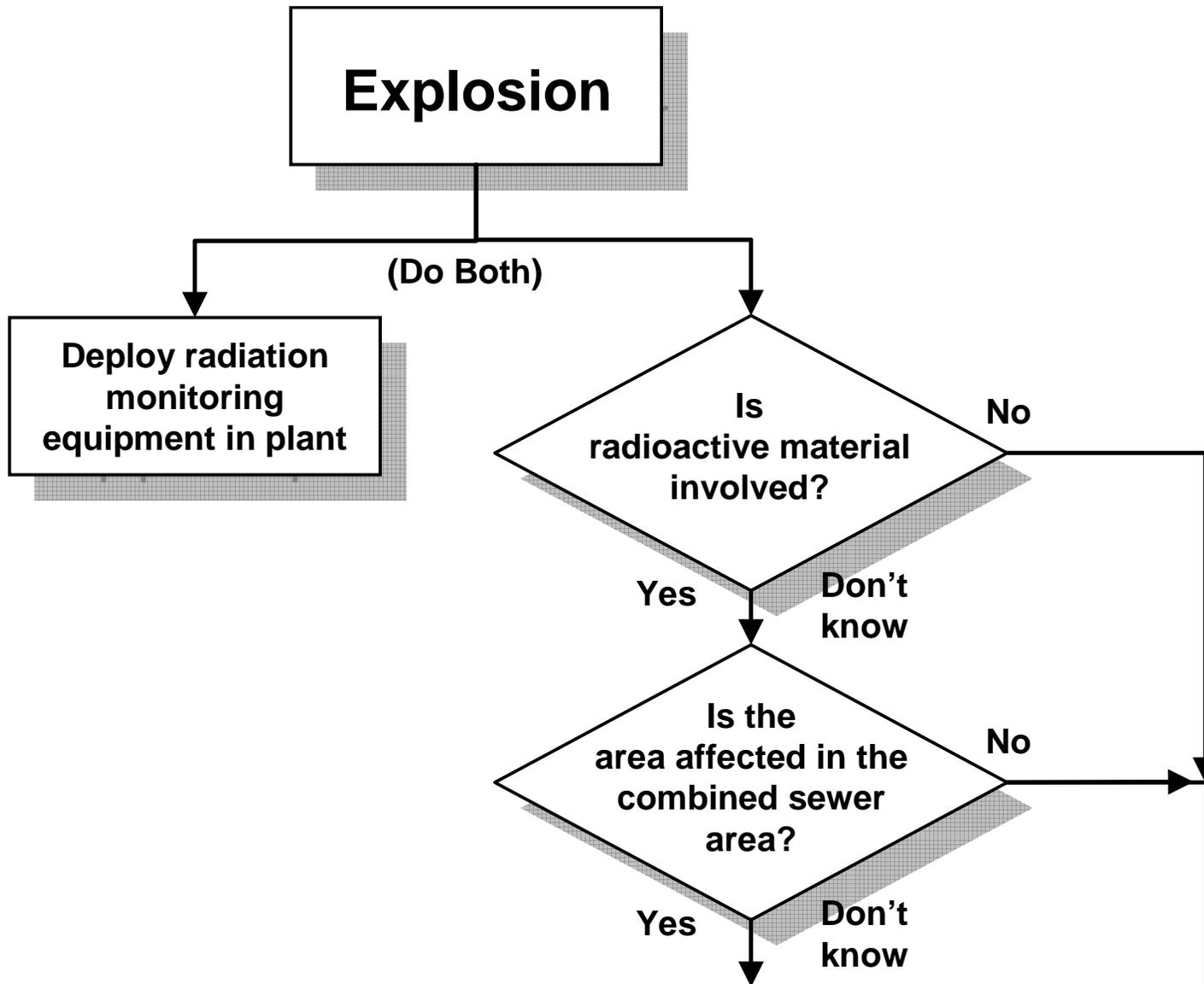
- Management personnel typically did not have technical background, but understood the need to be educated
  - Many discussions, visits and tours
  - Provided reference material for review
  - Designed one day orientation

