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Prairie Island Independent Spent Fuel Storage Installation

License Renewal Application

Discussion of Requests for Additional Information

Rockville, Maryland

June 16, 2014

Attendees - NSPM

Mike Baumann – Director, Nuclear Fuel Supply

Martin Murphy – Director, Nuclear Licensing and Regulatory Affairs

Terry Pickens – Director, Regulatory Policy

Gene Eckholt – Manager, Projects Licensing

Oley Nelson – Engineer, Spent Nuclear Fuel Projects

Sam Chesnutt – Engineer, Projects Licensing

Agenda

- Introductions
- Objective of Meeting
- Background
- Discussion of Requests for Additional Information and NSPM Proposed Responses
- Closing Remarks

Acronyms

ACI	American Concrete Institute	NRC	Nuclear Regulatory Commission
AMP	Aging Management Program	NSPM	Northern States Power – Minnesota
AMR	Aging Management Review	OE	Operating Experience
CAP	Corrective Action Program	PINGP	Prairie Island Nuclear Generating Plant
DOE	Department of Energy	PEO	Period of Extended Operations
EPRI	Electric Power Research Institute	RAI	Request for Additional Information
GALL	Generic Aging Lessons Learned	SAR	Safety Analysis Report
ISFSI	Independent Spent Fuel Storage Installation	TLAA	Time Limited Aging Analysis
LRA	License Renewal Application	TN	Transnuclear

Objective Of Meeting

- Ensure clear understanding of RAIs
- Reach agreement on response strategies

Background

- ISFSI Operations commenced - 1995
- NSPM submitted PI ISFSI License Renewal Application (LRA) - October 2011
  - Requested 40 year extension beyond October 2013
- Submitted Responses to Initial Round of Technical RAIs - July 2013
- 2nd Set of RAIs – May 2014

Discussion of RAI-12

- **RAI-12:**

Provide an AMP for high burnup fuel addressing the 10 points in NUREG-1927; the AMP should be based on the DOE Cask Demonstration test plan.

Discussion of RAI-12 (Cont'd)

Response to RAI-12

- Will provide an AMP based on DOE Demonstration plan
- AMP will include Toll Gate Assessments
- AMP will be included in revision to Appendix A of LRA, Aging Management Plan

Discussion of RAI-1

- **RAI-1:**

Identify each instance in the safety analysis report (SAR) that refers to a limited storage system period – explain and justify their disposition.

Discussion of RAI-1 (Cont'd)

Response to RAI-1:

- Propose to provide markups of each instance in SAR that refers to a storage system period (e.g., 20 years)
- SAR update categories:
  - Delete storage period if no technical basis
  - Revise storage period if new analysis
  - Clarify how storage period applies during PEO
- Will provide complete list of SAR updates and justification of categorization

Discussion of RAI-2

- **RAI-2:**

Provide a revised Aging Management Program (AMP) for the concrete pad, or provide detailed justifications for why five listed aging effects / mechanisms do not require an AMP, for both above-grade and below-grade areas, as applicable.

Discussion of RAI-2

Response to RAI-2:

- **Three of the listed aging effects / mechanisms for the concrete pad are addressed in the LRA, Table 3.4-1 (AMR) and A2.1-1 (AMP):**
  - **Cracking, Loss of Strength from cement aggregate reactions**
  - **Increase in porosity/permeability and Loss of Strength due to leaching of Ca(OH)2**
  - **Cracking due to Settlement**

Discussion of RAI-2 (Cont'd)

- Will provide site-specific technical justification for exclusion of:
  - Cracking, Loss of Material from chemical attack
    - Not exposed to aggressive chemical environment
  - Cracking, Loss of Material / Bond from corrosion of embedded steel
    - Good quality, well consolidated, properly cured concrete pads.

Discussion of RAI-3

- **RAI-3:**

Specify which materials properties are covered by the aging effect "Change in Materials Properties" when referring to the aging mechanism "Leaching of Ca(OH)2" in the concrete pad and justify visual examination.

Discussion of RAI-3 (Cont'd)

Response to RAI-3:

- Material properties that can be affected by leaching include:
  - Increase in porosity and permeability
  - Reduced strength
  - Lower pH
- Visual examination can detect evidence of leaching such as white lime deposits

Discussion of RAI-4

- **RAI-4:**

Revise the license renewal application (LRA) to include a water chemistry program as part of the AMP for the concrete pad, or provide justification for exclusion.

Discussion of RAI-4 (Cont'd)

Response to RAI-4:

- Will revise AMP in Appendix A to LRA, to include groundwater chemistry
- Proposed Frequency is every six months
- Proposed acceptance criteria
  - Chloride ≤ 500 ppm
  - Sulfate ≤ 1500 ppm
  - pH ≥ 5.5

Discussion of RAI-5

- **RAI-5:**

Revise inspection frequencies consistent with ACI 349.3R or justify discrepancies. Also, justify opportunistic inspections of below-grade areas.

Discussion of RAI-5 (Cont'd)

Response to RAI-5:

- Inspection frequency for ISFSI concrete pad is proposed to be the same as other PINGP concrete structures
  - Above-grade – 5 years
  - Inaccessible – inspections of opportunity
    - Will clarify frequency in LRA Section A2.4.2
- Inspection frequency consistent with GALL, NUREG-1801, Rev.2, Section XI.S6, Structures Monitoring

Discussion of RAI-6

- **RAI-6:**

Describe the Corrective Action Program (CAP) and when inspection results of the concrete pad will initiate an Action Request, change to the AMP, or notification to the NRC. Also, address use of operating experience (OE) from other ISFSIs. Explain monitoring and trending of identified but uncorrected aging effects.

Discussion of RAI-6 (Cont'd)

Response to RAI-6:

- **CAP Action Request initiated when acceptance criteria are exceeded:**
  - **Cracking – identified size limits**
  - **Change in material properties – calcium streaks and deposits (indicative of leaching)**
  - **Loss of material – identified size limits for surface scaling, spalling**
- **Criteria are consistent with Tier 2 criteria in ACI 349.3R for conditions requiring evaluation**

Discussion of RAI-6 (Cont'd)

- CAP program is 10 CFR 50 Appendix B program
- CAP evaluations include:
  - Extent of condition evaluation
  - Actions to accept or repair as appropriate, including possible increase in inspection frequency or expansion of sample population
  - Evaluation for NRC reportability
  - Determination if AMP needs to be revised

Discussion of RAI-6 (Cont'd)

- Site OE program reviews issues identified by NRC and industry (e.g., INPO, Owners groups, TN cask users group)
  - Concrete OE issues are similar to other Plant concrete structure issues
  - OE reviews could lead to a CAP
  - CAP program evaluation will determine need for modifying the AMP
- AMP includes monitoring and trending

Discussion of RAI-7

- **RAI-7:**

Provide additional information in the AMP for the berm:

- ***Define "absence of aging effects"***
- ***Provide basis for inspection frequency***
- ***Identify material properties that will change due to dessication and explain visible signs of change***

Discussion of RAI-7 (Cont'd)

RAI-7 Discussion:

- AMP for berm is consistent with PINGP AMP for earthen structures
- "Absence of aging effects" for the berm includes:

  (aging effects terminology from EPRI reports)
  - No loss of form – no indications of slope instability or settlement
  - No loss of material – no evidence of erosion
  - No change in material properties – no evidence of erosion

Discussion of RAI-7 (Cont'd)

- Dessication is a drying of soils that results in a loss of soil adhesion – visible signs would include accelerated effects of erosion
- Inspection frequency of 5 years is based on Plant structural inspections, also consistent with GALL report, NUREG-1801 Rev. 2

Discussion of RAI-8

- **RAI-8:**

Provide a detailed technical basis for the acceptance criteria for visual examinations of the cask: the absence of any signs of aging, as indicated in LRA Section A2.6.2.

Discussion of RAI-8 (Cont'd)

Response to RAI-8

- **Acceptance criteria of the "absence of any of the aging effects listed in Table A2.1-1" ensures conservative initiation of an Action Request in the CAP program**
  - **Aging effect listed in Table A2.1-1 for casks is "Loss of Material" due to various corrosion mechanisms**
  - **Acceptance criteria are not met if Inspector observes any corrosion**

Discussion of RAI-8 (Cont'd)

- Any observed corrosion is evaluated in the CAP program
- CAP Program relies on engineering evaluations to determine actions
- Calculation referred to in the RAI provides basis for inspection frequency – is not a quantitative or actionable operation criterion

Discussion of RAI-9

- **RAI-9:**

Provide conclusive evidence to support no observable loss of material statement regarding the lead cask examination. Also, clarify photographs of the inspection and address observations regarding pits and measurable loss of material.

Discussion of RAI-9 (Cont'd)

Response to RAI-9:

- Use of visual examinations is consistent with NUREG 1927, Appx E, Component Specific Aging Management
- Only "conclusive evidence" is inspection report with documented observations by the inspector
- Inspector documented no observable depth to corrosion (including pitting corrosion)
- AMP will be revised to clarify "no measureable loss of material" should be "no observable loss of material"
- Discussion of photos and annotations

Discussion of RAI-11

- **RAI-11:**

Provide a TLAA to support position that there will be no buildup of flammable hydrogen based on radiolytic degradation of the neutron shield polymer. Provide AMP for the relief valve if needed.

Discussion of RAI-11 (Cont'd)

Response to RAI-11:

Will provide analysis:

- **Calculation of potential flammable gas generation based on methodology in NUREG/CR-6673**
  - **Conservatively includes energy deposition in resin from both gamma and neutron radiation**
- **The amount of gas generated is less than solubility capacity of resin**
- **Analysis concludes that the amount of flammable gas released from resin would be negligible**

Discussion of RAI-10

- **RAI-10:**

Provide an AMP to detect degradation of cask neutron shield. The current radiation monitoring program does not adequately address detector selection, measurement location selection, resolution of measurement data, time dependency of the decaying source term, or detection of cracks or unexpected degradation of the shield.

Discussion of RAI-10 (Cont'd)

Response to RAI-10:

- NSPM will provide additional support for position that there is no aging effect for neutron shield that could result in a loss of shielding intended function
  - Aging effects such as embrittlement, cracking, loss of elasticity do not affect intended function
  - Calculation discussed in response to RAI 11 shows hydrogen generated by radiolytic degradation will remain absorbed in the poly material
    - No loss of shielding

Discussion of RAI-10 (Cont'd)

- Will provide clarification that current surveys can detect degradation before loss of intended function
  - Intended function is to provide shielding for compliance with offsite dose regulations, as demonstrated by Safety Analysis
  - Loss of intended function would be defined as a reduction in shielding effectiveness that results in actual dose rates that exceed those based on the Safety Analysis

Discussion of RAI-10 (Cont'd)

- Neutron survey meters
  - Will discuss neutron energy spectrum used during survey meter calibration
  - Will explain that meter readings are conservatively higher than actual due to different neutron energy spectra in calibration source vs. casks
  - Shielding degradation could result in a shift to higher energy neutrons which would produce even higher measured values

Discussion of RAI-10 (Cont'd)

- Measurement Locations
  - Survey measurements at consistent locations
  - Measurements taken approximately 2 m from casks – at a point straight out from each cask
  - Approximately 1 m above ground
  - Minimizes impact of dose from adjacent casks

Discussion of RAI-10 (Cont'd)

- Measurement resolution
  - Meter scale is analog, 1 to 10 mr/hr; data typically recorded to nearest 1 mr
  - Elevation is at point of high dose rate
  - Consistent measurement locations provide representative sample of casks

Discussion of RAI-10 (Cont'd)

- Trending
  - Trending of 2-meter survey data shows dose rates below dose rates based on Safety Analysis
  - Increases in dose rate trends will detect degradation before loss of intended function

Closing Remarks


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ANNOTATED PHOTOGRAPHS

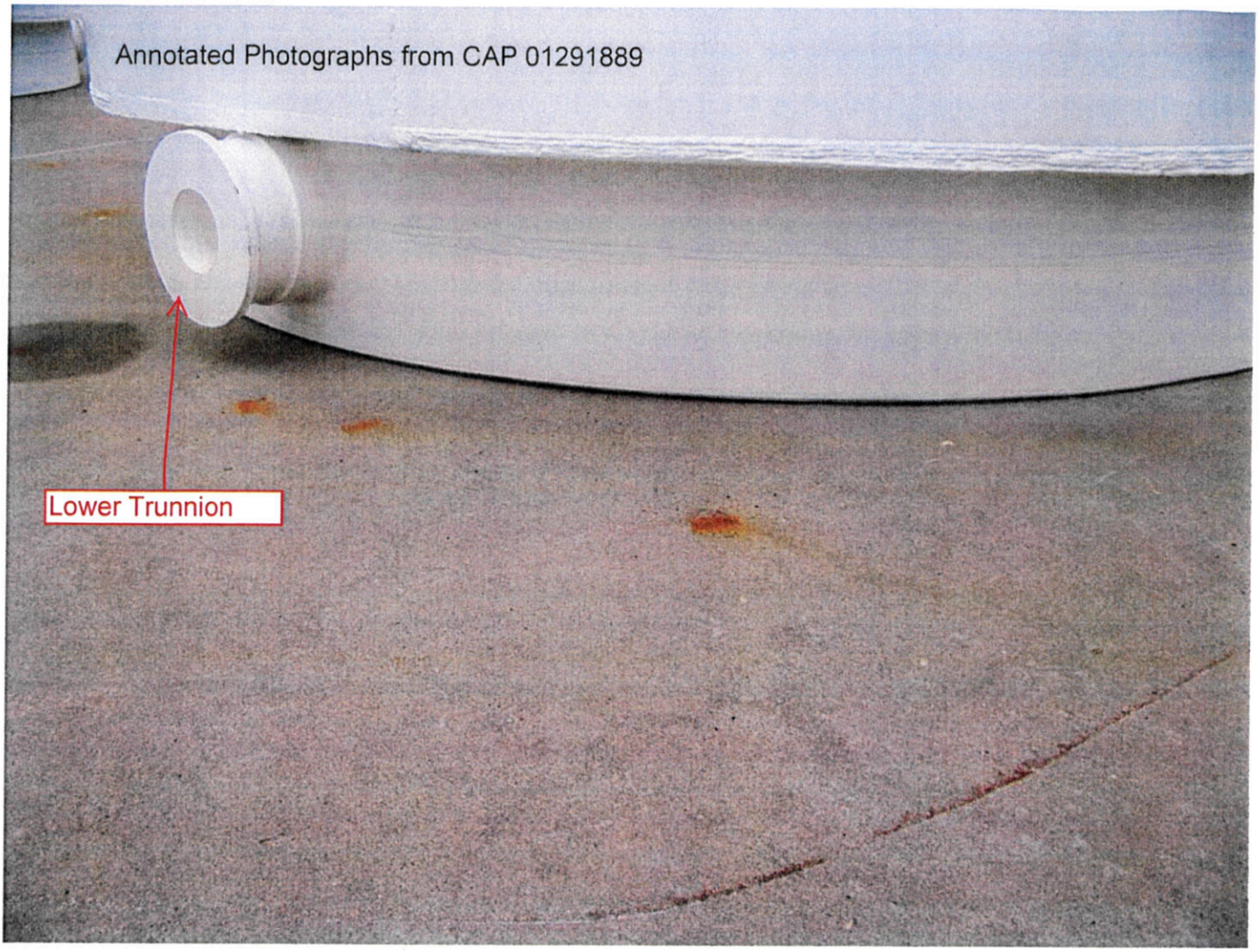
FROM CAP #01291889

CASK #1 BOTTOM INSPECTION

Photos were originally provided in

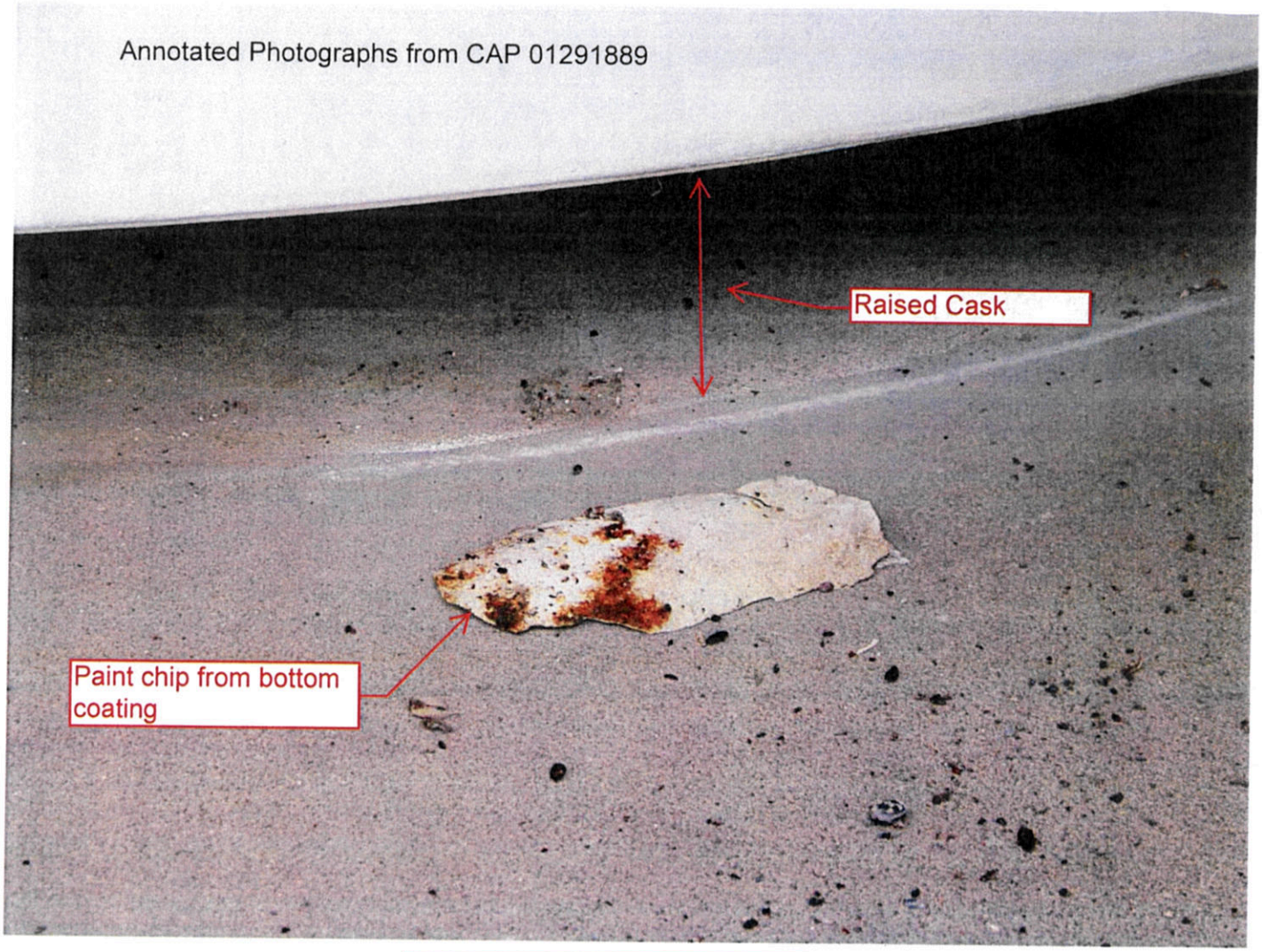
PI RAI Response letter dated July 26, 2013, L-PI-13-073

