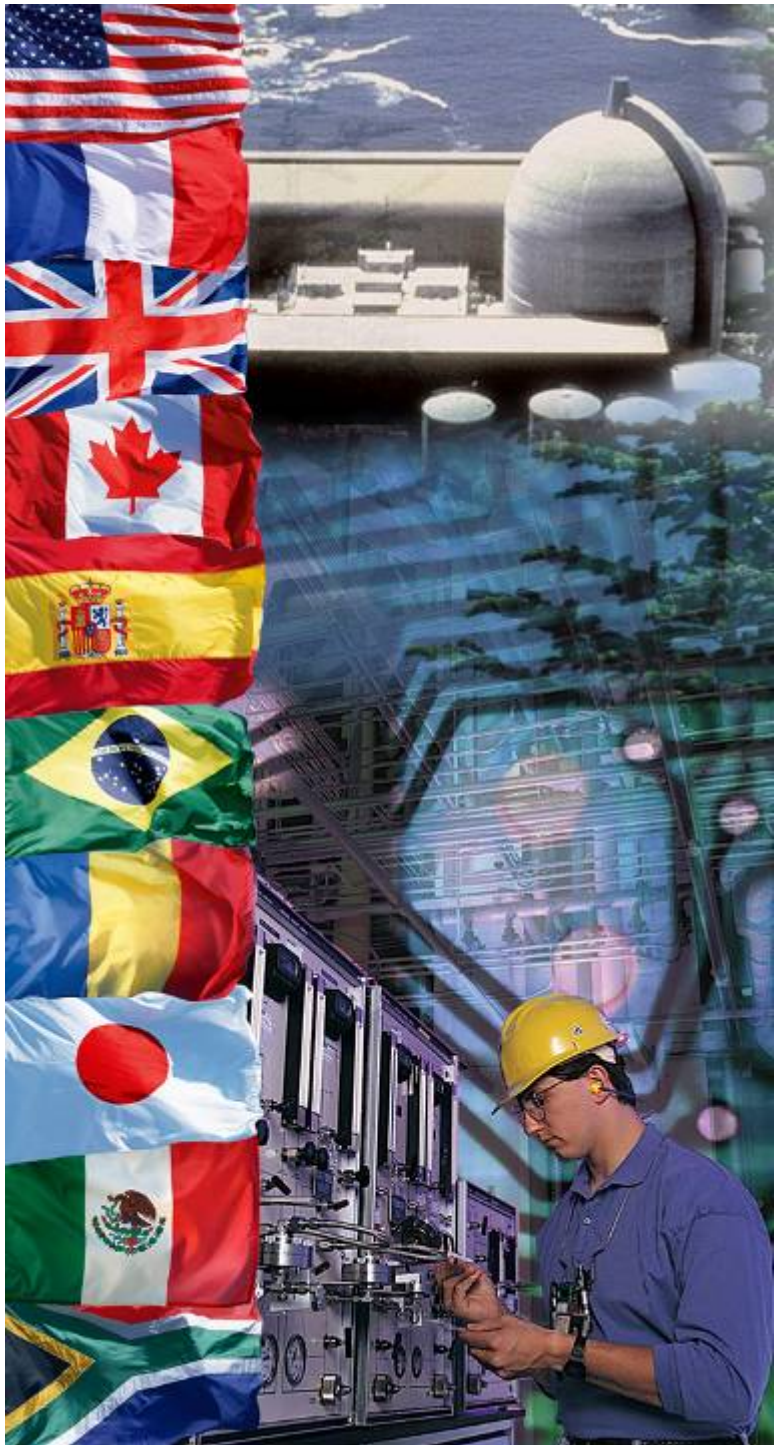

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Single Side Access Capability

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Objectives

- Review Single Side Access Capability
  - Austenitic Piping Welds
  - Dissimilar Metal Welds

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Current Capability

- Austenitic Piping Welds
  - No procedures fully qualified
    - 10CFR50 requires that procedures be demonstrated on test sets where all flaws are located on the far side of the austenitic weld
      - Requires ultrasonic beam to propagate through weld material to cover the required examination volume
  - To date no procedures have been capable of meeting this requirement
  - PDI still tests procedures and personnel on samples where flaws can be detected