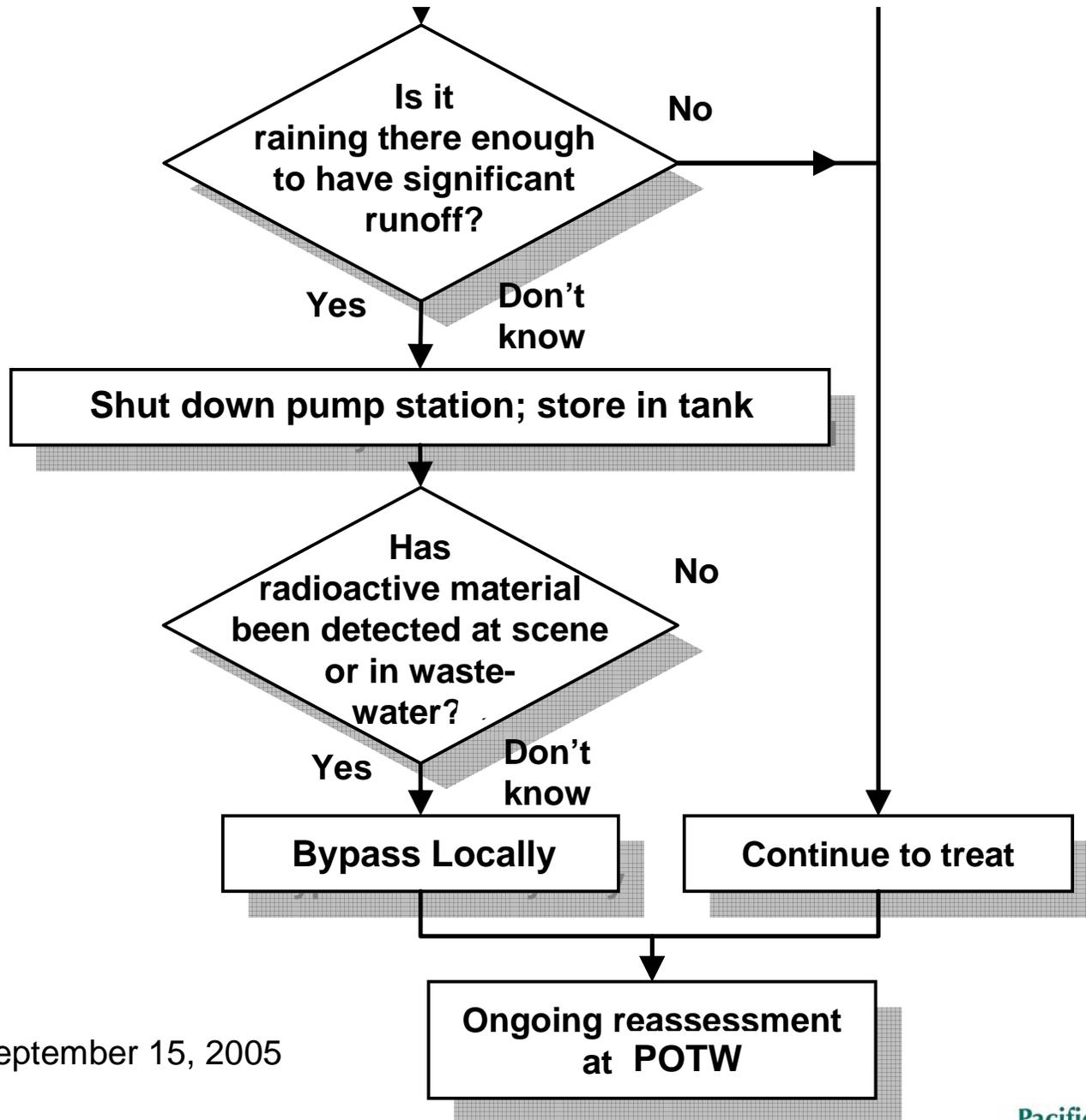
# Challenge 2

- Determining the appropriate radiation protection standards
  - The workers ARE NOT radiation workers
  - State regs are for licensed facilities
  - OSHA regs (State or 29 CFR 1910.1096) apply but are out of date
    - Use of dose equivalent rather than effective dose equivalent
    - $1\frac{1}{4}$  rems/qtr + 40 DAC-h/7 d; 3 rems/qtr if  $H_{\text{lifetime}} < 5(N-18)$
    - No mention of public dose limits
    - No discussion of ALARA
- Recommended following State codes and apply limit of 100 mrem/yr