Enclosure 2, Attachment 2



From CAP 01291889,
Bottom Inspection of Cask #1

Annotated Photographs from CAP 01291889



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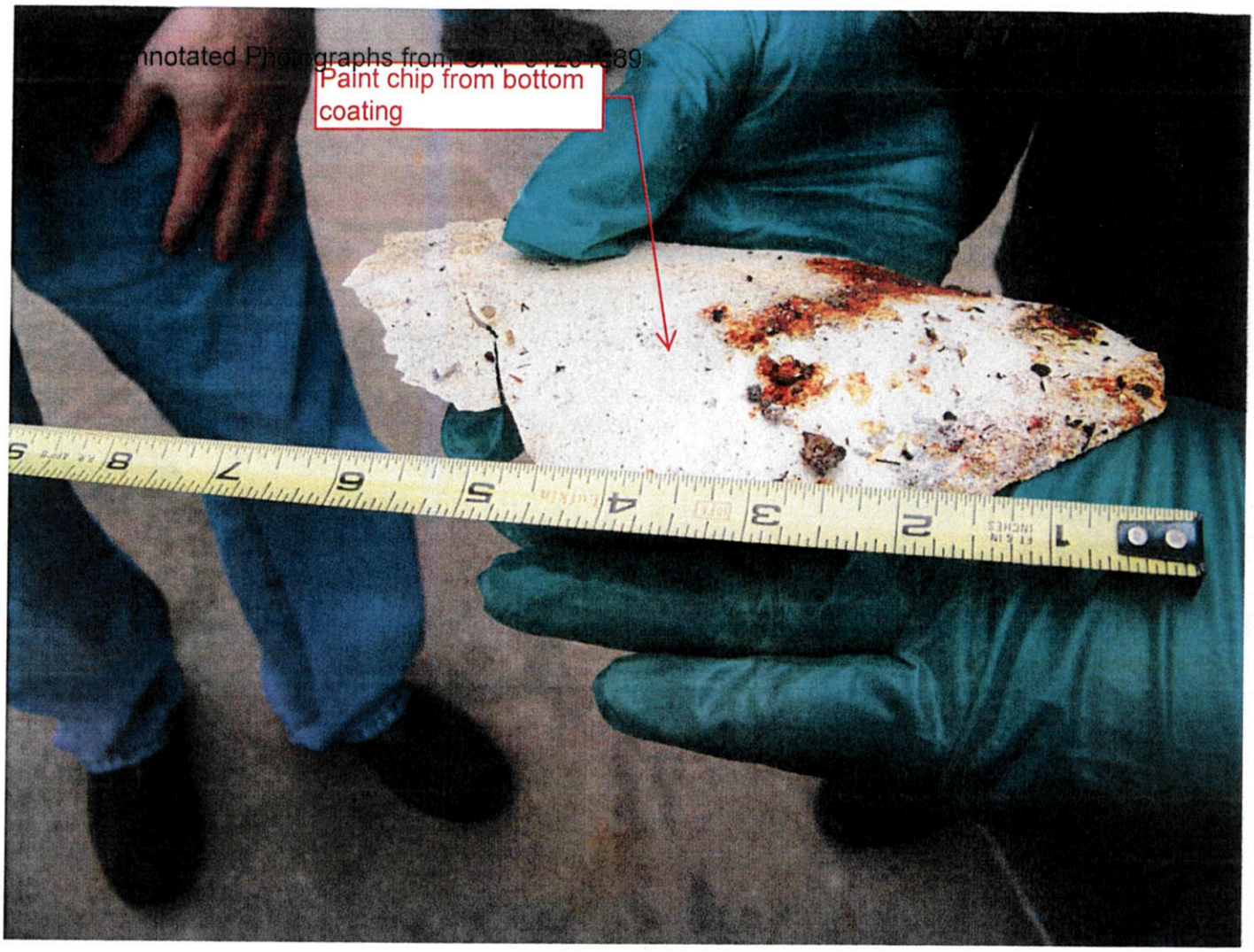
Bottom Inspection of Cask #1



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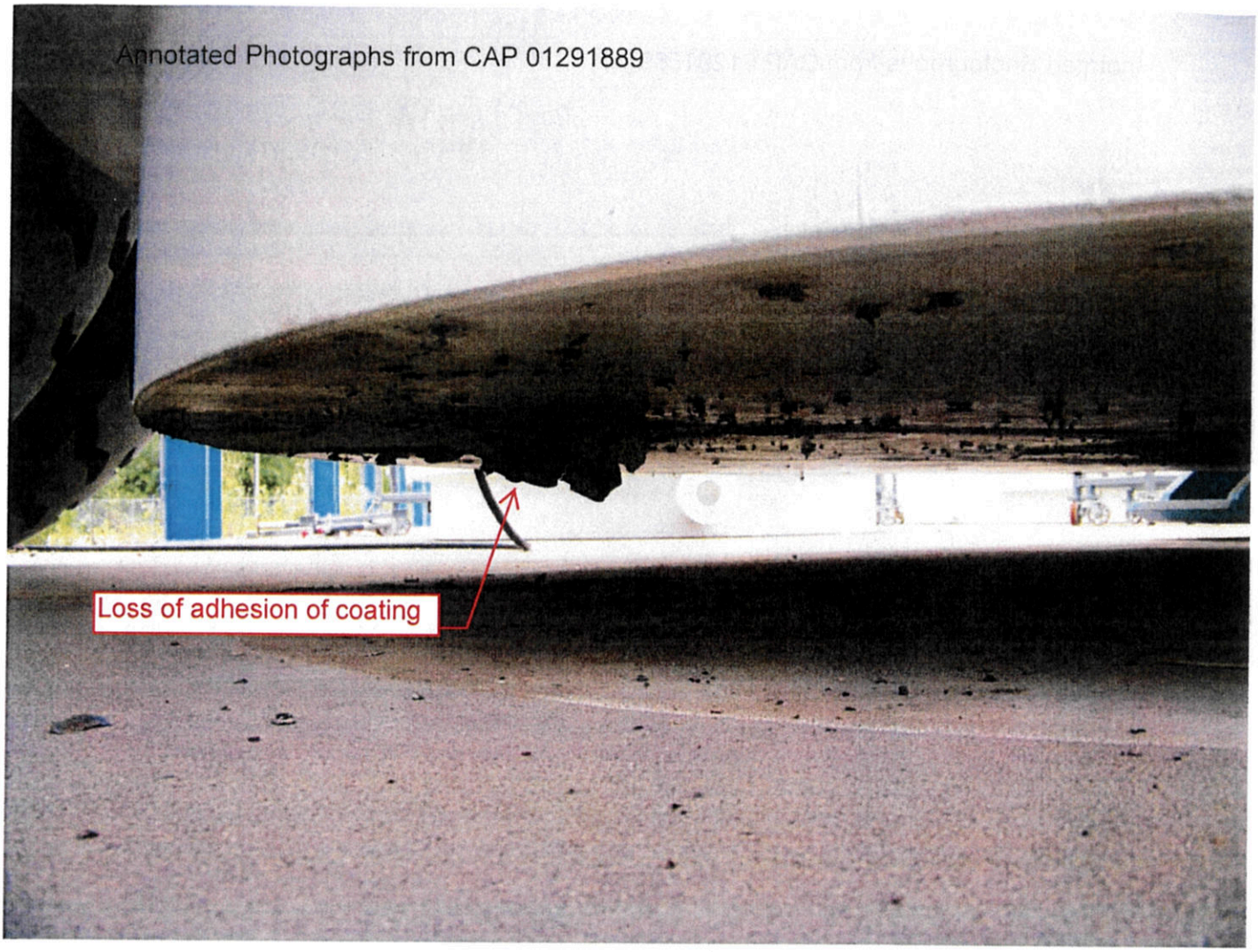
Annotated Photographs from CAP 01291889



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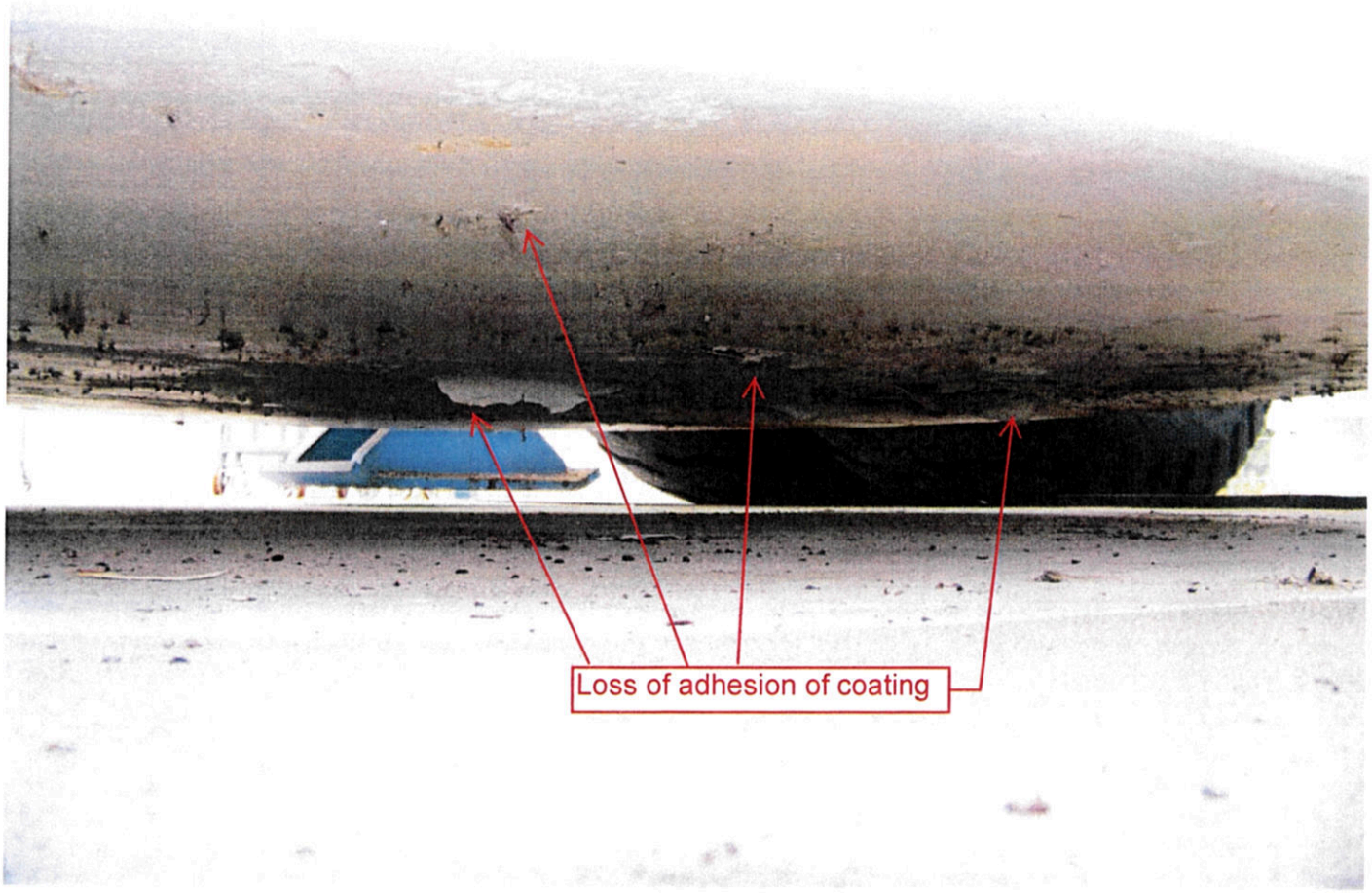

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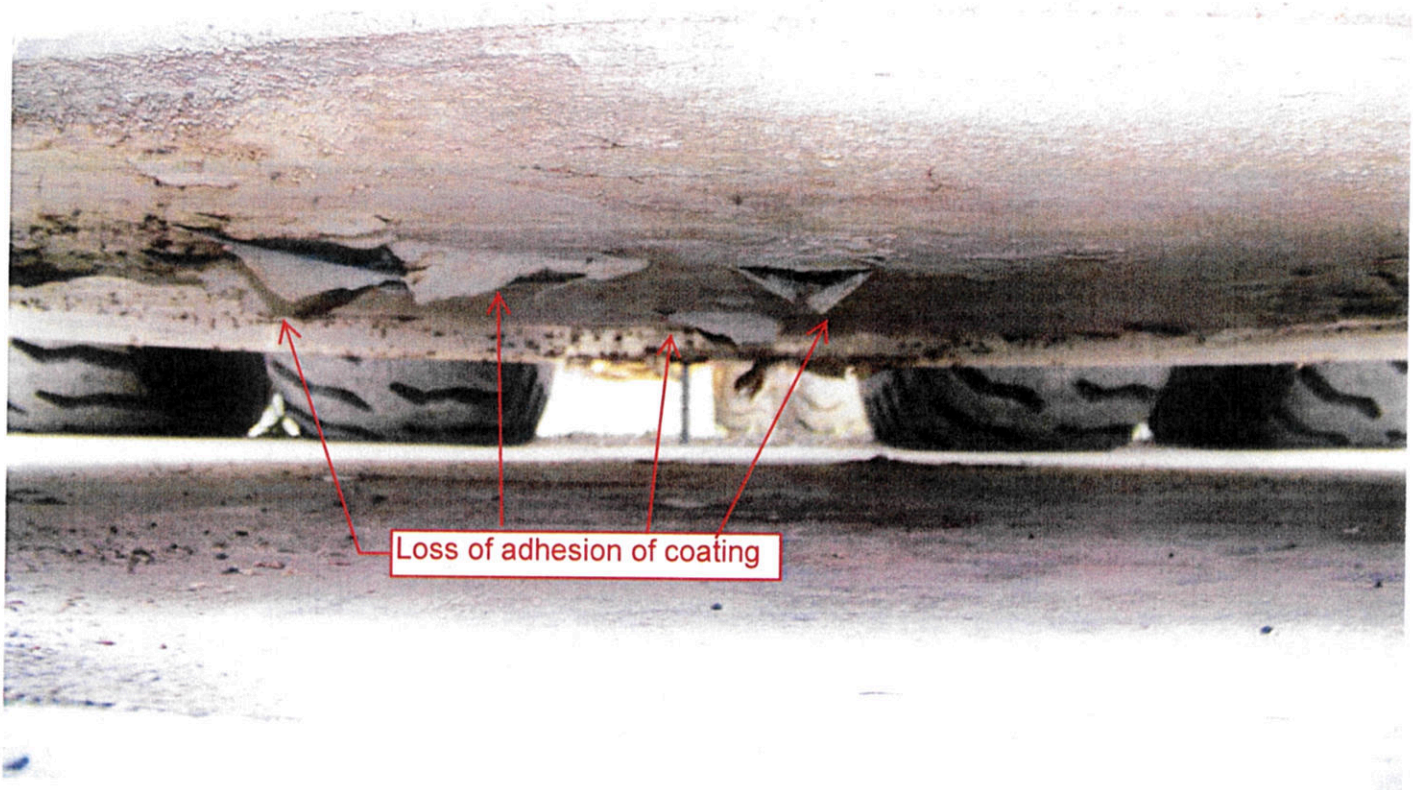

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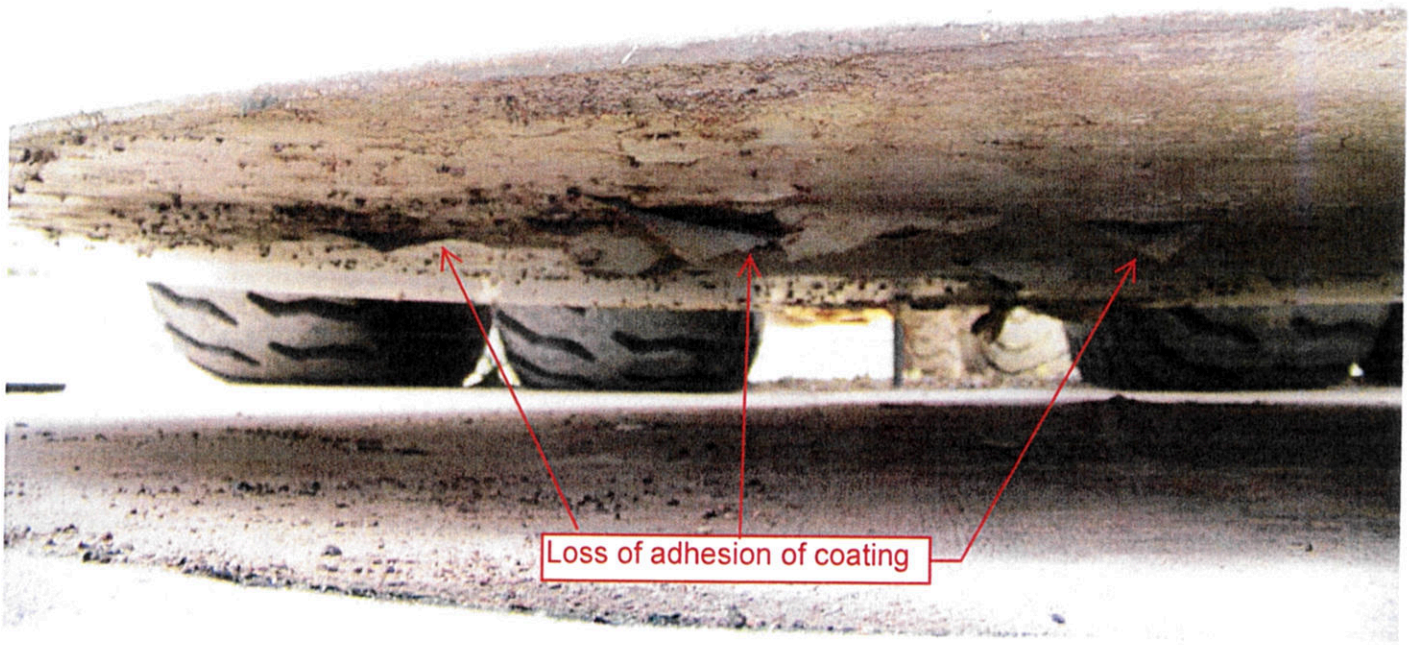

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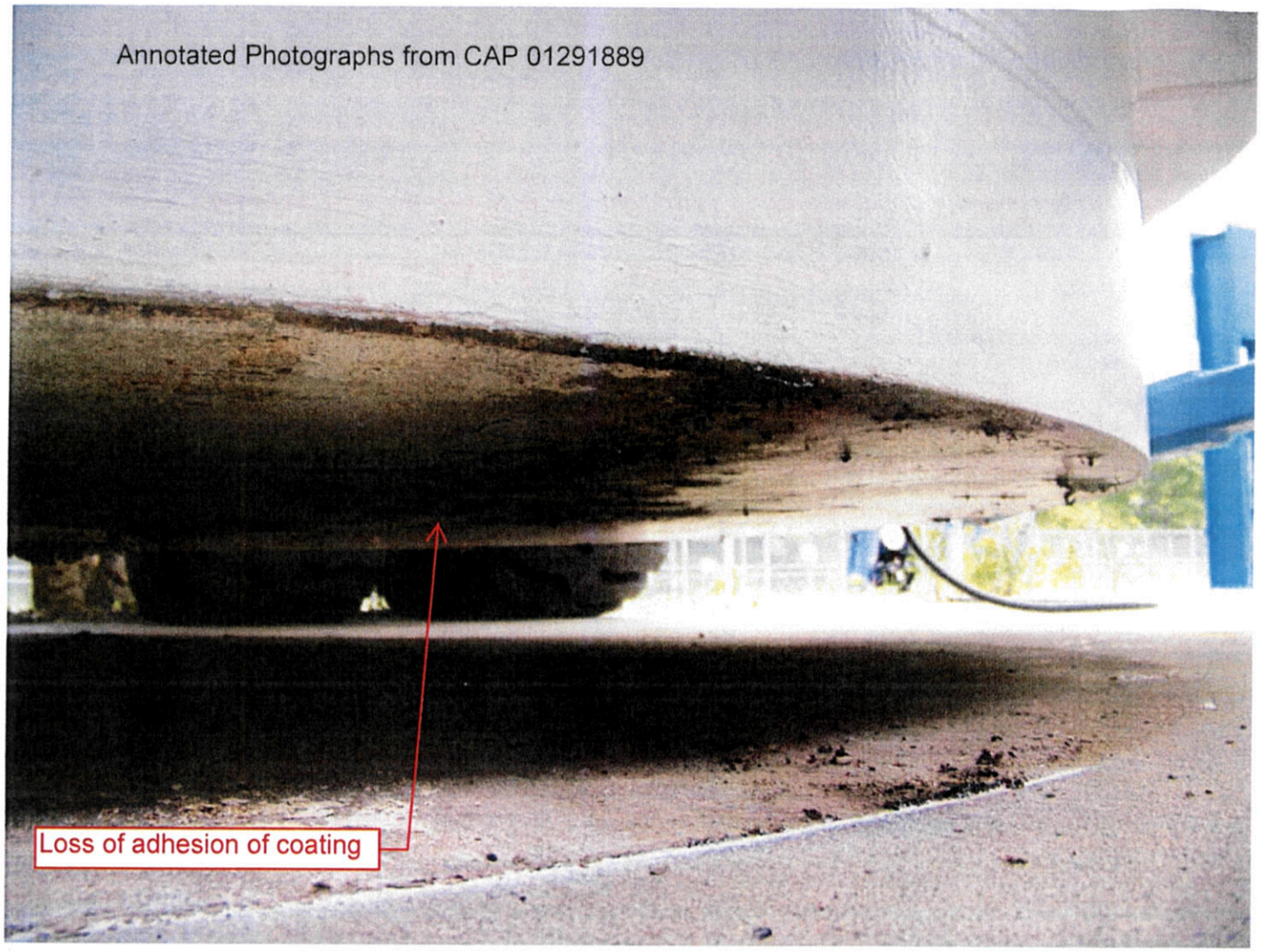

