

BOARD BRIEFING BOOK

Evaluating the Reliability of Occupational Dose Reconstruction at the Pinellas Plant
An Evidence-Based Scientific Assessment of SEC-00256
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1. SUMMARY

Purpose of this Briefing

This briefing evaluates whether the historical evidence supporting SEC-00256 satisfies the scientific requirements necessary for reliable occupational dose reconstruction under the SEC statutory standard.

Scientific Question

Does the available historical evidence provide sufficient scientific confidence that occupational radiation doses for the proposed Pinellas Plant worker class can be reconstructed under the SEC standard?

Scientific Finding

Reliable dose reconstruction requires evidence that is complete, representative, reliable, and independently validated across relevant operations, radionuclides, worker populations, monitoring programs, and exposure pathways.

Key Scientific Principle

The central scientific issue is not whether historical records exist. The question is whether the totality of the historical evidence provides sufficient independent evidence to reconstruct occupational radiation doses for the proposed worker class under the SEC standard.

2. THE SCIENTIFIC FRAMEWORK FOR DOSE RECONSTRUCTION An Evidence-Based Framework for Evaluating SEC-00256



Figure 2-1 Occupational dose reconstructability is evaluated through a sequential framework in which each evidence category contributes to the overall scientific confidence supporting the SEC determination.

Scientific Question

What historical evidence must be demonstrated before occupational radiation doses can be reconstructed with scientific reliability under the SEC standard?

Scientific Finding

Scientific confidence depends on demonstrating that each category is adequately supported by complete, representative, reliable, and independently validated historical evidence.

3. WHY THE PINELLAS PLANT WAS SCIENTIFICALLY UNIQUE



Figure 3-1. The operational complexity of the Pinellas Plant increased the amount and diversity of historical evidence required to reconstruct occupational radiation dose with scientific confidence.

Scientific Question

How does the historical complexity of the Pinellas Plant affect the evidence required for reliable dose reconstruction?

Scientific Finding

The Pinellas Plant combined multiple radionuclides, precision weapon-component manufacturing, classified and unclassified missions, research integrated with production, evolving manufacturing processes, and diverse worker populations. This complexity increased the range and detail of historical evidence needed to support reliable dose reconstruction.

Principal Characteristics

- Multiple radionuclides and changing radiological processes.
- Concurrent research, production, and classified activities.
- Diverse worker populations operating across changing missions and contractors.

Scientific Implication

This complexity requires historical evidence base capable of validating reconstruction assumptions across the full scope of facility operations.

4. RECONSTRUCTING THE HISTORICAL WORKPLACE

HOW DO WE RECONSTRUCT THE HISTORICAL WORKPLACE?

The Foundation of Reliable Occupational Dose Reconstruction



Figure 4-1. Accurate reconstruction of the historical workplace establishes the foundation for evaluating source terms, worker populations, monitoring, documentation, and all subsequent reconstruction assumptions.

Scientific Question

Can occupational radiation doses be reconstructed without first accurately reconstructing the historical workplace?

Scientific Finding

No. Dose reconstruction begins with an accurate reconstruction of the historical workplace. Establishing where work occurred, which radionuclides were present, how operations changed, and who performed the work is essential to determining whether doses can be reconstructed with scientific confidence.

Key Principle

Dose reconstruction cannot exceed the quality of the historical workplace reconstruction on which it is based. Establishing where work occurred, what radionuclides were present, how operations changed, and who performed the work is the essential first step in determining whether occupational radiation doses can be reconstructed with scientific confidence.

5. WORKER POPULATION, MONITORING, AND BIOASSAY



Figure 5-1. Confidence in reconstructed doses depends on demonstrating that the monitored and bioassay populations accurately represent the workers with potential occupational radiation exposure.

Scientific Question

Does the historical record demonstrate that the population used for dose reconstruction accurately represents all workers with potential occupational radiation exposure?

Scientific Finding

Dose reconstruction depends on a documented and verifiable progression from potentially exposed workers to the final dose reconstruction population. Scientific confidence requires evidence that worker identification, monitoring enrollment, bioassay participation, and record completeness are representative, consistently applied, and independently supported throughout each stage.