# Challenge 3

- Determining when there would be radioactive material in the wastewater—and how bad is it?
  - Sampling and monitoring instrumentation was not currently available
  - Until instrumentation is in place, plan is to discharge to the local water body
- Needed to determine when to process wastewater and when to hold up or discharge directly
- Created flow charts for decision making





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# Challenge 4

- How to create a radiation protection tool for untrained workers that were concerned about the health effects of radiation
  - Provide basic instruction in the plan
  - Recommended visual aids such as simple charts to be hung on walls for reference
  - Provide instrumentation for trained staff and dosimetry for workers

# Contents of Plan

- Recognition of an emergency
- Emergency Notification
- Emergency Communication
- Incident Command System
- Evacuation and Sheltering
- Initial Response
- General Safety Information

# 10 Principles and 10 Commandments of Radiation Protection

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No.	Principle	Commandment (familiar)
1.	Time	Hurry (but don't be hasty)
2.	Distance	Stay away from it or upwind of it
3.	Dispersal	Disperse it and dilute it
4.	Source Reduction	Make and use as little as possible
5.	Source Barrier	Keep it in
6.	Personal Barrier	Keep it out
7.	Decorporation (Internal & Skin)	Get it out of you and off of you
8.	Effect Mitigation	Limit the damage
9.	Optimal Technology	Choose best technology
10.	Limitation of Other Exposures	Don't compound risks (don't smoke)

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# Actions Management Can Take to Limit External Irradiation

- Ensure workers protect themselves (above)
  - training, establishing restricted areas, using postings
- Dispersal
- Reduce source amounts
  - manage waste streams
  - decontamination programs
- Erect shielding
- Divide up “hot” jobs

# Actions Workers Can Take to Limit External Irradiation

- limit exposure time
- stay away from radiation source
- use radiation-absorbing shielding

# Protection Against Intakes by Inhalation

- For obvious reasons, workers already minimize the inhalation of wastewater aerosols, vapors, and gases
- Enormous dilution
- Not expected to be significant route of intake
  - $^{226}\text{Ra}$  and  $^{222}\text{Rn}$  might be an exception

# Actions Management Can Take to Limit Inhalation of Radioactive Material

- administrative (management) controls
  - provide procedures, training, equipment, gear
- dispersal
- reducing activity in plant
- containment & confinement
- dividing up “hot” jobs

# Actions Workers Can Take to Limit Inhalation of Radioactive Material

- limiting exposure time
- staying upwind
- using ventilation (confined space entry techniques)
- minimizing the resuspension of radioactive contamination on surfaces
- using personal protective equipment
- if inhalation is suspected, nose-blowing, sneezing, coughing up and spitting out

# Protection Against Intakes Through Dermal Contact and by Ingestion

- For obvious reasons, workers already minimize the dermal contact with and ingestion of wastewater!
- Radioactive contamination
  - just like dirt
  - “stuff being where you don’t want it”
  - invisible, so instruments needed

# Actions Workers Can Take to Limit Dermal Contact with, Ingestion of, Radioactive Material

- Preventing or minimizing contamination of anything that can be ingested or come in contact with the face
- Minimizing the resuspension of radioactive contamination on surfaces
- Staying upwind
- Using ventilation
- Using personal protective equipment
- Prompt decontamination