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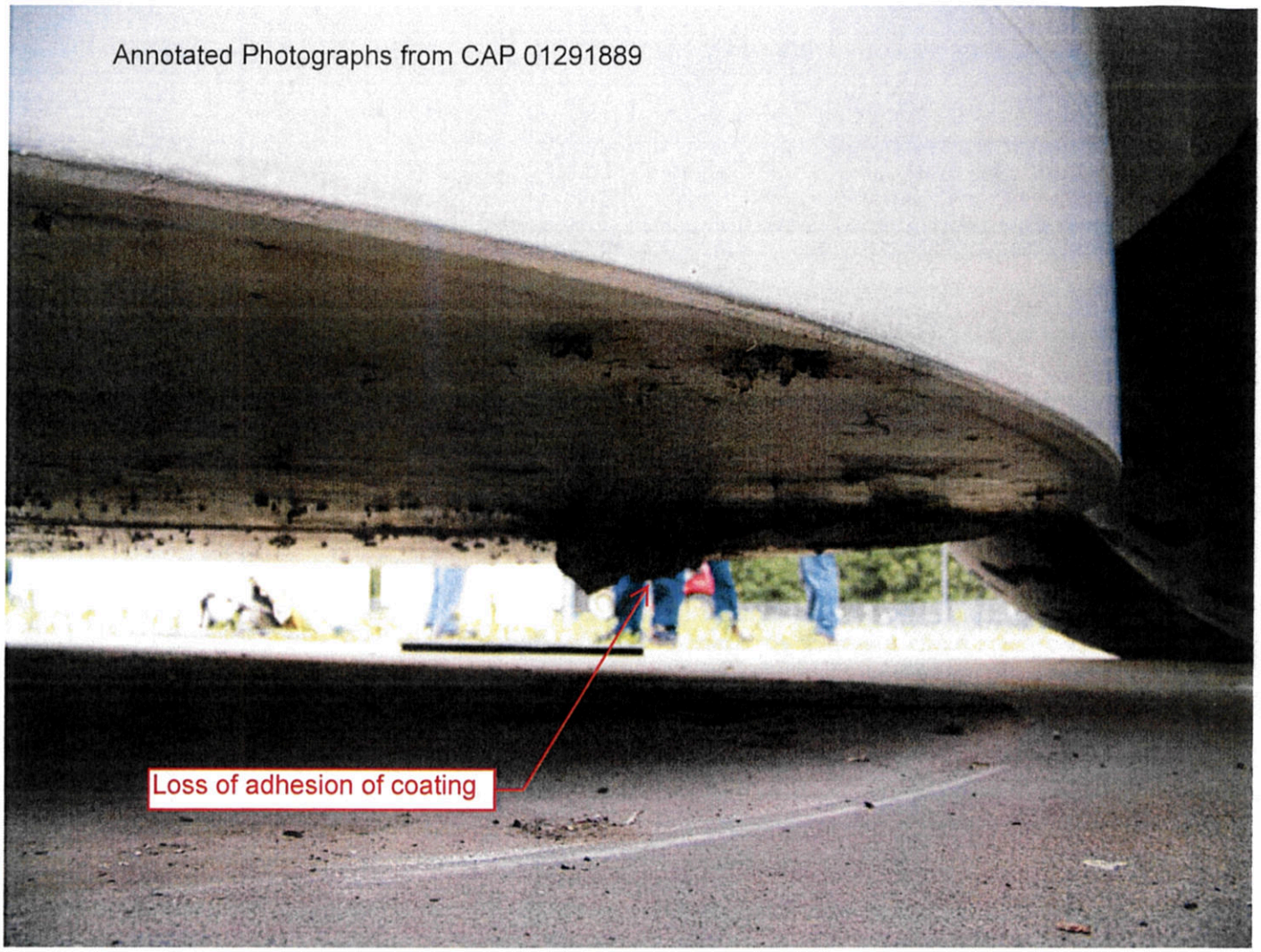

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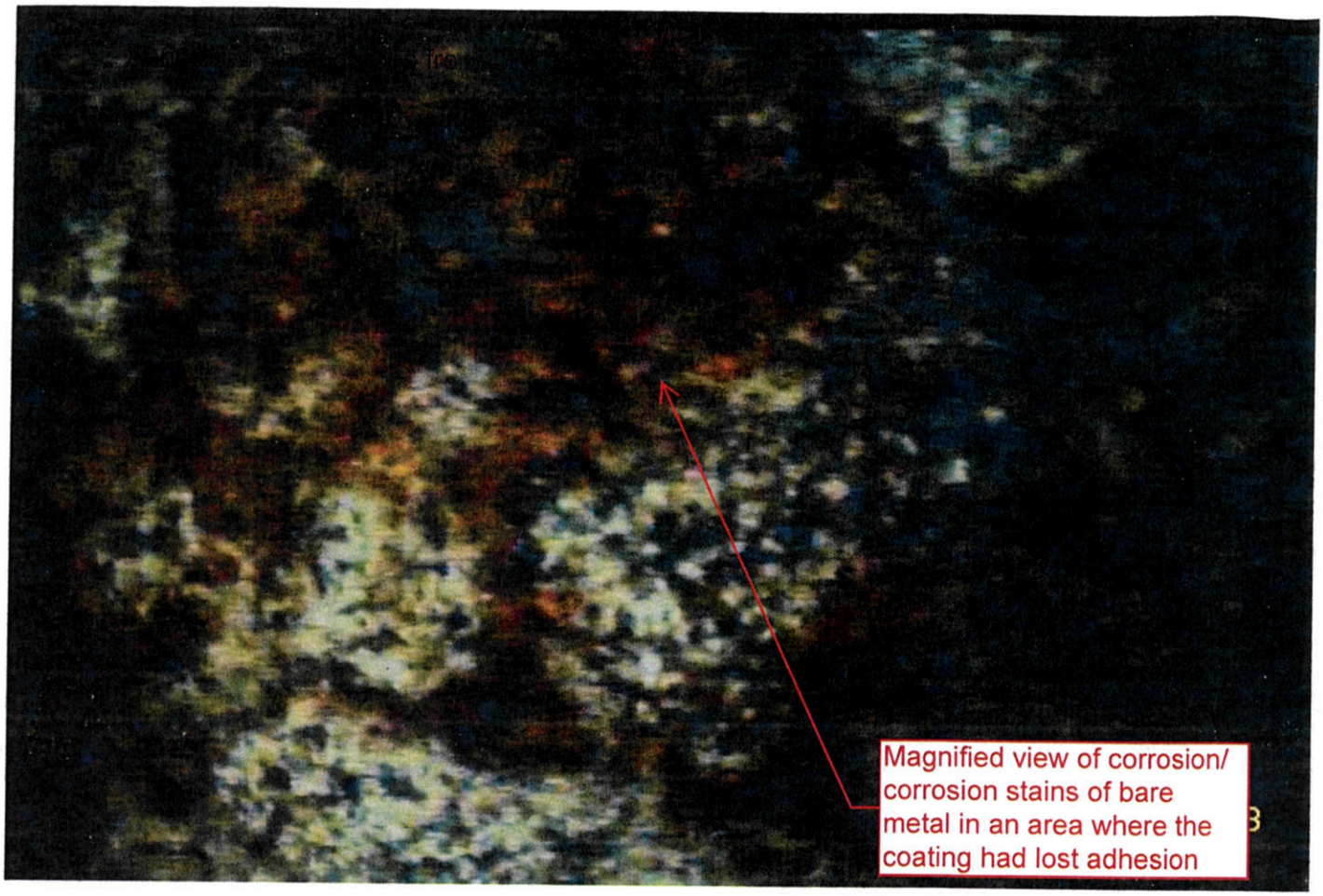

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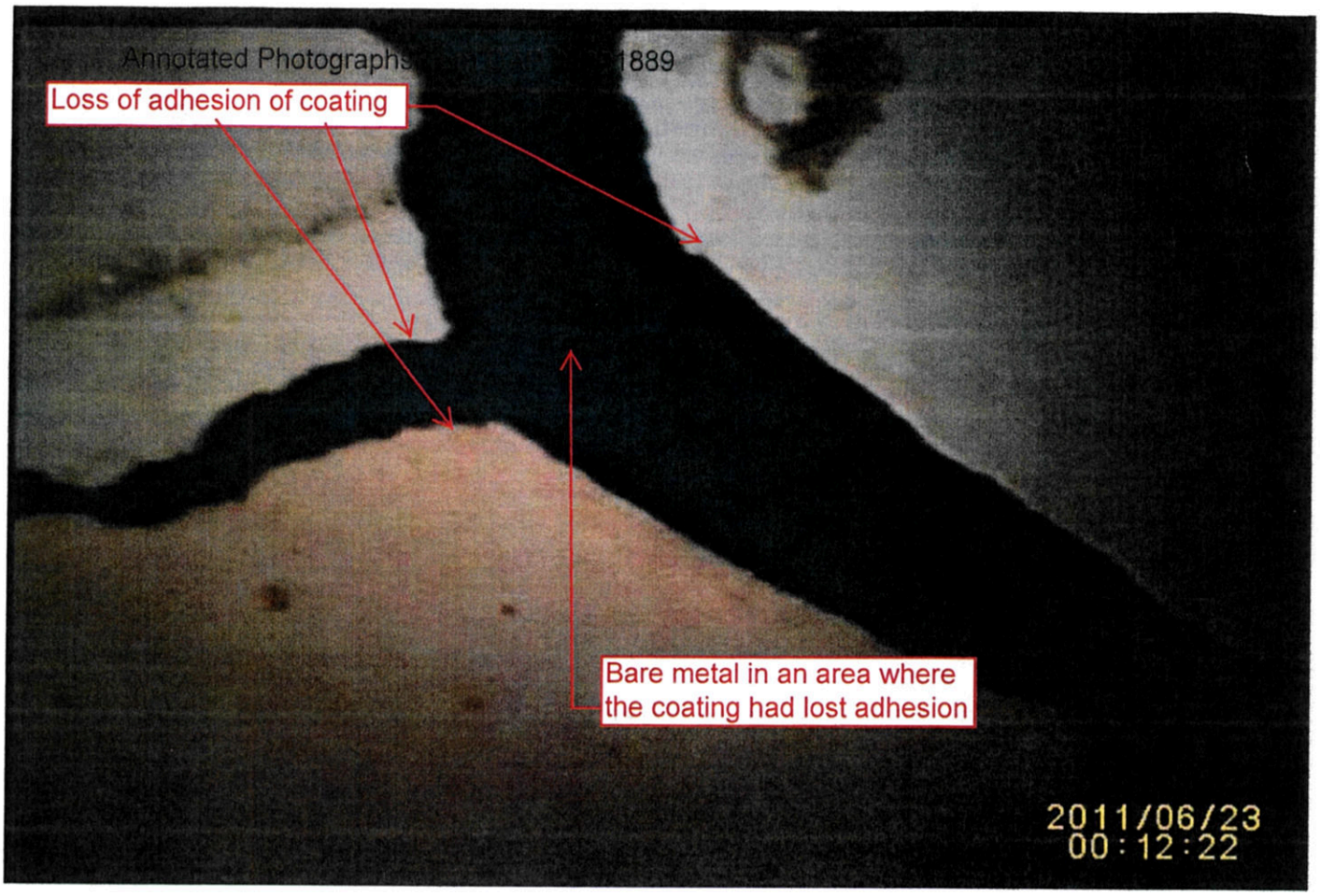

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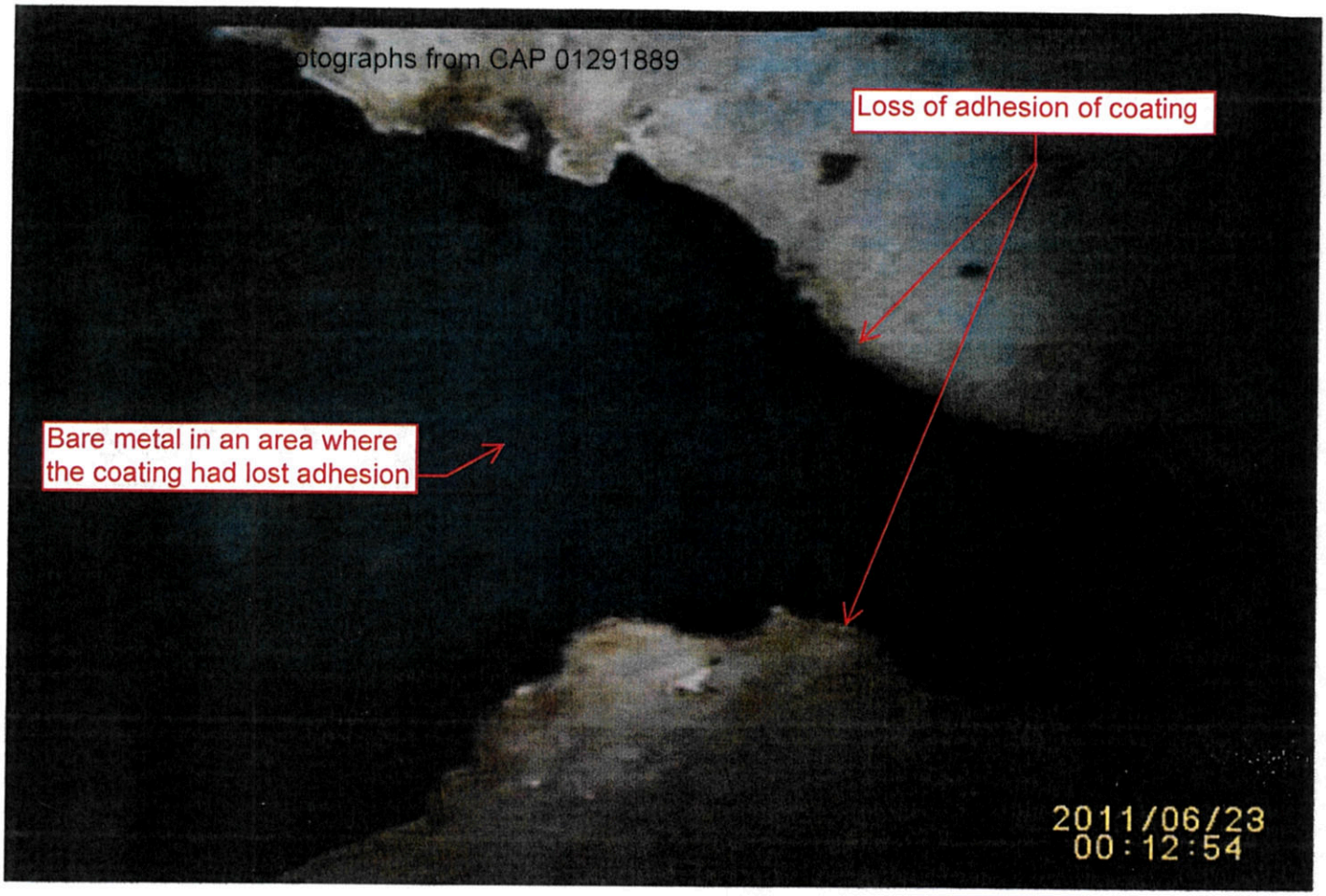

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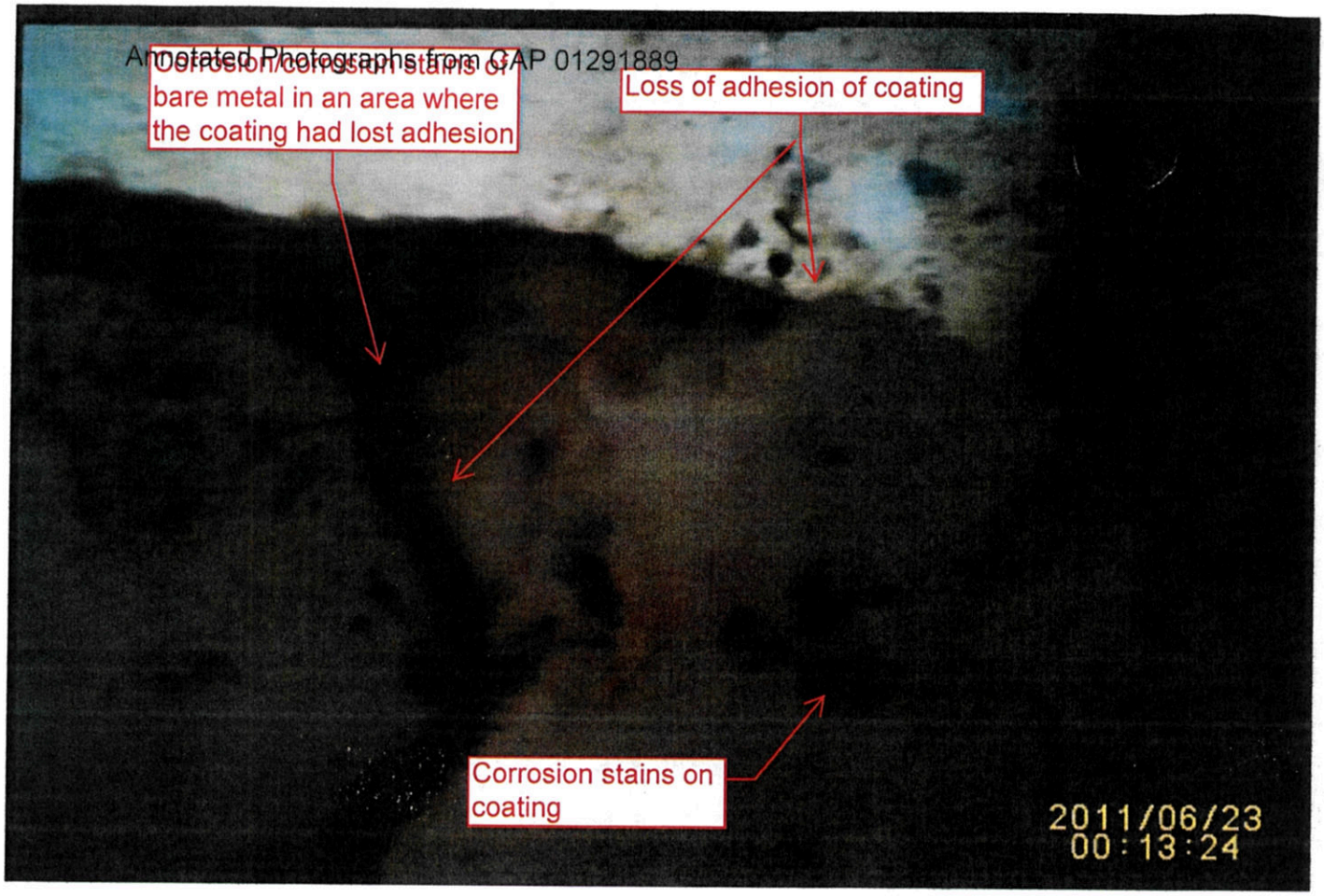

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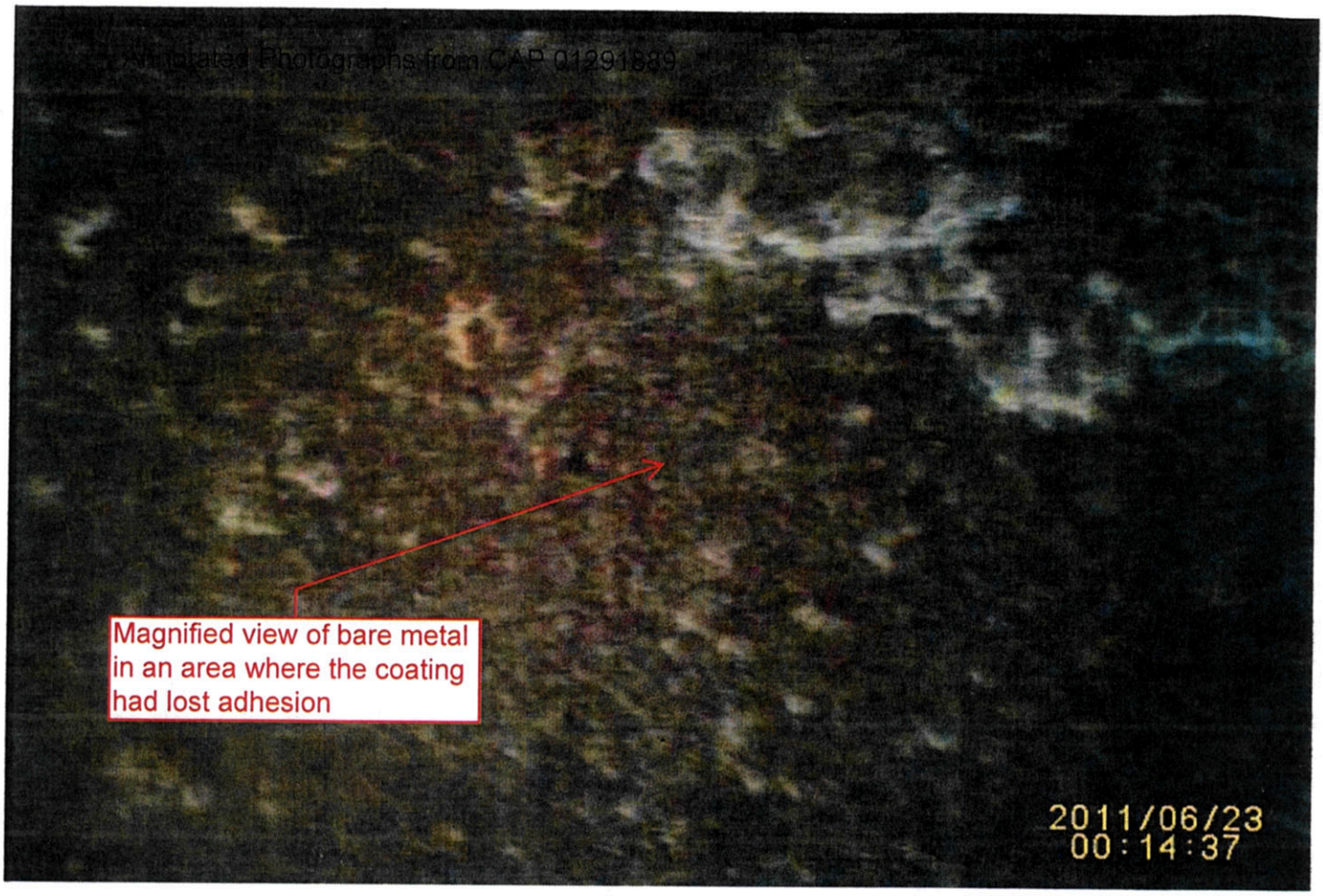