Scientific Takeaway

Reliable dose reconstruction requires evidence that monitored and bioassayed workers represent the full population with meaningful exposure potential—not merely evidence that some monitoring records exist.

6. PLUTONIUM SOURCE TERMS AND HISTORICAL EVIDENCE

Evaluating Historical Evidence Supporting Internal Dose Reconstruction



Figure 6-1. Plutonium source terms are best characterized by integrating operational chronology, shipment records, workplace evidence, environmental information, and bioassay rather than relying on any single source.

Scientific Question

Does the historical evidence adequately characterize plutonium source terms and potential occupational exposure opportunities relevant to occupational dose reconstruction?

Scientific Finding

Multiple historical evidence sources—including operational chronology, documented material shipments, facility records, environmental information, and bioassay results—contribute to evaluating plutonium source terms. Scientific confidence depends on integrating these evidence sources rather than interpreting any single record in isolation.

Integrated Finding

Reliable plutonium dose reconstruction requires a source term corroborated by operational chronology, material records, workplace and environmental evidence, and bioassay—not merely evidence that plutonium was present.

7. INDEPENDENT VALIDATION OF THE HISTORICAL RECORD

Evaluating Reconstruction Assumptions Using Historical Evidence

 TESTING THE SEC STANDARD USING THE DOE TIGER TEAM ASSESSMENT 				
<i>Does Independent Historical Evidence Support Confidence in Dose Reconstruction?</i>				
SEC RECONSTRUCTABILITY REQUIREMENT	SCIENTIFIC STANDARD (What Must Be Demonstrated)	DOE TIGER TEAM FINDINGS (Independent Assessment)	SCIENTIFIC IMPLICATION for Dose Reconstruction	IMPACT on CONFIDENCE (Overall Assessment)
1  HISTORICAL RECORD	Historical records should accurately document operations, hazards, and radiological conditions.	 - Documentation deficiencies - Incomplete records - Configuration management weaknesses	Raises questions regarding whether the historical record completely represents workplace conditions used in dose reconstruction.	 REDUCED CONFIDENCE Completeness uncertain
2  SOURCE TERMS	Radionuclides, quantities, physical forms, and release mechanisms should be characterized.	 - Environmental contamination findings - Radiological control deficiencies - Contamination events identified	Indicates the historical record should be evaluated to determine whether source terms were fully characterized.	 UNCERTAIN Requires validation
3  WORKER POPULATION	All potentially exposed worker groups should be identified and represented.	 - Program implementation weaknesses - Management system deficiencies - Training deficiencies	Supports evaluating whether all worker populations and exposure opportunities were adequately represented.	 UNCERTAIN Representation uncertain
4  MONITORING PROGRAMS	Bioassay, dosimetry, air monitoring, and environmental monitoring should adequately represent exposures.	 - Weak implementation of radiological controls - Monitoring program deficiencies - Procedural weaknesses	Supports independent evaluation of monitoring completeness and representativeness.	 REDUCED CONFIDENCE Adequacy questioned
5  DOCUMENTATION QUALITY	Reconstruction inputs should be based upon complete and reliable documentation.	 - Recordkeeping weaknesses - Quality assurance deficiencies - Document control issues	Documentation quality directly influences confidence in reconstruction assumptions.	 REDUCED CONFIDENCE Reliability issues
6  INDEPENDENT VALIDATION	Reconstruction assumptions should be confirmed through multiple independent evidence sources.	 - DOE Tiger Team was an independent assessment - Evaluated the same systems that generate historical evidence	Provides an independent benchmark for evaluating the completeness and reliability of historical evidence.	 INCREASED CONFIDENCE Independent review
7  SCIENTIFIC CONFIDENCE	Confidence requires the collective strength of all evidence categories.	 Multiple deficiencies across documentation, QA, implementation, environmental controls, and management systems	Confidence depends on evaluating the cumulative effect of these findings rather than considering each issue in isolation.	 REDUCED CONFIDENCE Cumulative impact
 SCIENTIFIC INTERPRETATION The DOE Tiger Team Assessment did not evaluate dose reconstruction directly. However, it independently evaluated many of the same systems that generate the historical evidence used in retrospective dose reconstruction. Consequently, its findings are relevant to assessing whether the historical record satisfies the SEC standard.  SCIENTIFIC QUESTION Do the independent findings of the DOE Tiger Team Assessment support confidence that the historical evidence satisfies each element required for reliable occupational dose reconstruction under the SEC standard?  SCIENTIFIC FINDING The Tiger Team Assessment identified documented weaknesses affecting documentation, radiological controls, quality assurance, environmental management, program implementation, and record systems. These findings warrant careful evaluation because each corresponds to evidence categories that contribute to scientific confidence in retrospective occupational dose reconstruction.				
 KEY TAKEAWAY: The SEC standard is satisfied only when the historical evidence, evaluated collectively, is complete, representative, reliable, independently validated, and scientifically sufficient to support dose reconstruction for the proposed worker class.				