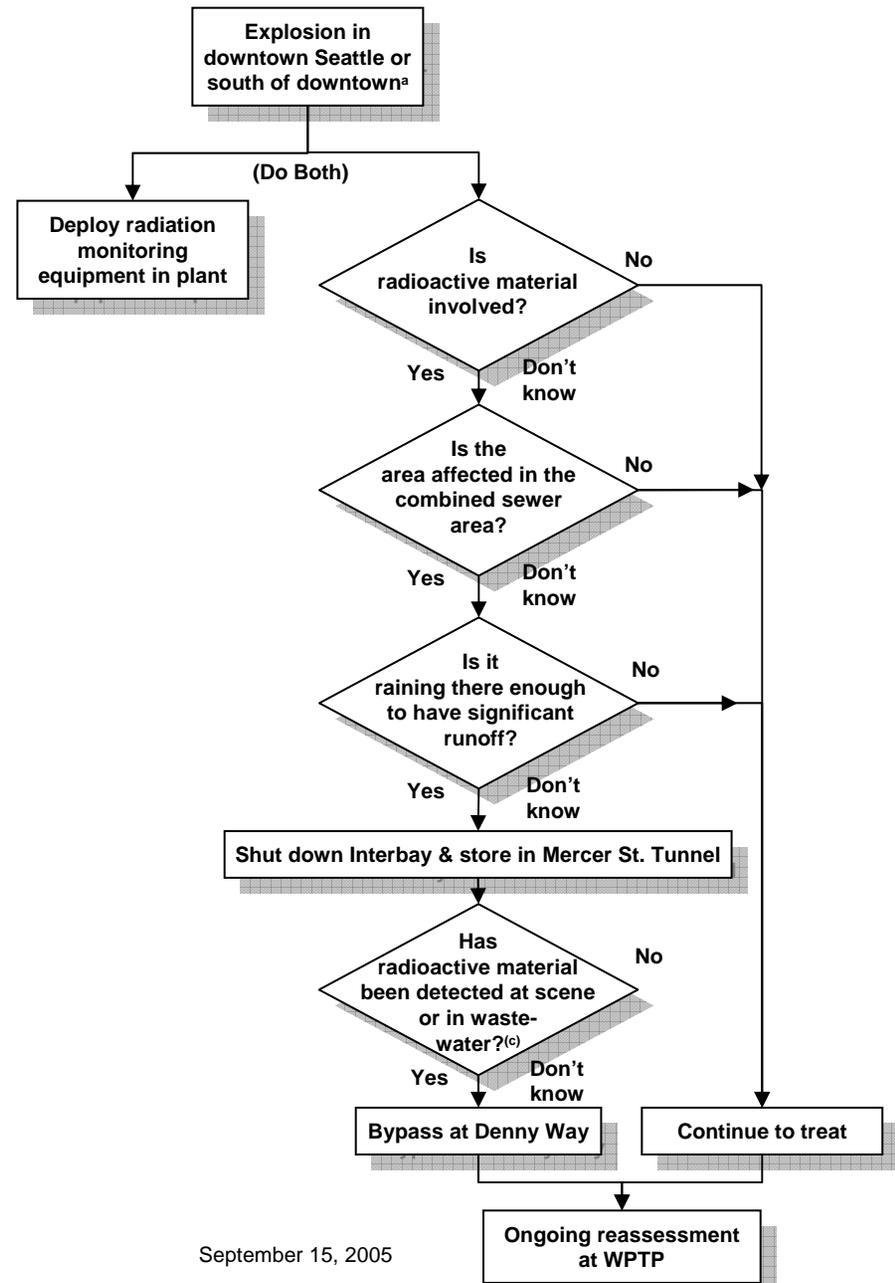
# Lessons Learned

- Education: both management and workers
- Keep it Simple
- Team Approach
- Patience

# Summary

- The “emergency plan” is really a very basic “radiation protection plan” for workers that are not trained as radiation workers
- It is a very good basis for other cities that have the same types of issues or other industrial complexes that may have to deal with protecting workers after an RDD event