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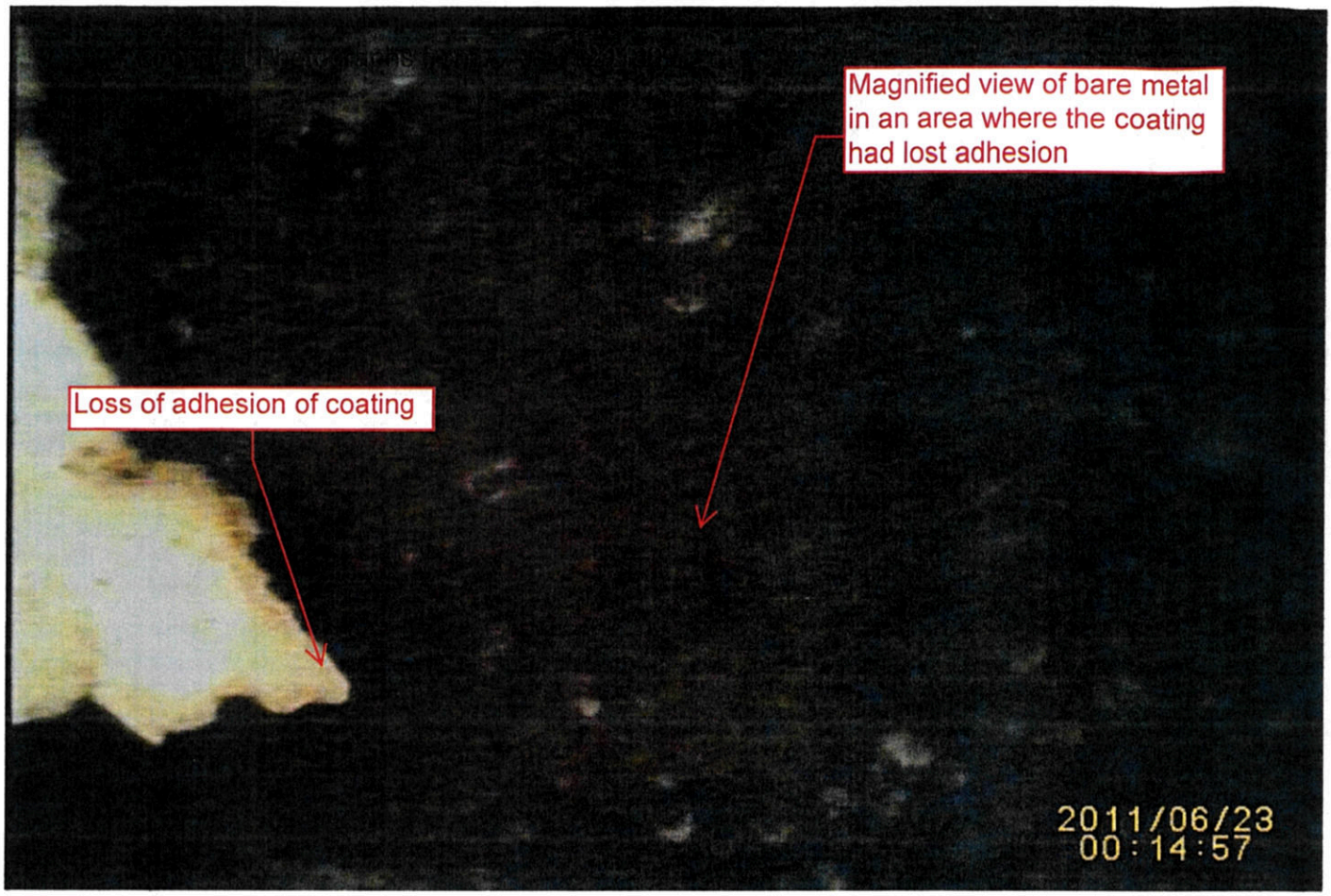

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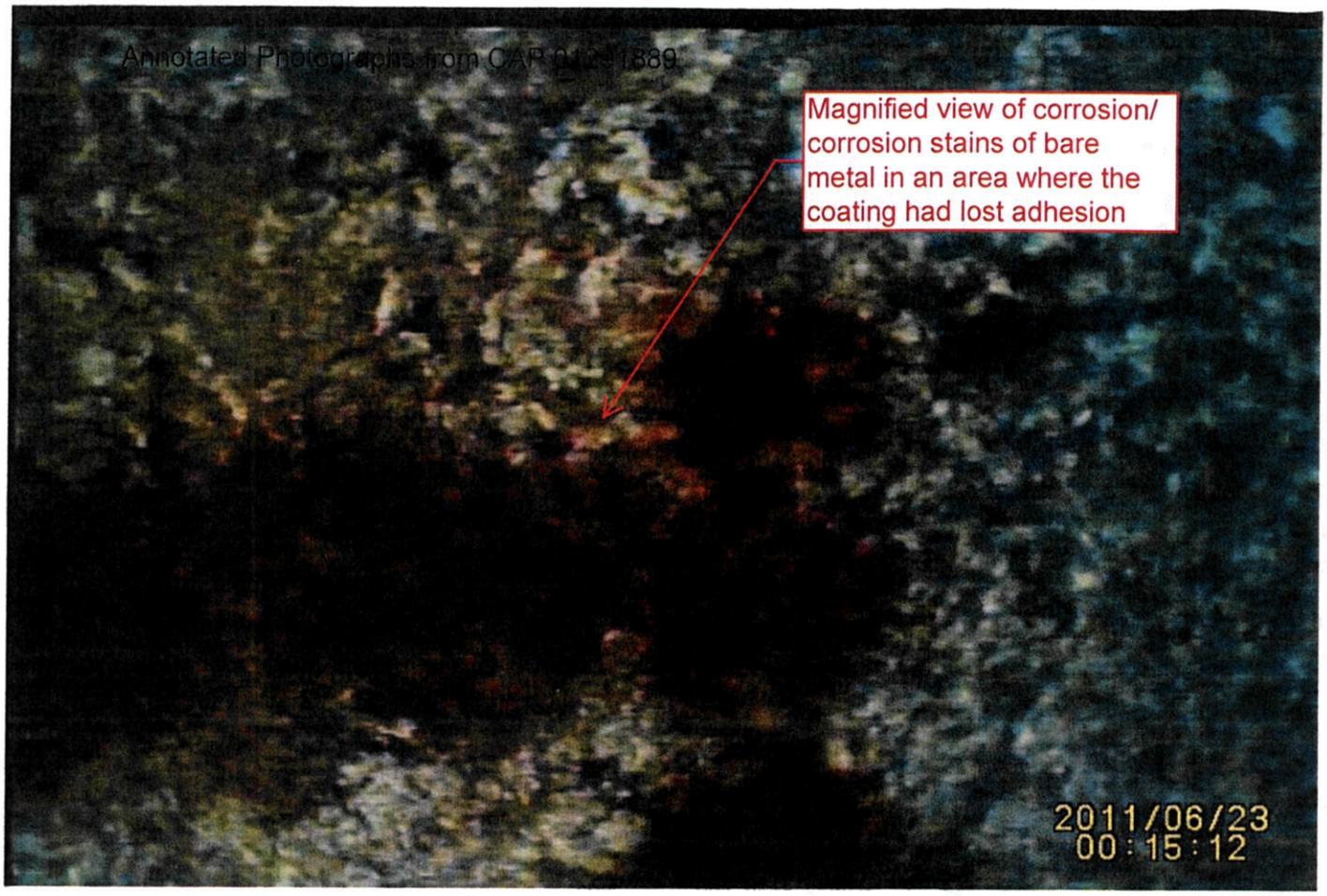

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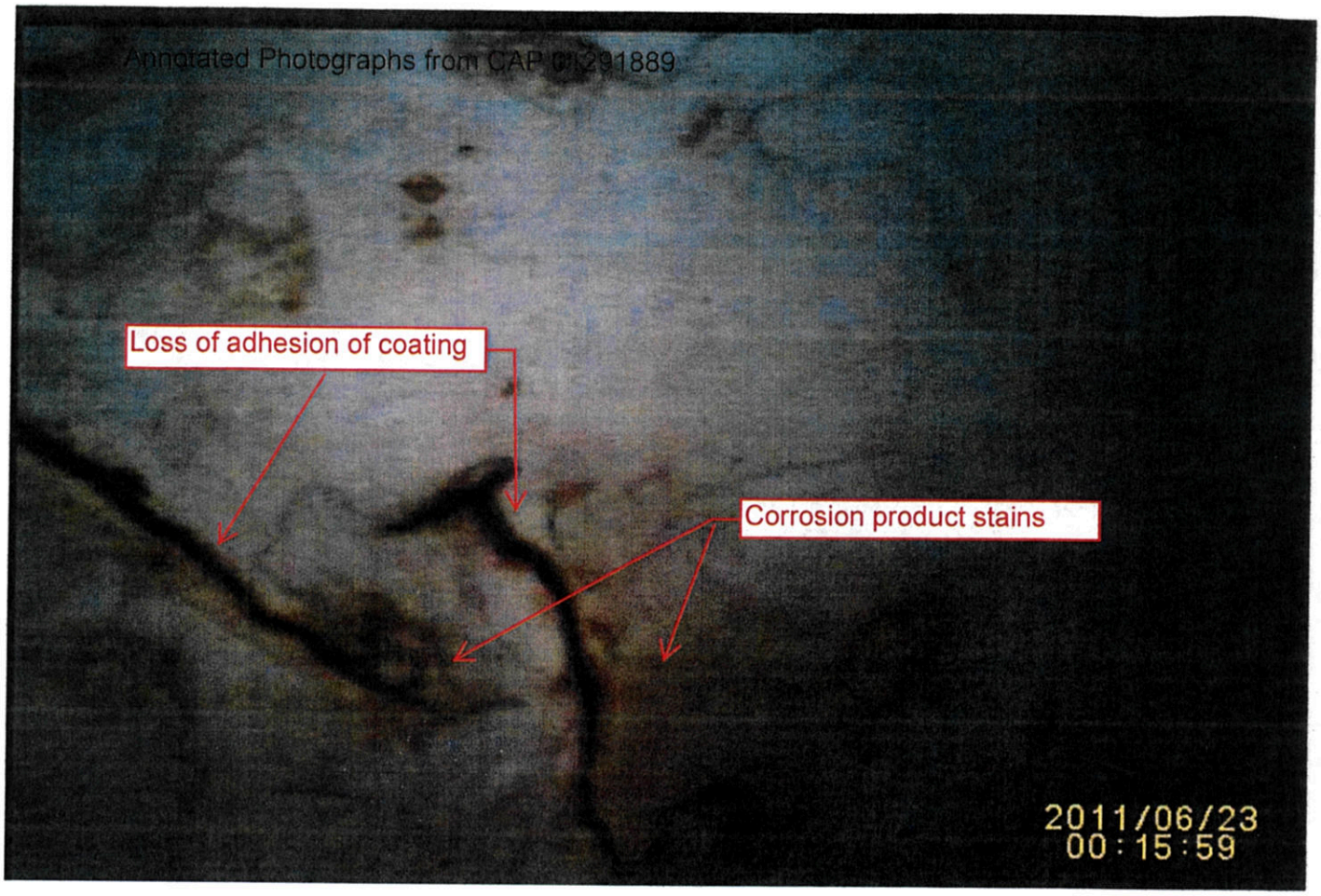


From CAP 01291889,
Bottom Inspection of Cask #1

ANNOTATED PHOTOGRAPHS

FROM CAP #01290943

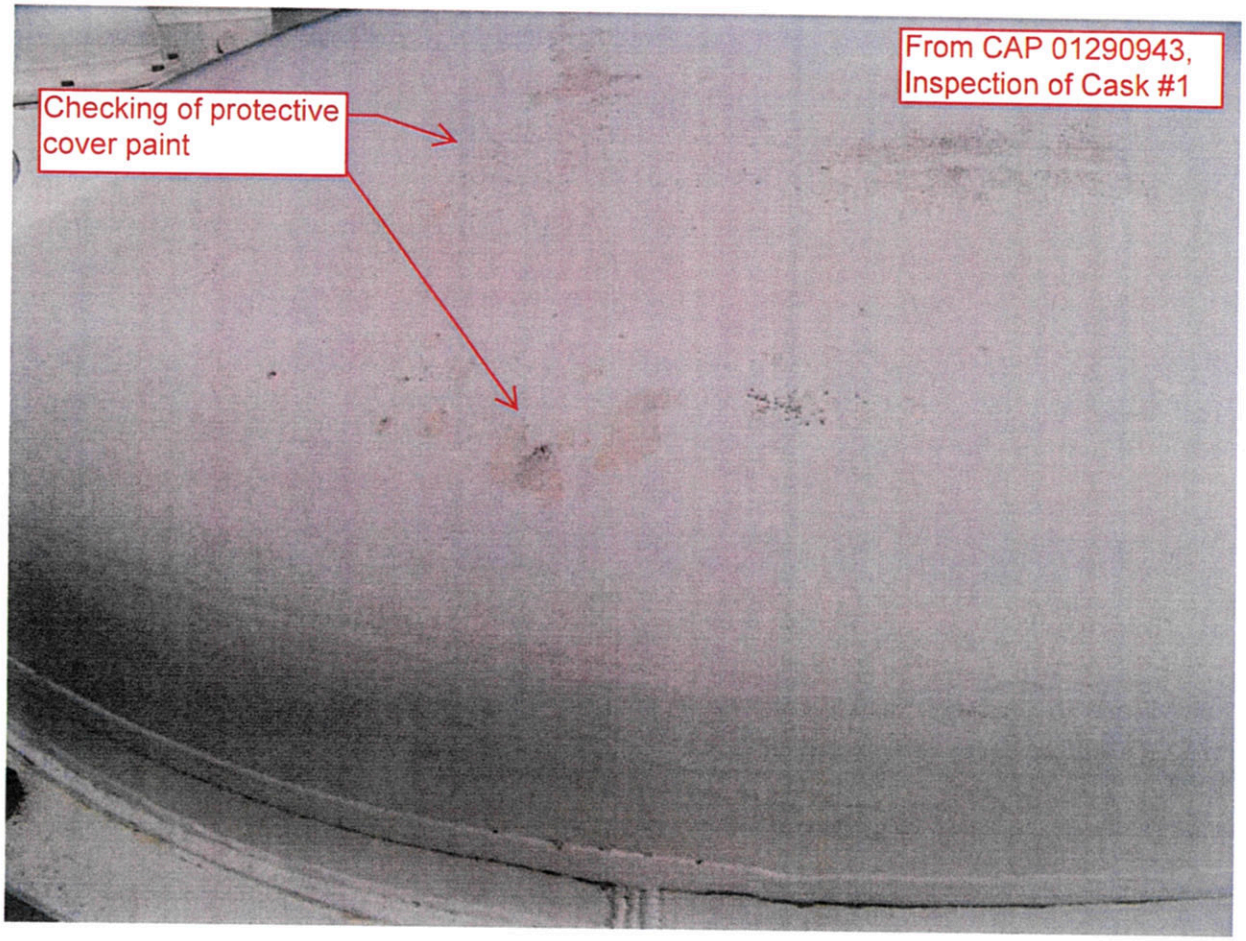
CASK #1 INSPECTION

Photos were originally provided in

PI RAI Response letter dated July 26, 2013, L-PI-13-073

Enclosure 2, Attachment 3

Annotated Photographs from CAP 01290943



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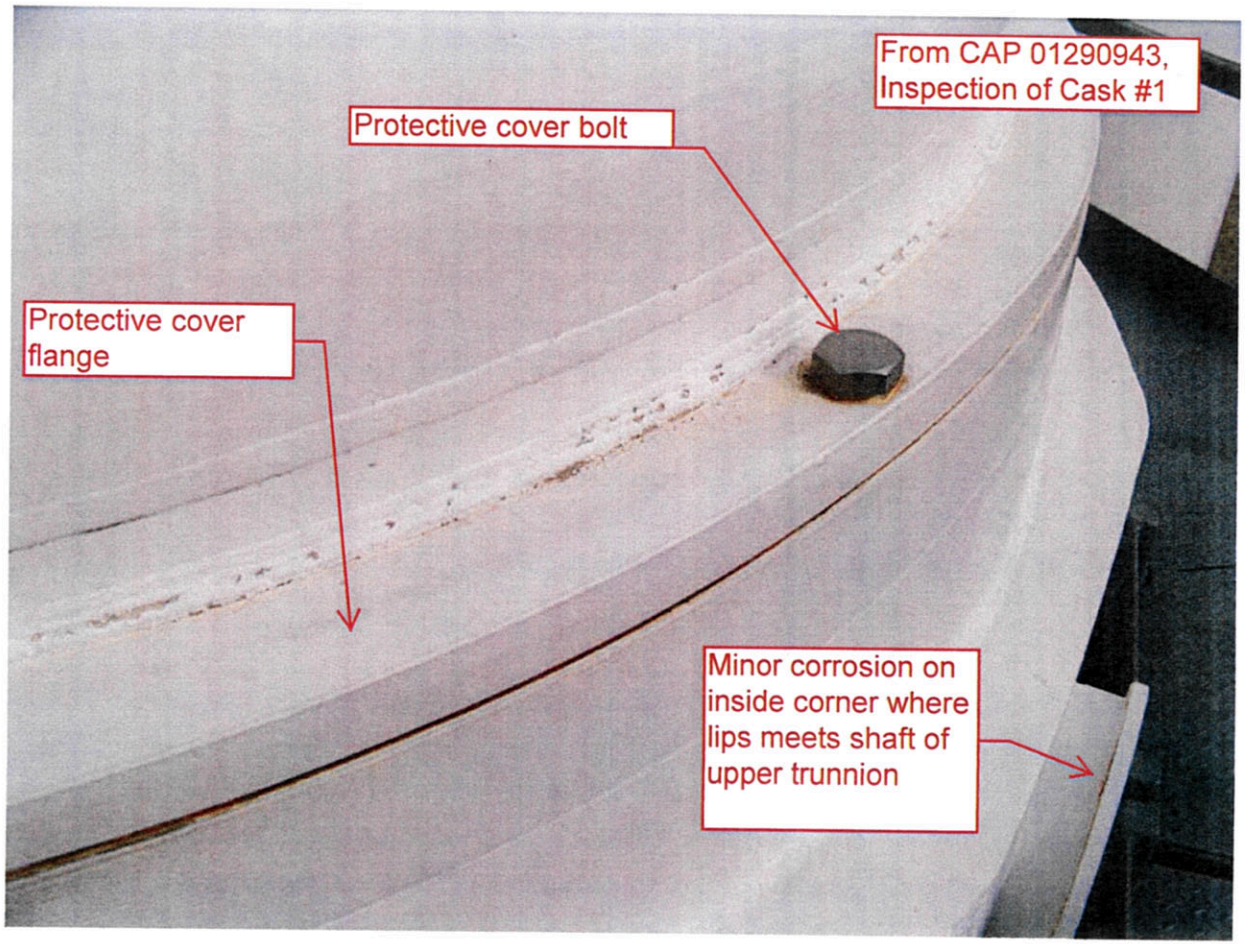