Figure 7-1. Independent validation strengthens scientific confidence by confirming reconstruction assumptions through multiple, independent historical evidence sources.

Scientific Question

Can the historical evidence supporting occupational dose reconstruction be independently validated?

Scientific Finding

Independent validation is a fundamental component of scientific confidence. Reconstruction assumptions are strengthened when they are corroborated by multiple historical evidence sources. Where independent validation is limited by incomplete, unavailable, or classified records, confidence depends on whether the remaining evidence is sufficient to support dose reconstruction.

The Role of the DOE Tiger Team Assessment

The DOE Tiger Team Assessment did not reconstruct worker doses. It independently evaluated records management, radiological protection, quality assurance, environmental management, and operational controls—systems that affect the reliability of the historical evidence used in dose reconstruction.

Classification and Independent Validation

Classification does not itself establish unreconstructability. It becomes scientifically relevant when it prevents independent verification of operations, radionuclide inventories, exposure opportunities, monitoring practices, or reconstruction assumptions.

Scientific Takeaway

Reconstruction assumptions are strongest when corroborated by independent evidence. Where records are incomplete, unavailable, or classified, the remaining evidence must still be sufficient to validate those assumptions.

8. EVALUATING CUMULATIVE UNCERTAINTY

Why Scientific Confidence Depends on the Entire Evidence Chain



Figure 8-1. Scientific confidence is determined by the combined performance of interconnected evidence categories; uncertainty in one component may influence confidence throughout the reconstruction process.

Scientific Question

Should reconstruction uncertainties be evaluated individually or as an interconnected scientific system?

Scientific Finding

Dose reconstruction depends upon an interconnected chain of historical evidence. Scientific confidence is determined by the cumulative effect of uncertainties across the entire evidence chain rather than by any single uncertainty considered in isolation.

Scientific Principle

One uncertainty rarely determines reconstructability. Confidence is established—or reduced—by the cumulative effect of all evidence considered together.