# Dirty Bomb: Radioactive Material



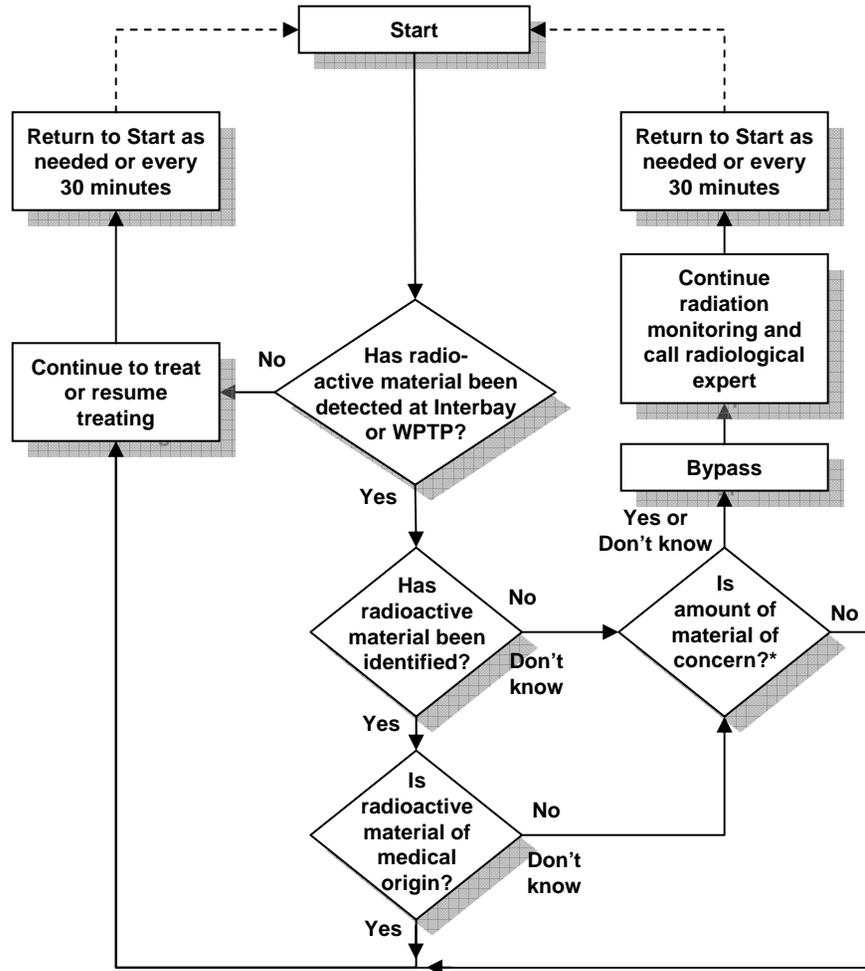
<sup>a</sup>Possible dirty bomb

<sup>b</sup> See page x of this plan for locations of equipment and procedures

<sup>c</sup> See procedure for determining if radioactive material is involved

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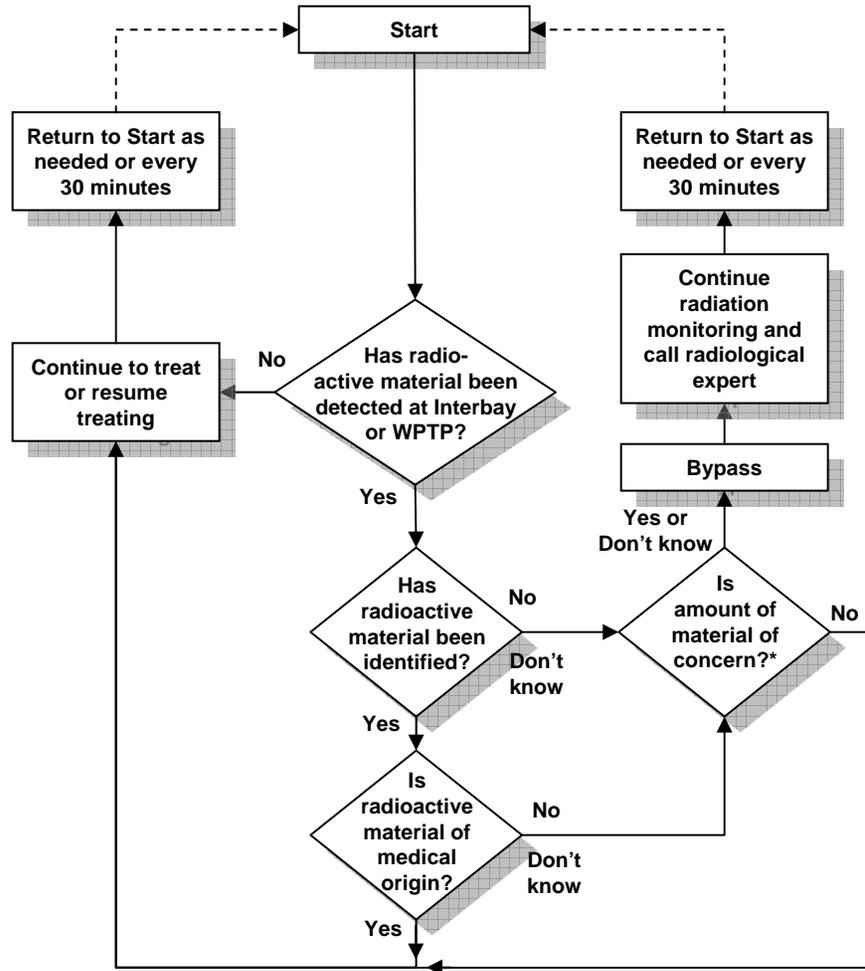
# Ongoing Reassessment: Hazard Characterization



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