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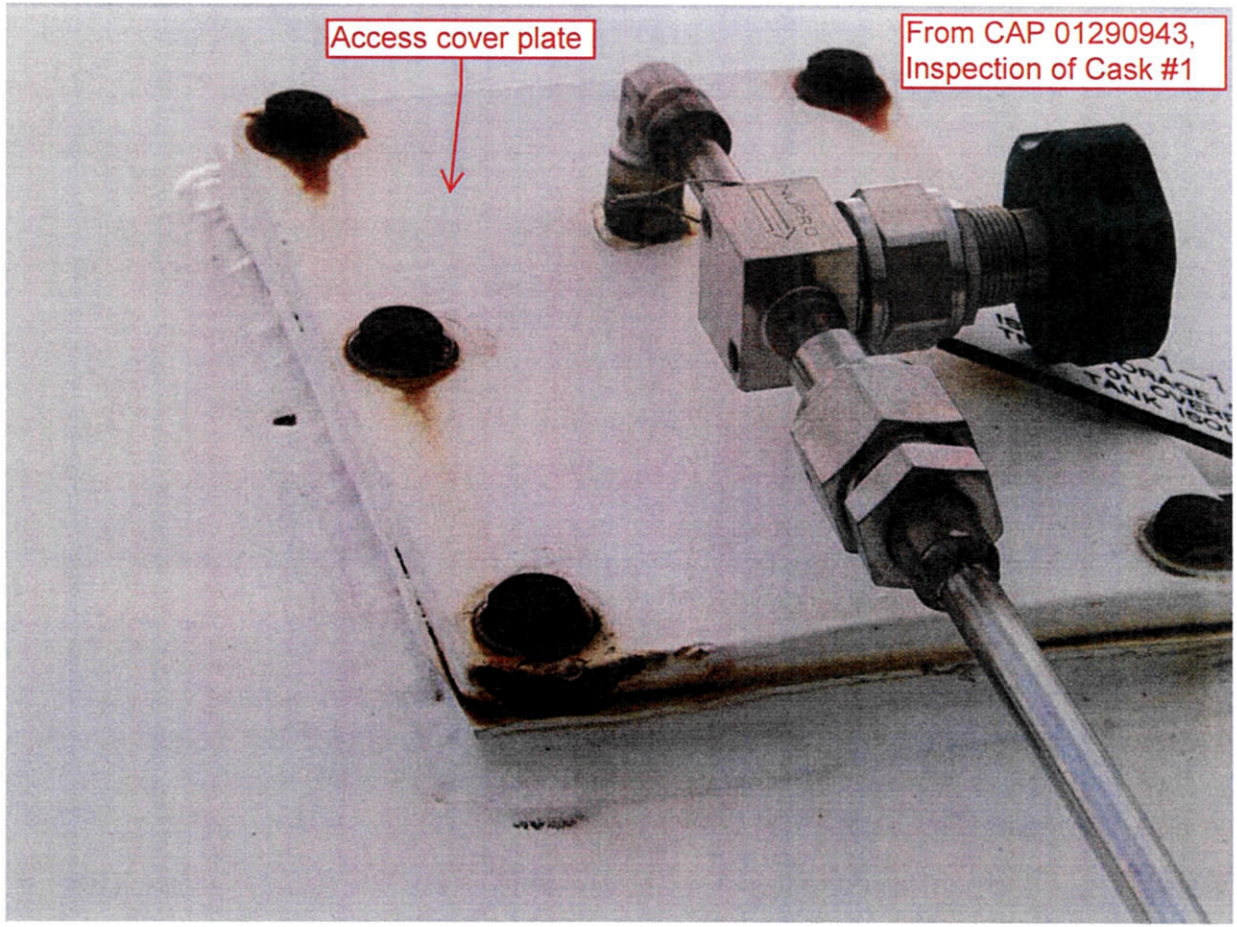

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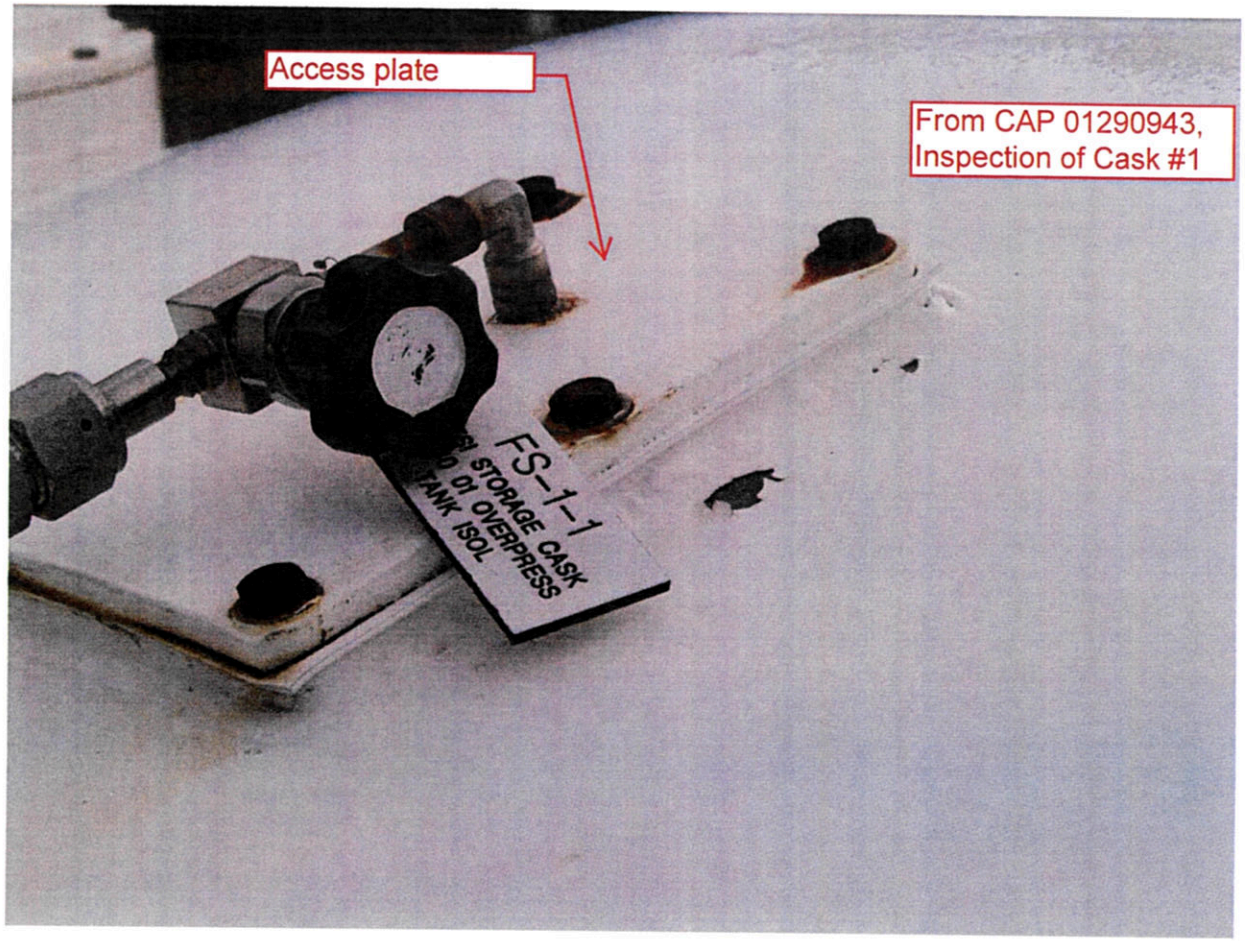

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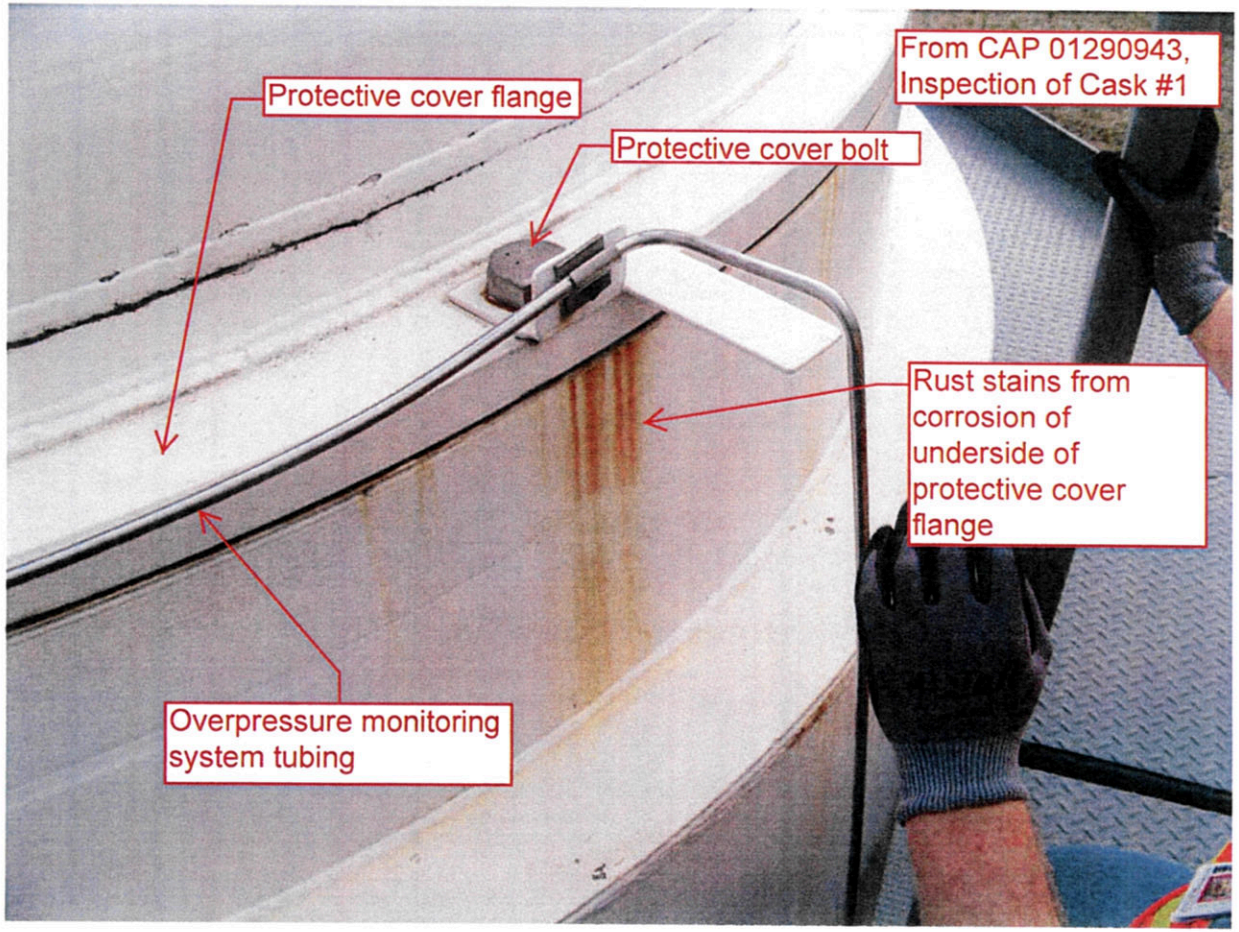

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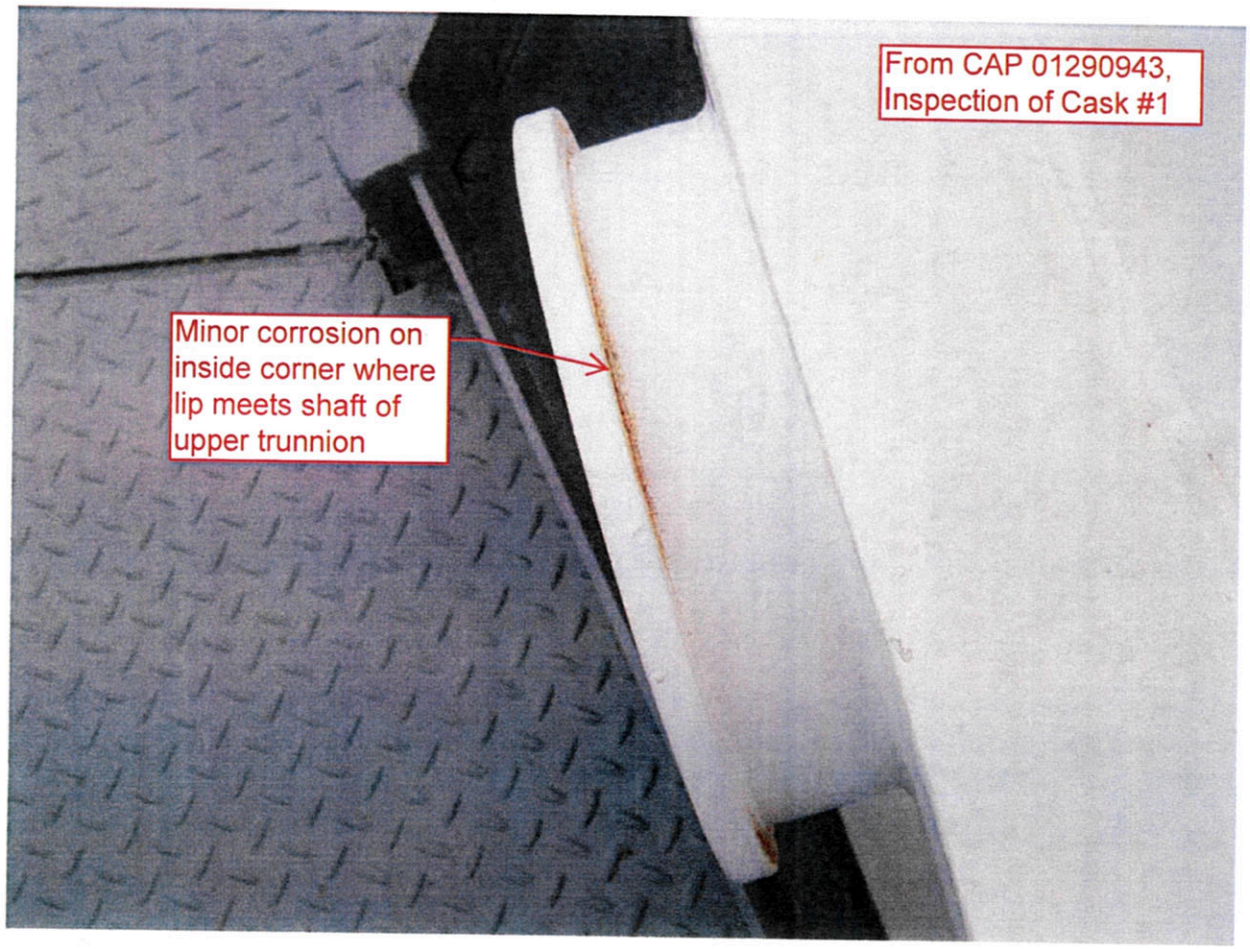

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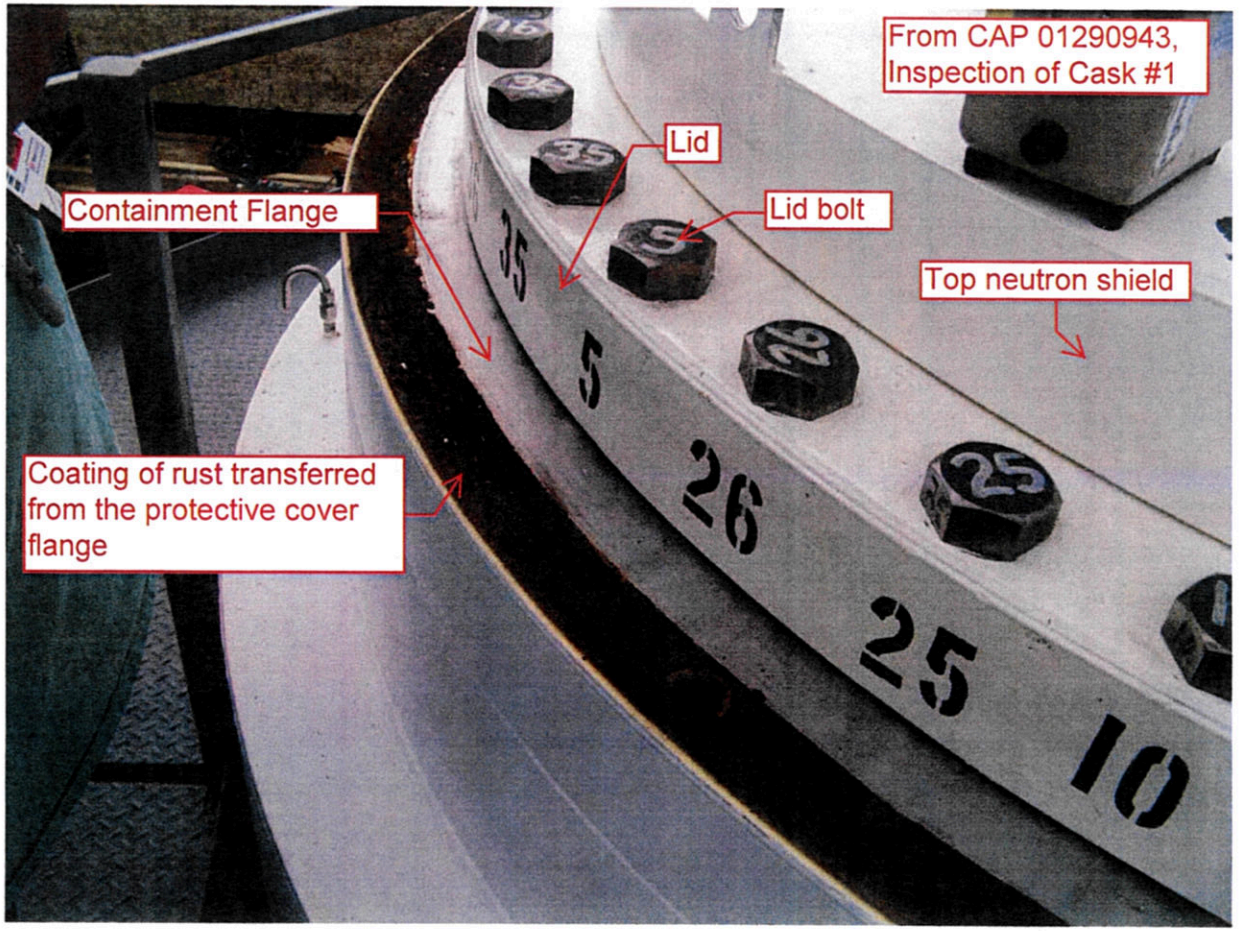

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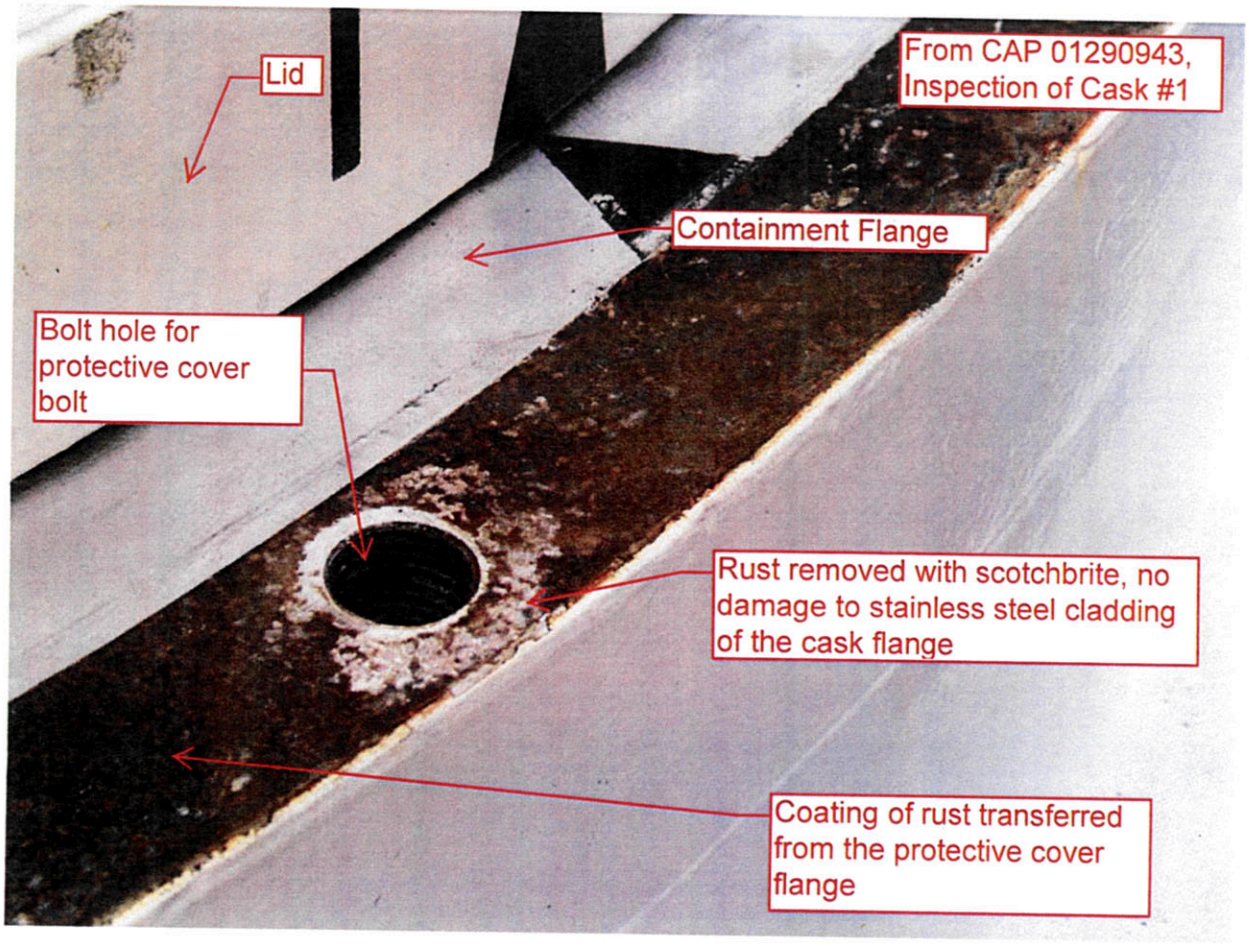