9. APPLYING THE SEC RECONSTRUCTABILITY STANDARD

Evaluating the Collective Historical Evidence

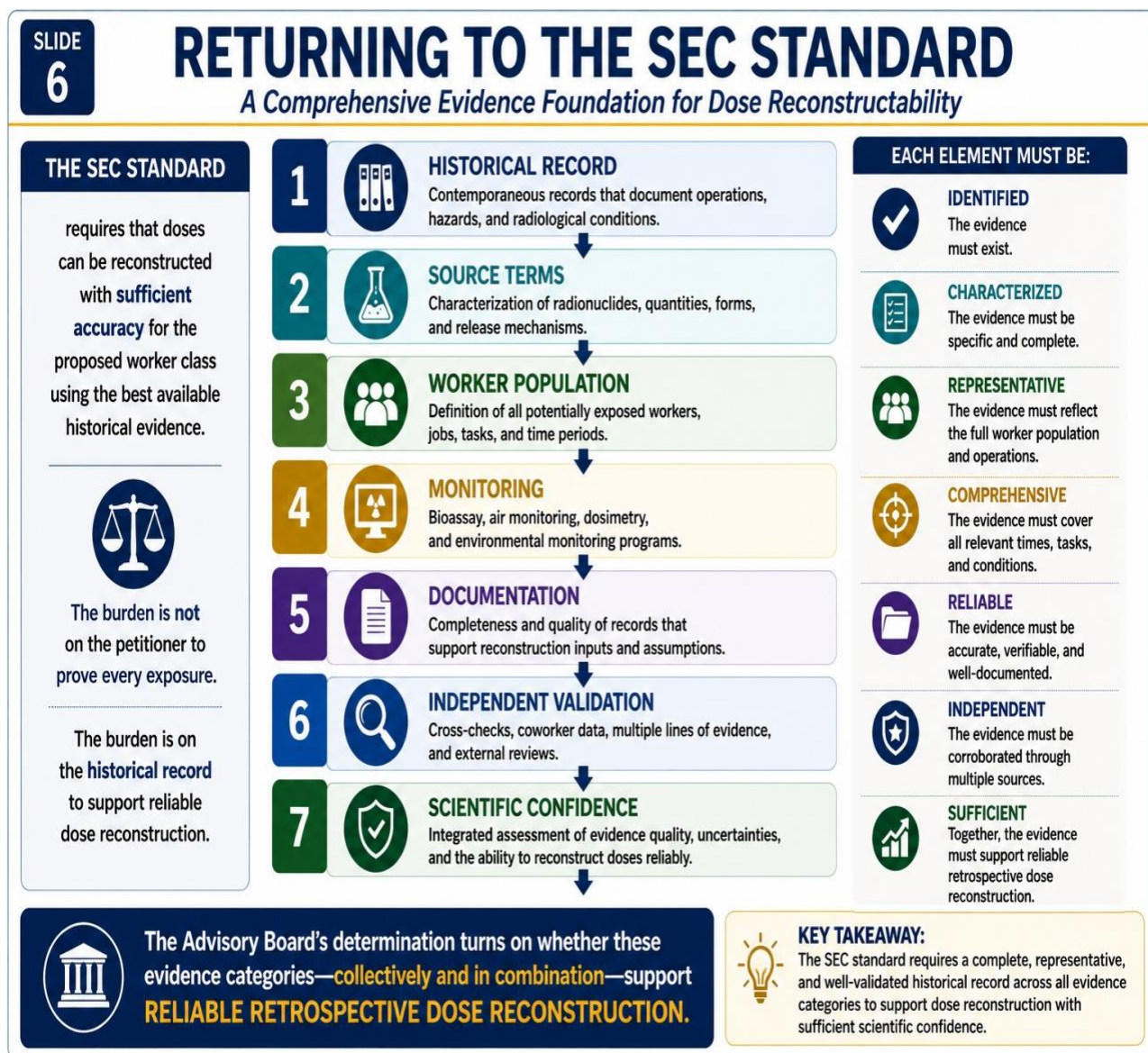


Figure 9-1. The SEC reconstructability standard is evaluated by considering the collective strength of all major evidence categories rather than any single document, monitoring result, or analytical assumption.

Scientific Question

What historical evidence must be demonstrated before occupational radiation doses can be reconstructed under the SEC standard?

Scientific Finding

The SEC reconstructability standard is satisfied only when the collective historical evidence supports dose reconstruction for the proposed worker class. This determination

depends on the integrated evaluation of all major evidence categories rather than any single document, monitoring result, or reconstruction assumption.

Characteristics of Reliable Reconstruction

Confidence in dose reconstruction is strengthened when the historical evidence is:

- ✓ Complete — The available records adequately describe the relevant operations and exposure conditions.
- ✓ Representative — The evidence reflects the workers, radionuclides, operational periods, and exposure scenarios under evaluation.
- ✓ Reliable — Historical records are internally consistent and suitable for scientific interpretation.
- ✓ Independently Validated — Key reconstruction assumptions are supported by multiple independent lines of historical evidence.
- ✓ Scientifically Sufficient — The collective evidence provides an adequate basis for reconstructing occupational radiation doses.

These characteristics should be considered collectively rather than independently.

10. FINAL SCIENTIFIC SYNTHESIS



Figure 10-1. The final assessment of reconstructability is based on integrating historical evidence into an overall determination of scientific confidence under the SEC standard.

Scientific Question

Does the collective historical evidence provide scientific confidence that occupational radiation doses for the proposed Pinellas Plant worker class can be reconstructed under the SEC standard?