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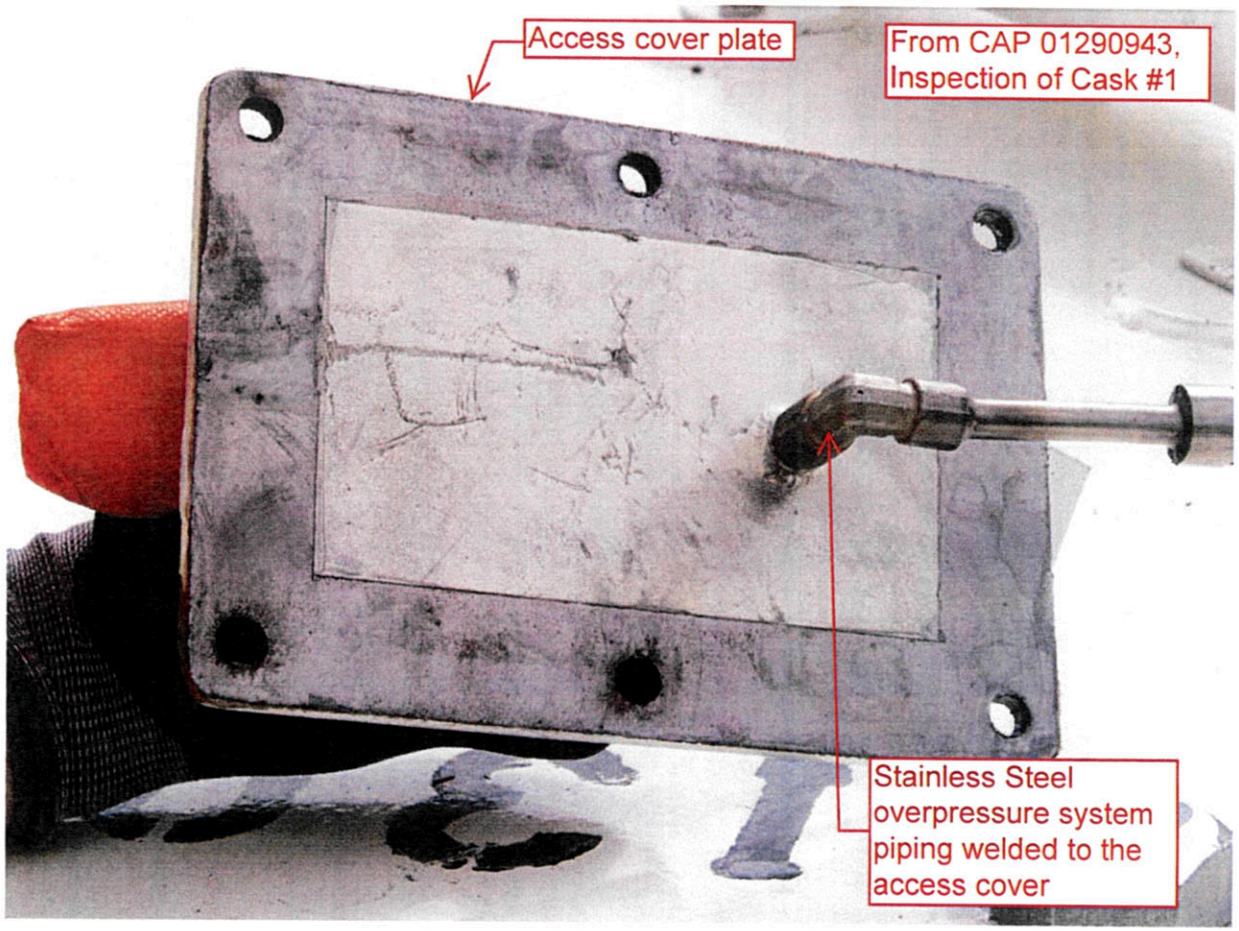

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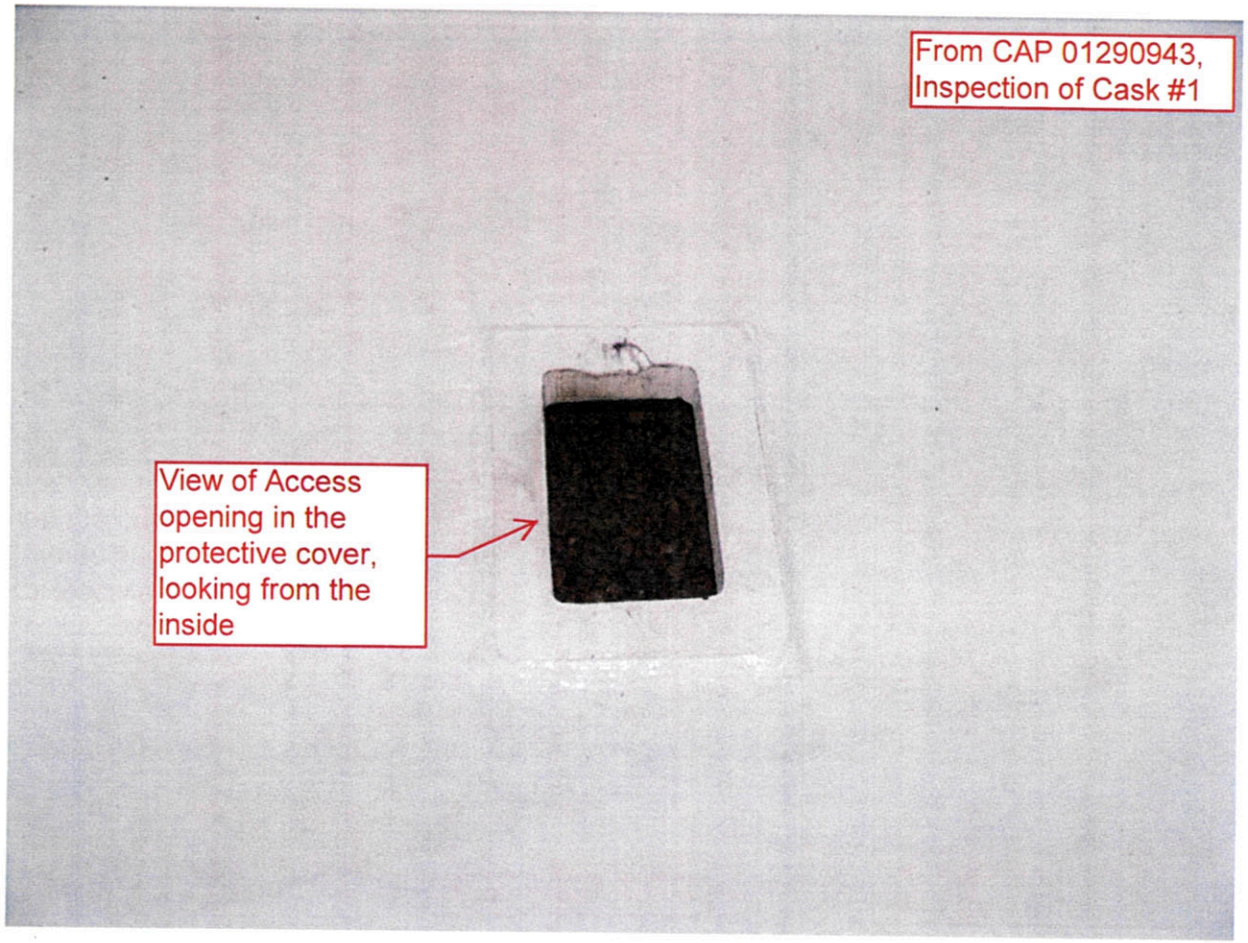

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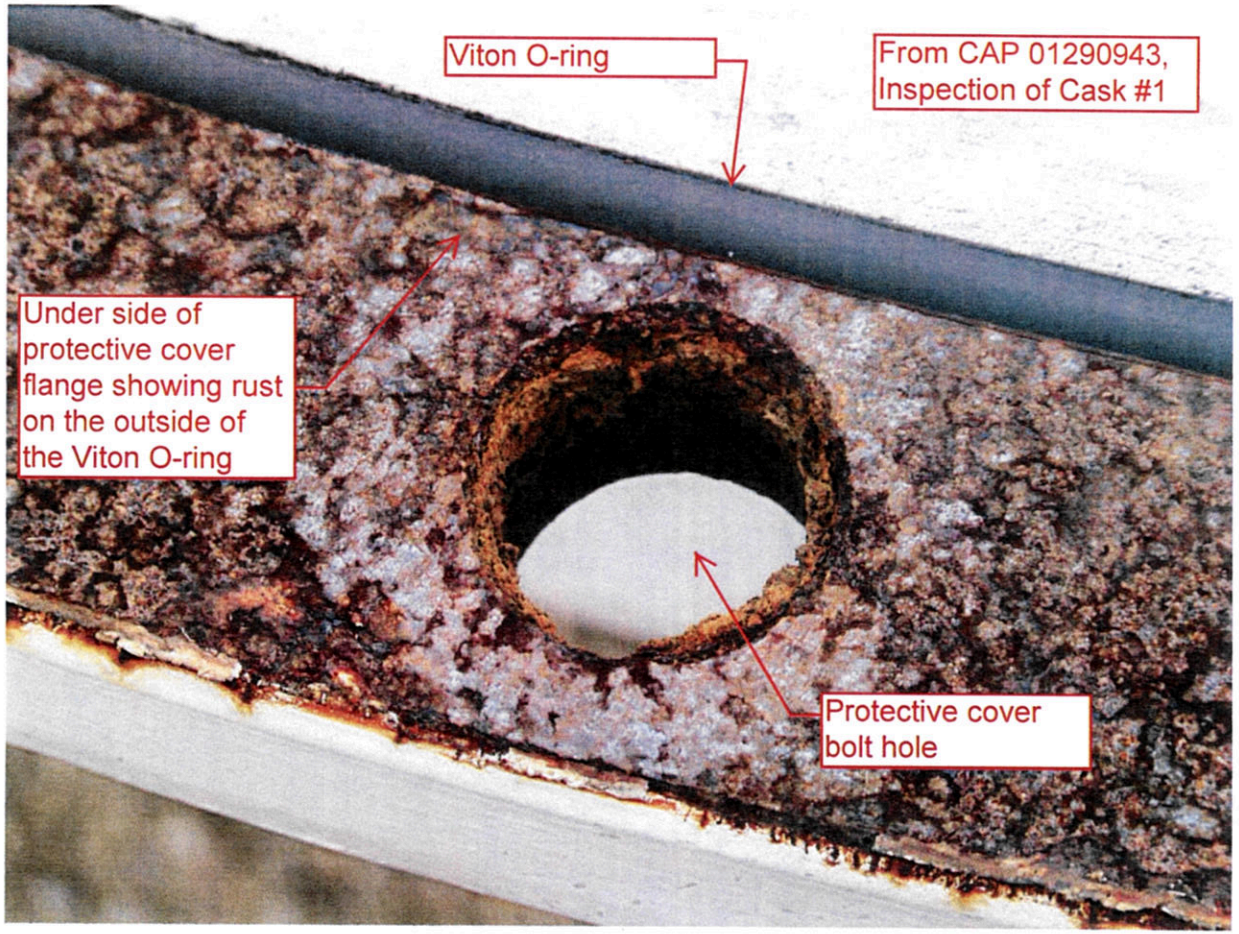

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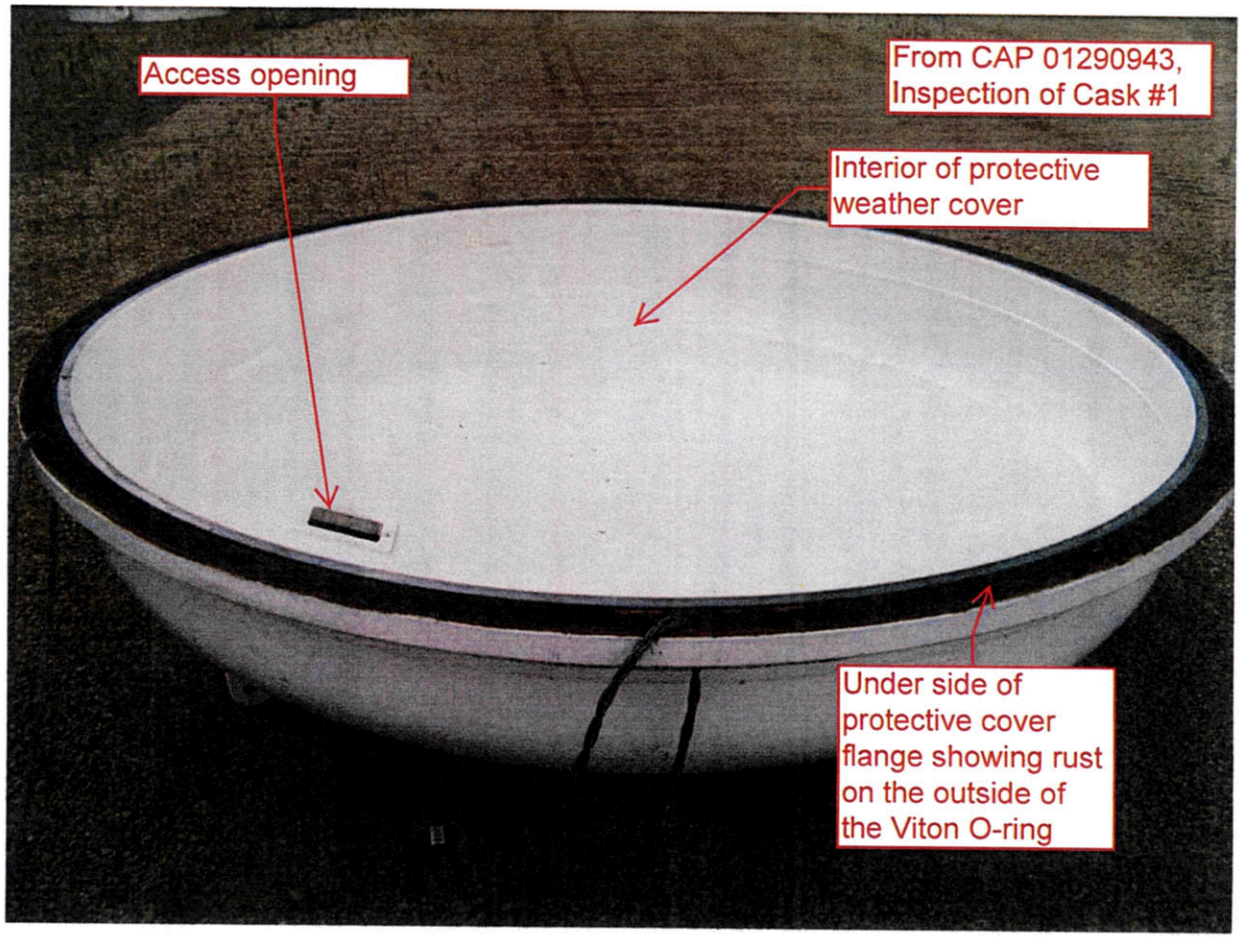


ANNOTATED PHOTOGRAPHS

FROM CAP #01289682

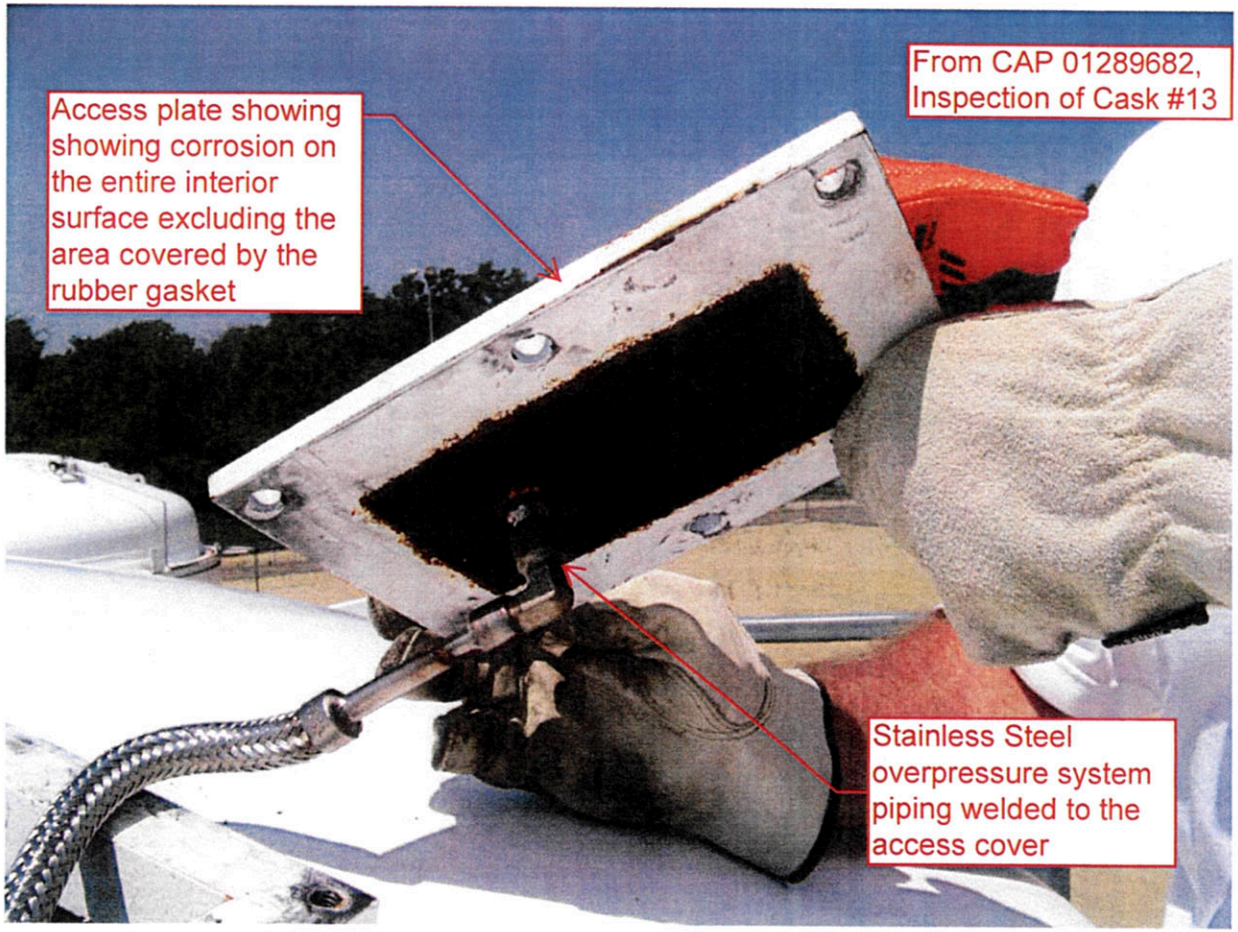
CASK #13 INSPECTION

Photos were originally provided in

PI RAI Response letter dated July 26, 2013, L-PI-13-073

Enclosure 2, Attachment 4

Annotated Photographs from CAP 01289682



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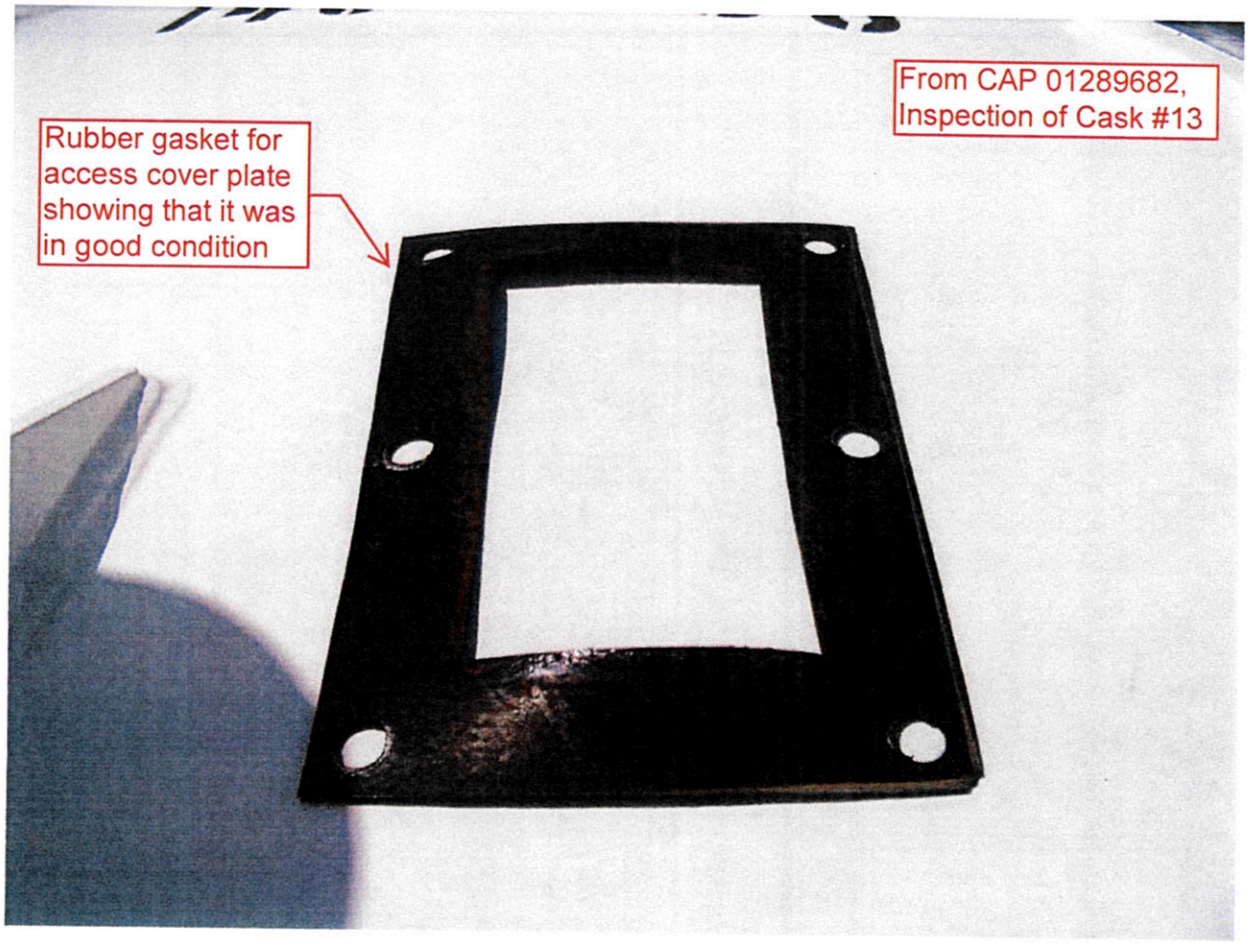

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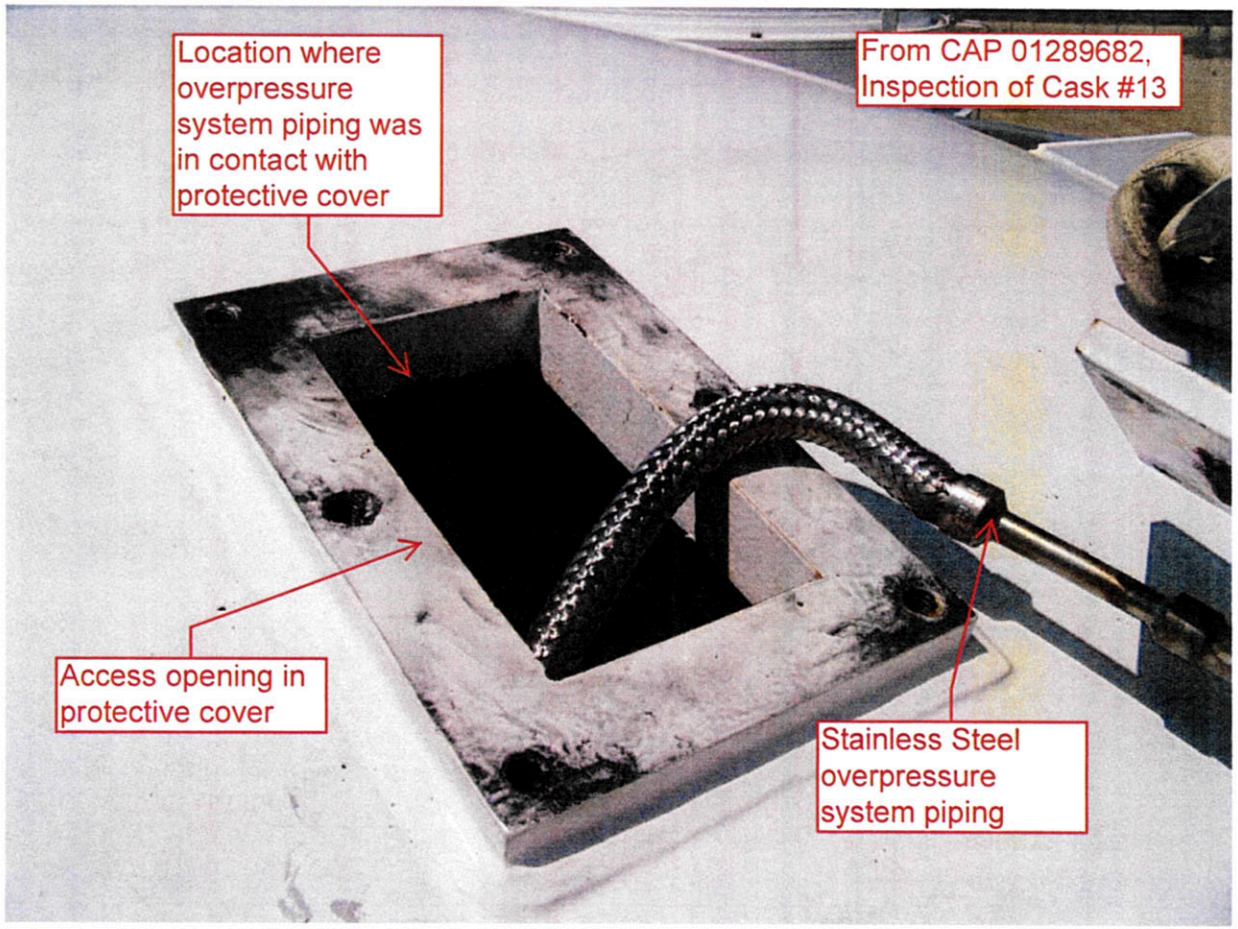
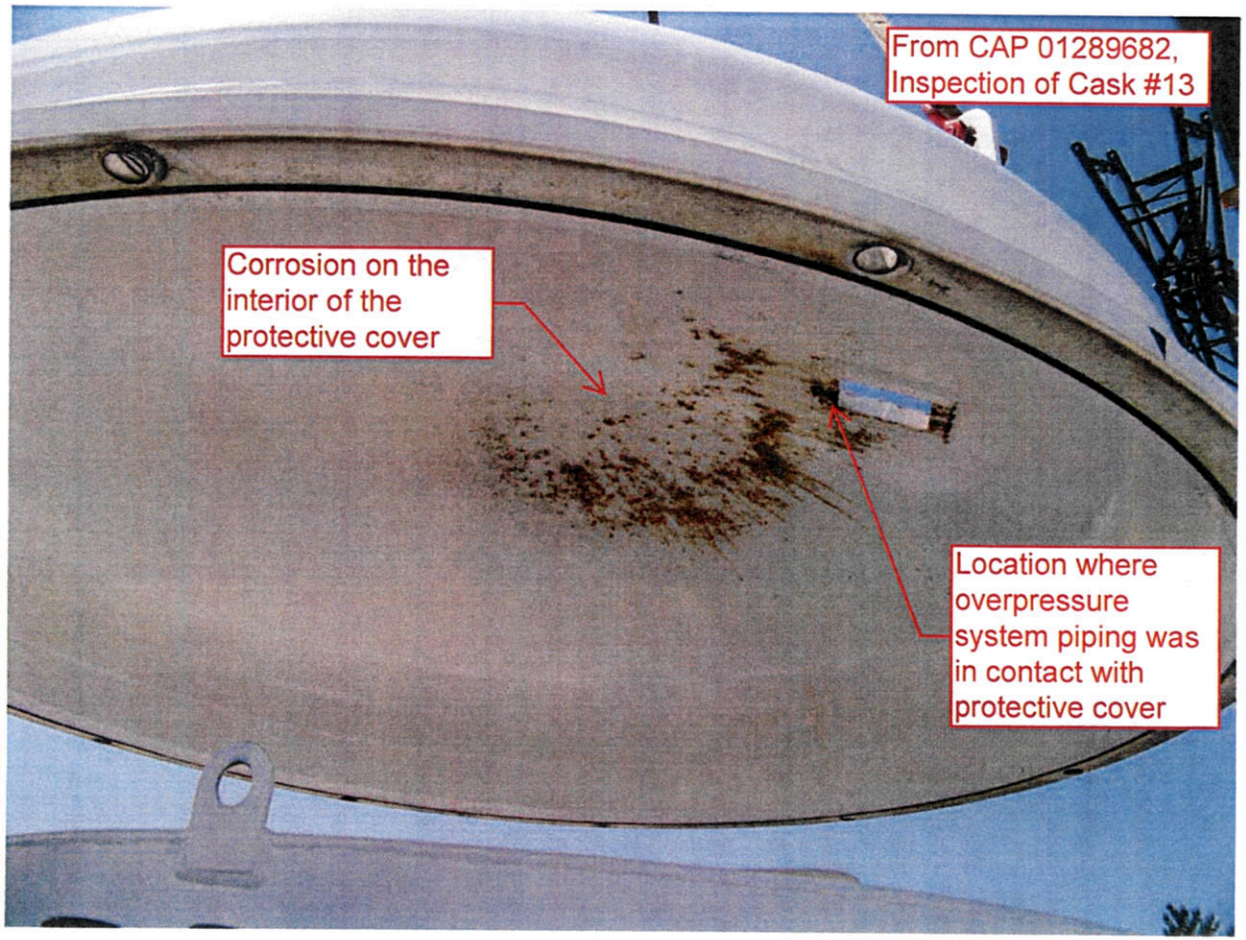
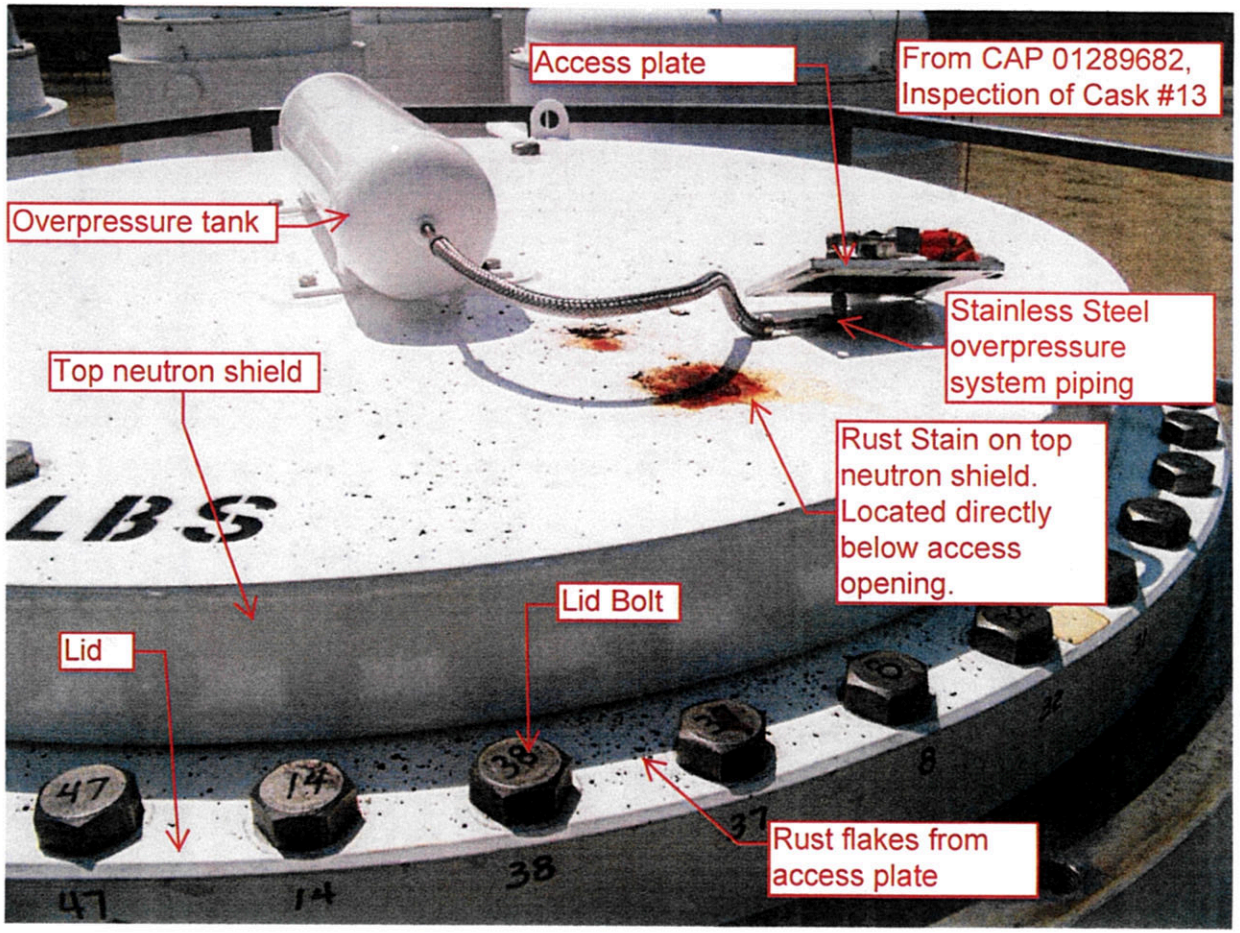


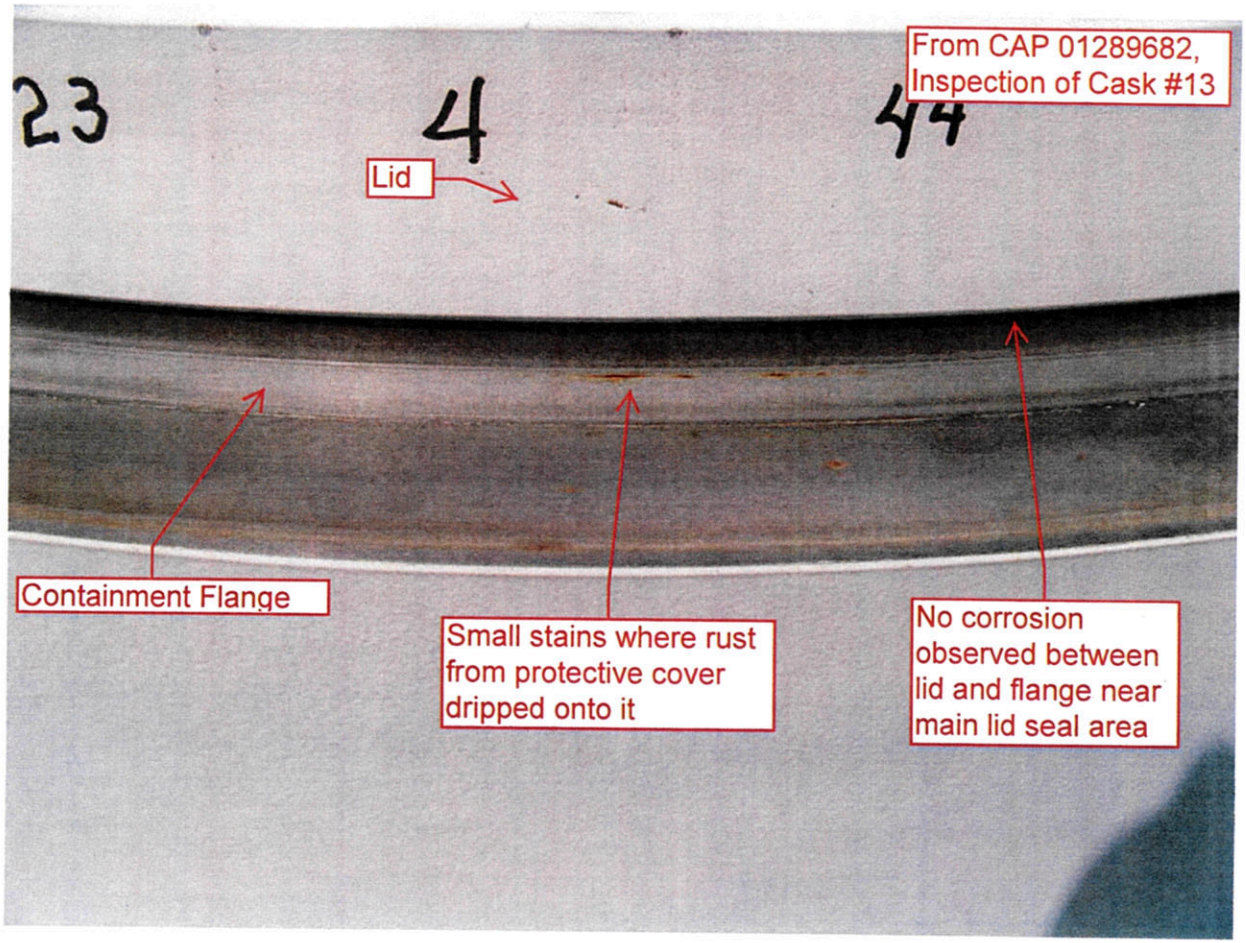
Annotated Photographs from CAP 01289682



Annotated Photographs from CAP 01289682



Annotated Photographs from CAP 01289682



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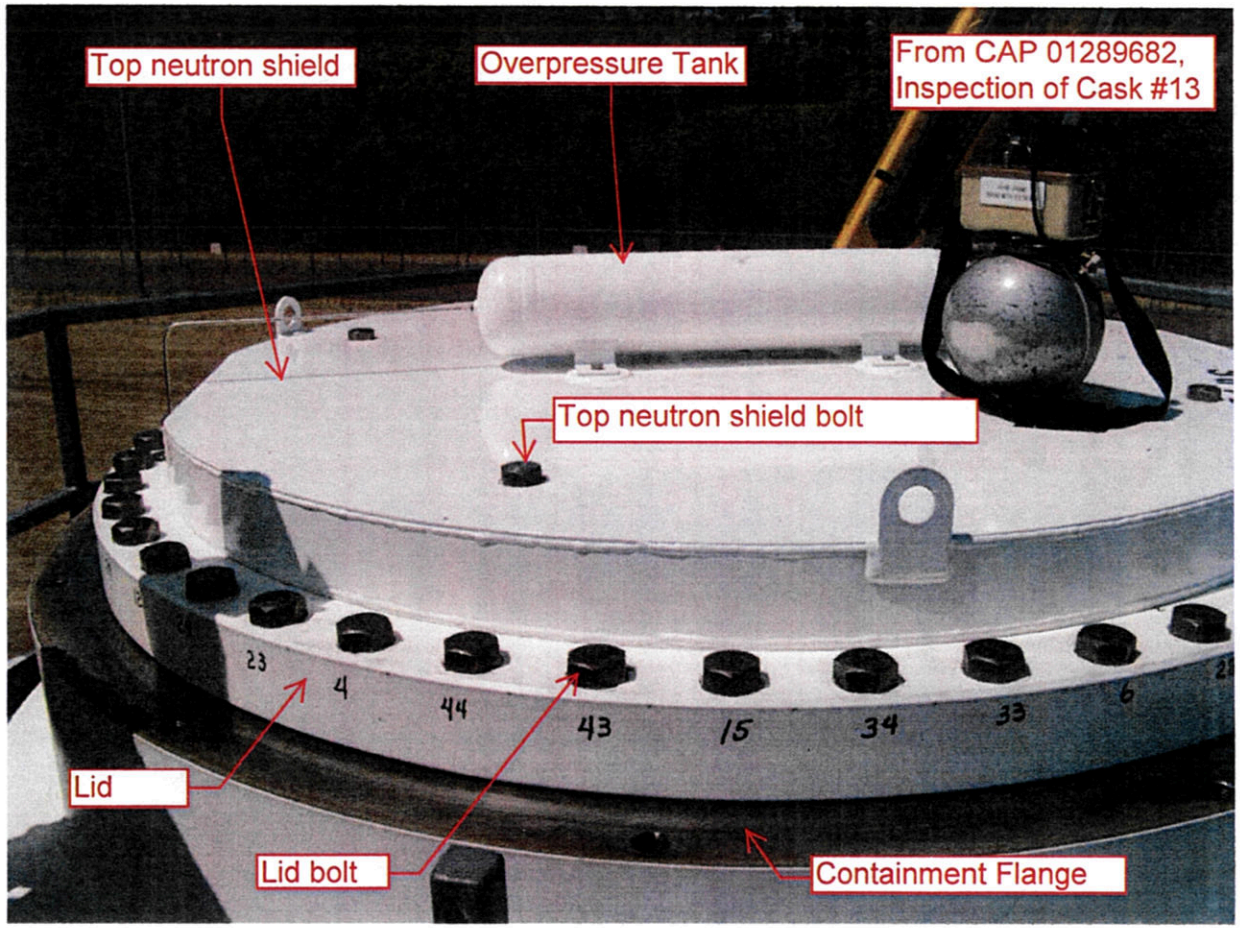
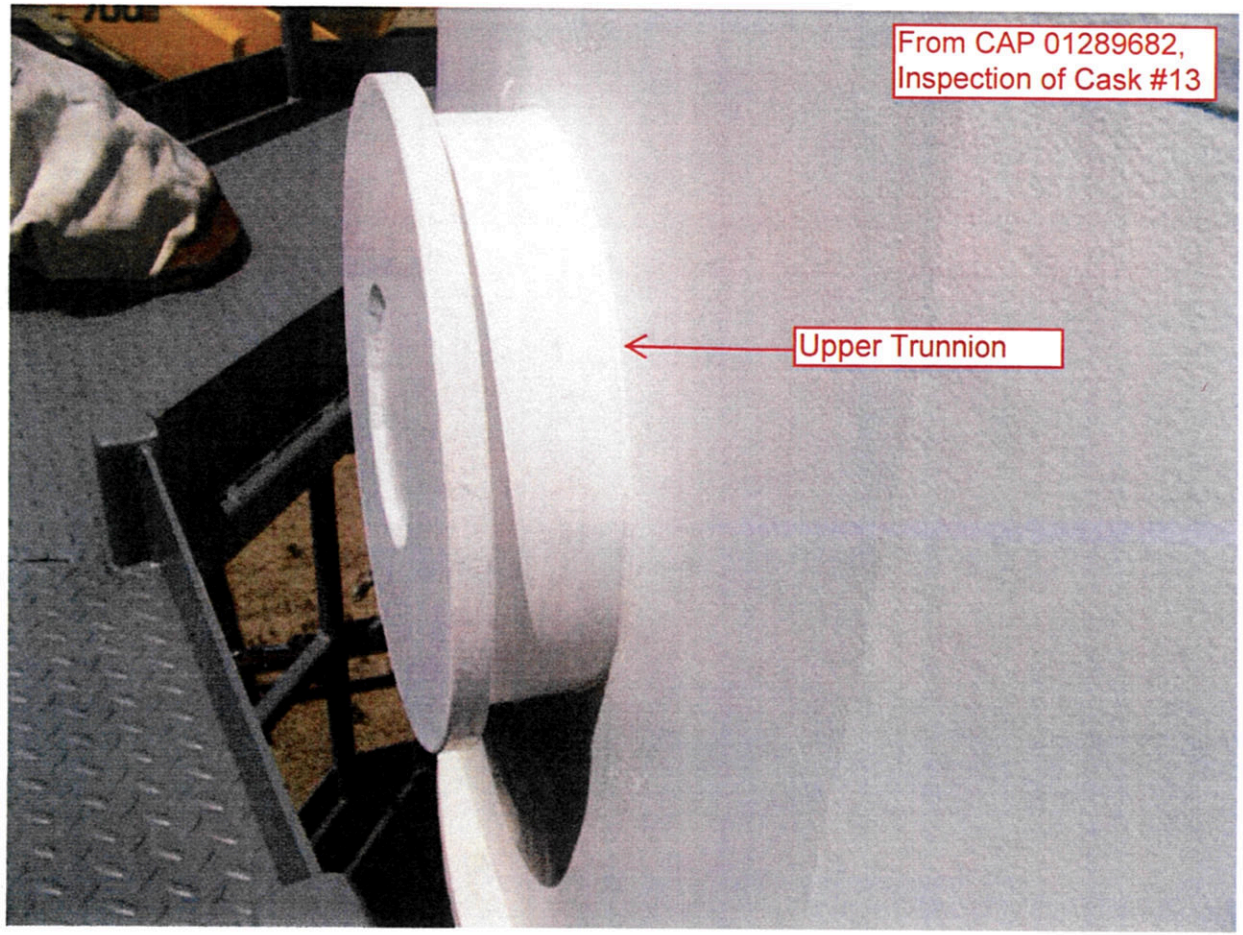