Scientific Finding

Reconstructability must be determined from the combined evidence concerning the historical workplace, source terms, worker population, monitoring and bioassay, documentation, independent validation, and cumulative uncertainty.

Final Board Takeaway

The question is not whether individual records exist or isolated uncertainties can be bounded. The question is whether the total historical evidence provides scientifically defensible occupational doses for the proposed Pinellas Plant worker class under the SEC standard.

11. Scientific Principles Supporting Reliable Dose Reconstruction

Scientific Principle 1

Scientific confidence—not simply record existence—is the central question.

The fundamental scientific issue is not whether historical records exist, but whether the collective historical evidence provides sufficient scientific confidence to reconstruct occupational radiation doses for the proposed worker class.

Scientific Principle 2

Dose reconstruction is an evidence-based scientific process.

Reliable occupational dose reconstruction depends upon integrating multiple categories of historical evidence rather than relying on a single document, monitoring result, or analytical assumption.

Scientific Principle 3

Scientific confidence requires complete, representative, reliable, and independently validated evidence.

The strength of dose reconstruction depends upon the quality of the underlying evidence across all major reconstruction categories. Evidence should be evaluated collectively rather than individually.

Scientific Principle 4

Facility complexity determines evidence requirements.

As operational complexity increases, the quantity, diversity, and specificity of historical evidence required to support reliable dose reconstruction also increase. Scientifically complex facilities require correspondingly robust documentation.

Scientific Principle 5

Reconstruction begins with the historical workplace.

Reliable dose reconstruction begins by accurately reconstructing where work occurred, which radionuclides were present, how operations evolved, and who performed the work. Every subsequent reconstruction step depends upon this historical foundation.

Scientific Principle 6

Dose reconstruction cannot exceed the quality of the historical workplace reconstruction.

Limitations in reconstructing historical operations necessarily limit confidence in all subsequent reconstruction assumptions.

Scientific Principle 7

Worker populations must be demonstrably representative.

Scientific confidence requires evidence that monitored and bioassayed workers accurately represent the full population of workers with meaningful occupational exposure potential.

Scientific Principle 8

Source terms require multiple independent evidence sources.

Reliable characterization of radionuclide source terms depends upon integrating operational history, material records, environmental information, workplace evidence, and bioassay rather than interpreting any single record in isolation.

Scientific Principle 9

Independent validation strengthens scientific confidence.

Reconstruction assumptions are scientifically stronger when supported by multiple independent lines of historical evidence rather than by a single source of information.

Scientific Principle 10

Classification becomes scientifically relevant when it limits validation.

Classification alone does not establish that dose reconstruction is impossible. Its scientific importance arises when it prevents independent verification of operations, radionuclide inventories, exposure opportunities, monitoring practices, or reconstruction assumptions.

Scientific Principle 11

Scientific confidence depends upon cumulative evidence.

Dose reconstruction should be evaluated as an interconnected scientific system. Confidence is determined by the combined effect of uncertainties across the entire evidence chain rather than by any single uncertainty considered in isolation.

Scientific Principle 12

Reconstruction assumptions should not be evaluated independently.

Historical workplace characterization, source terms, worker populations, monitoring, documentation, validation, and uncertainty function as interconnected components of a single reconstruction process.

Scientific Principle 13

The SEC standard evaluates the collective historical evidence.

Whether occupational doses can be reconstructed depends upon the integrated strength of all major evidence categories rather than any individual document or reconstruction assumption.

Scientific Principle 14

Reliable reconstruction possesses identifiable scientific characteristics.

Scientific confidence is strengthened when the historical evidence is:

- Complete
- Representative
- Reliable
- Independently validated
- Scientifically sufficient

These characteristics should be evaluated collectively rather than separately.

Scientific Principle 15

Final reconstructability is an integrated scientific judgment.

The ultimate determination of reconstructability results from evaluating the combined evidence concerning the historical workplace, source terms, worker populations, monitoring and bioassay, documentation, independent validation, and cumulative uncertainty.

Core Scientific Message

Reliable occupational dose reconstruction is not established by isolated records, individual monitoring results, or individual analytical assumptions. It is established when the collective historical evidence demonstrates—with sufficient scientific confidence—that occupational radiation doses for the proposed worker class can be reconstructed under the SEC standard.

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