Annotated Photographs from CAP 01289682



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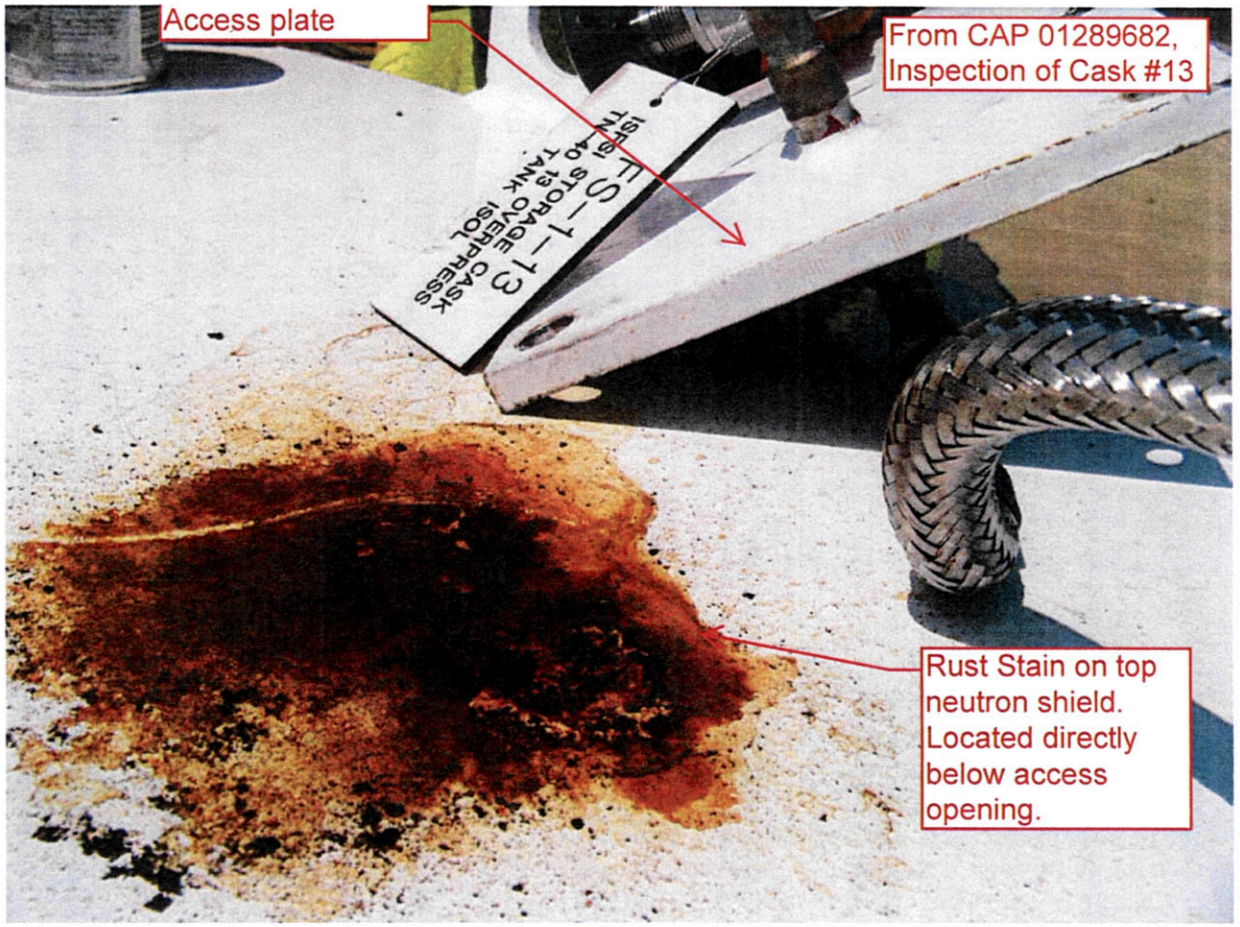

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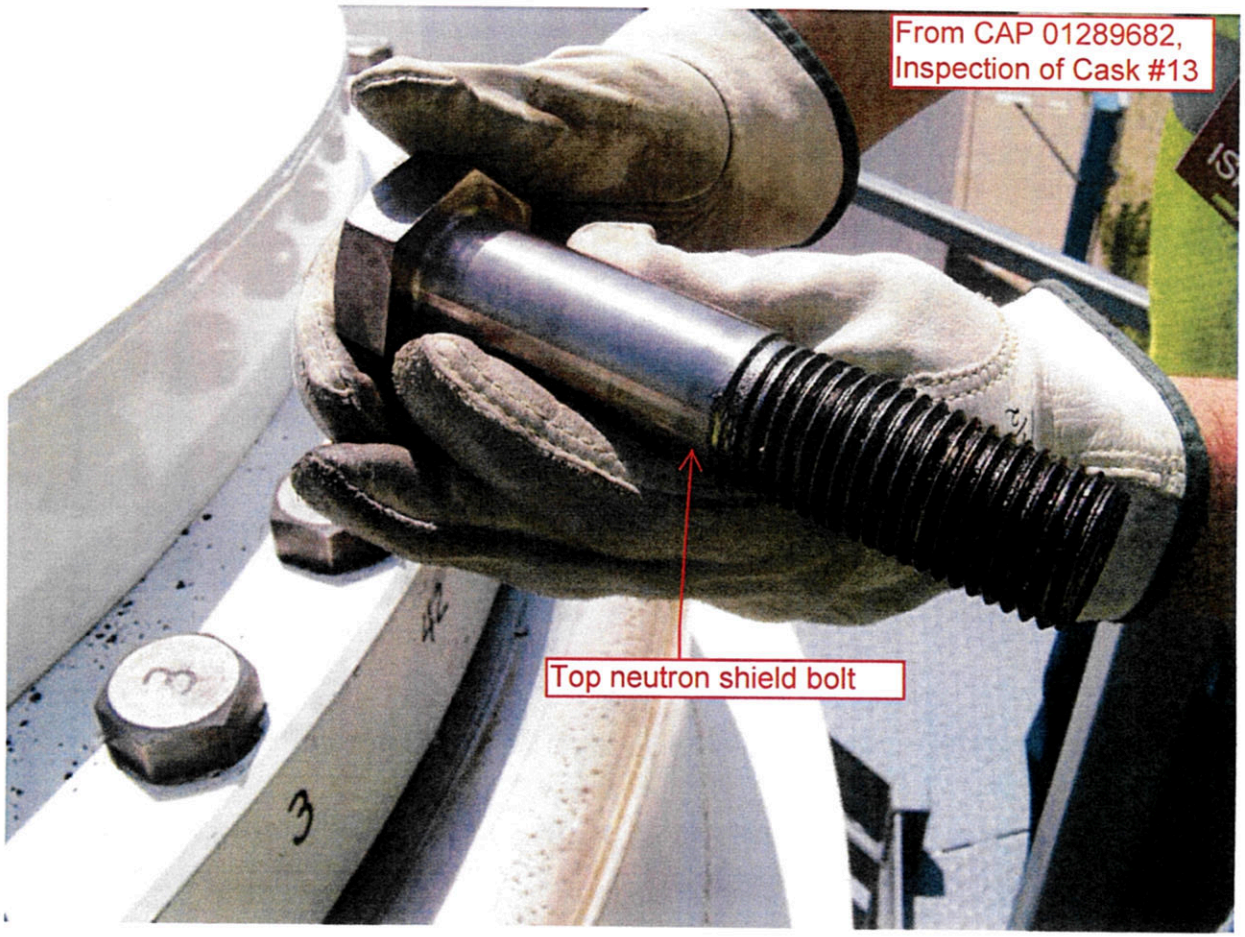

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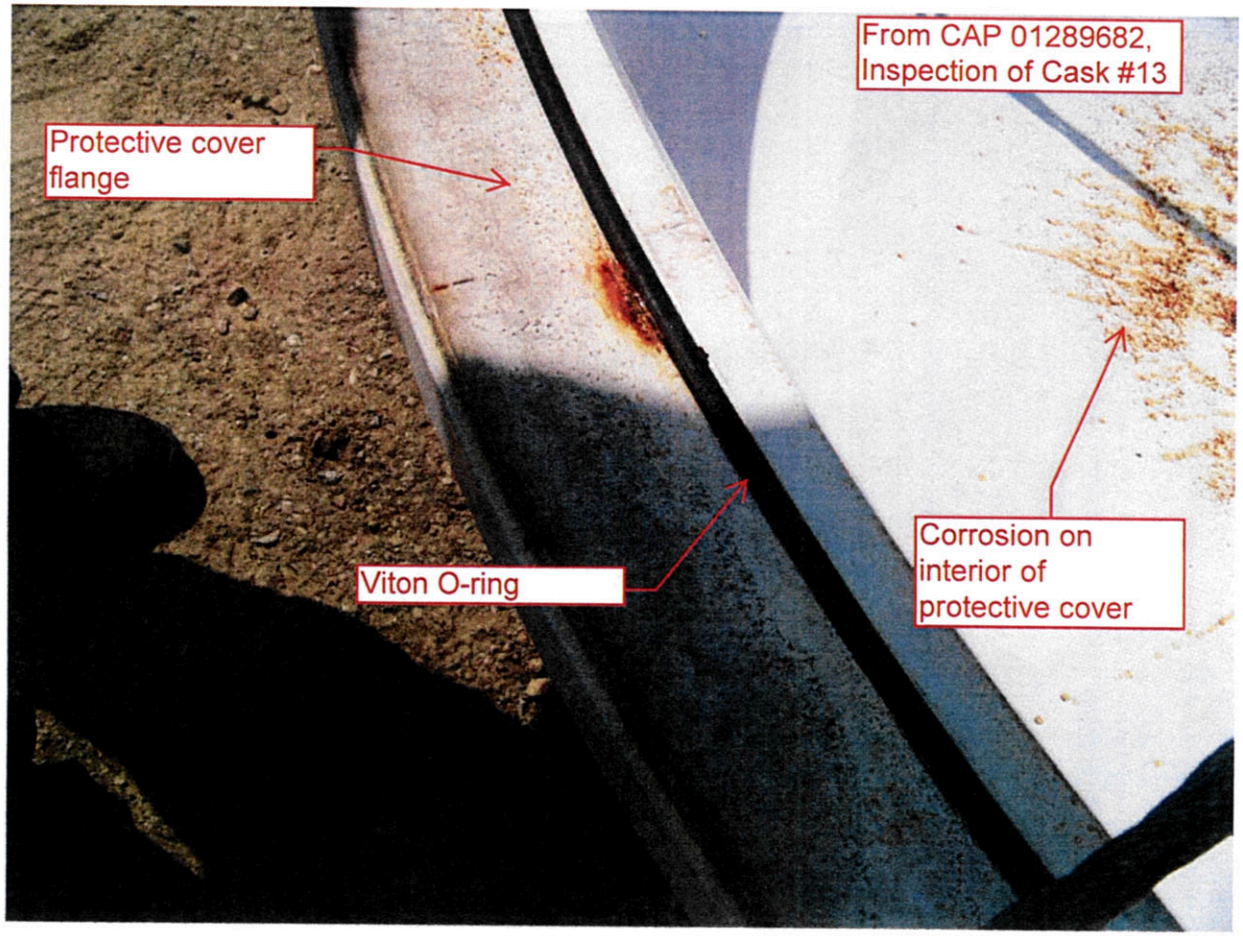

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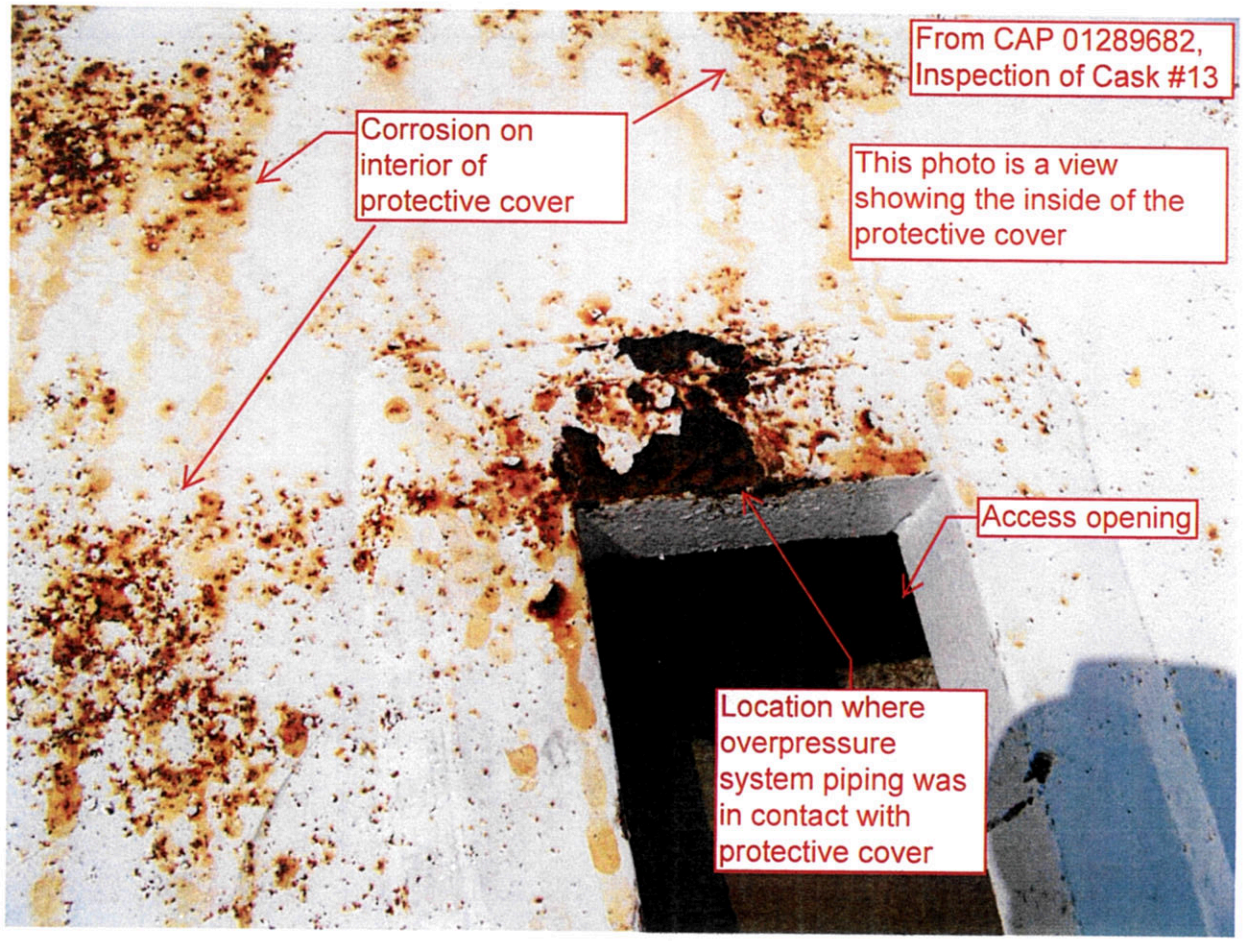

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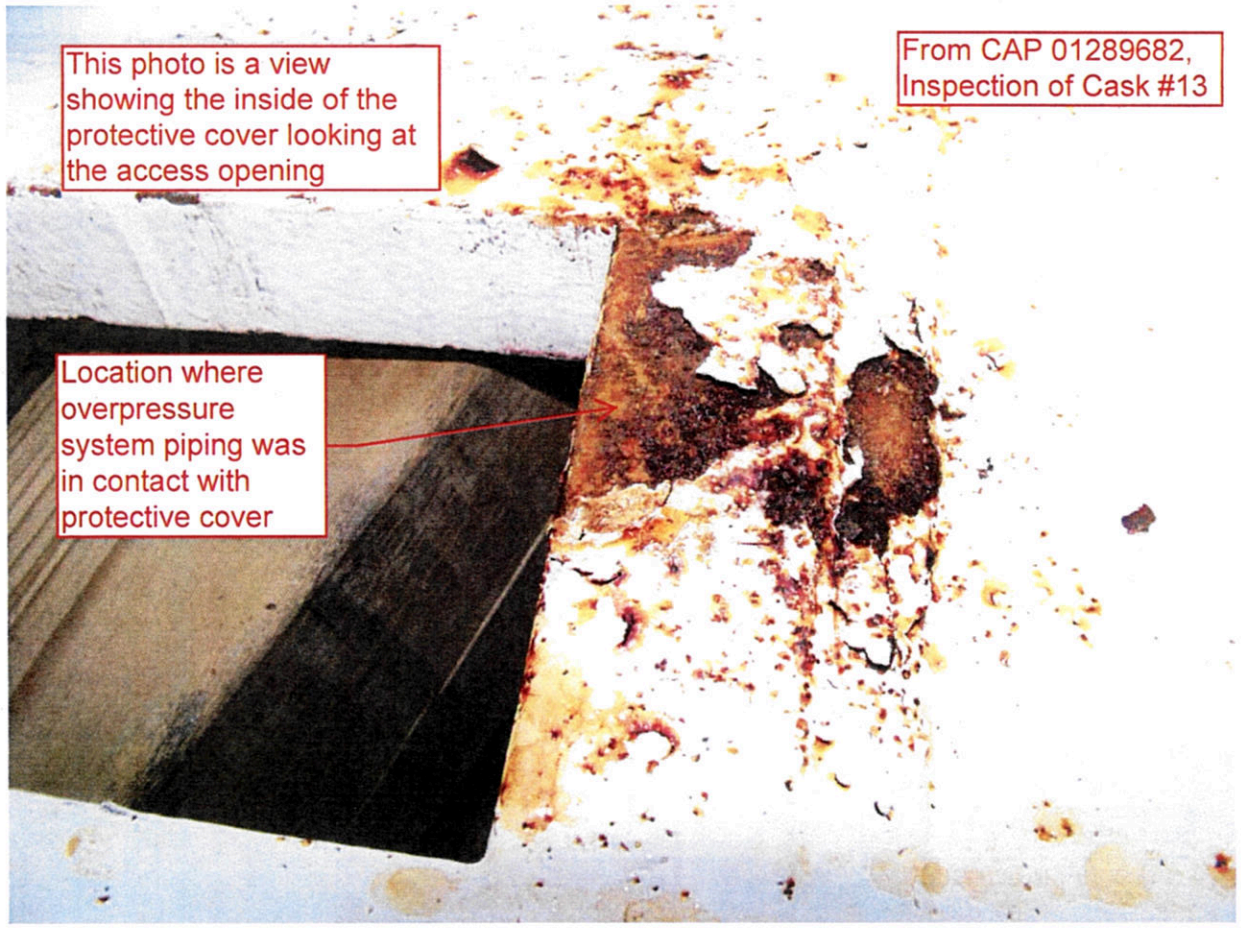

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