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Current Capability

- Dissimilar Metal Welds
  - All PDI qualified procedures have been qualified with access limited to a single side of the weld
    - Requires ultrasonic beam to propagate through austenitic weld material in order to detect, characterize and size the flaws

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Comparison of Examinations

- Austenitic Piping Welds
  - Utilizes Shear Wave Search Units
  - Weld crowns present in most cases
  - Diametric shrinkage present on most welds, but more prominent on thinner welds
  - Most welds have inside surface geometry that requires discrimination
  - Flaws are located in base material heat affected zone
  - Most single side welds are welds to components such as valves, flanges, pumps that do not allow access to the far side of the weld for scanning
  - Many piping welds take credit for weld crown reinforcement as part of thickness
    - Removal will violate minimum wall

- Dissimilar Metal Welds
  - Utilizes Refracted Longitudinal Search Units for examination of the weld and butter, but used shear wave search units for examination of the base material
  - Requires smooth flush surfaces
  - Diametric shrinkage present on welds that were replaced in field
  - Most of the welds are forged machined components with little to no inside surface geometry that require discrimination
  - Flaw can be located in austenitic base material and in the weld material
  - Most of the single sided welds are to large components and in many cases allow some access from the far side of the weld

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Examination Specifics

- Austenitic Piping Welds
  - 45 and 60 degree shear wave search units used to fully examine the weld heat affected zone adjacent to the weld
    - Provide good signal to noise ratio
    - Have a wide range of applicability
    - Small and less affected by geometry
    - Wedges can be conditioned to obtain better coverage on welds with crowns and or diametric shrinkage
  - Techniques are designed to discriminate flaws from geometric conditions such as root, counterbore and mismatch
  - Shear waves are not effective in penetrating through large amounts of austenitic weld material
  - Techniques are designed to examine heat effected zone from the adjacent base material, without have to scan on top of weld
    - Requires skewing of search unit
  - The refracted longitudinal search units are used for single sided examination of welds greater than 0.50” thick in attempt to cover the examination volume on the far side of the weld
    - Not as effective as shear wave search unit for examination of base material
    - Search units are focused and do not have a wide range of applicability
    - Search units are larger and have a bigger footprint
      - More affected by geometry
    - Wedges cannot be conditioned and generally are more affected by geometry

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Examination Specifics

- Dissimilar Metal Welds
  - Utilizes 45 and 60 Degree Refracted Longitudinal Wave Search Units
    - Provide good signal to noise ratio if focused properly and access is available
    - Do not have a wide range of applicability
    - Larger and more affected by geometry
      - Contoured
      - Does not allow skewing of search unit
    - Wedges cannot be conditioned to obtain better coverage on welds with crowns and or diametric shrinkage
  - Shear waves are not effective in penetrating through large amounts of austenitic weld material, but are used for used for examination of the ferritic and austenitic base material
  - Must be able to scan completely of the entire weld and butter in order to detect, characterize and size flaws
    - Requires flush smooth surface

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Why do we not use DM procedure to examine Single Sided austenitic welds?

- Most single sided piping welds are joined to some kind of component that limits the examination
  - Flange
  - Pump (Cast)
  - Valve (Cast)
- The majority of austenitic have surface conditions that do not meet dissimilar metal weld procedure requirements and cannot be improved to an acceptable condition
  - Component has larger outside diameter than pipe, thus causing a transition that cannot be removed
  - Component geometry does not allow coverage of the examination volume
  - Component material properties are not covered by the procedure qualification (Cast)
  - Pipes have irregular surface conditions due to mismatch that cannot be improved to an acceptable level
  - Most piping welds have diametric shrinkage that if removed would violate minimum wall requirements
    - More prevalent on thin piping welds
  - In many cases weld crown reinforcement if removed would violate minimum wall thickness
    - Counterbore has reduced thickness of pipe
- The presence of inside surface geometry may challenge the dissimilar metal weld procedures capabilities to characterize indications thus causing unacceptable false call rates

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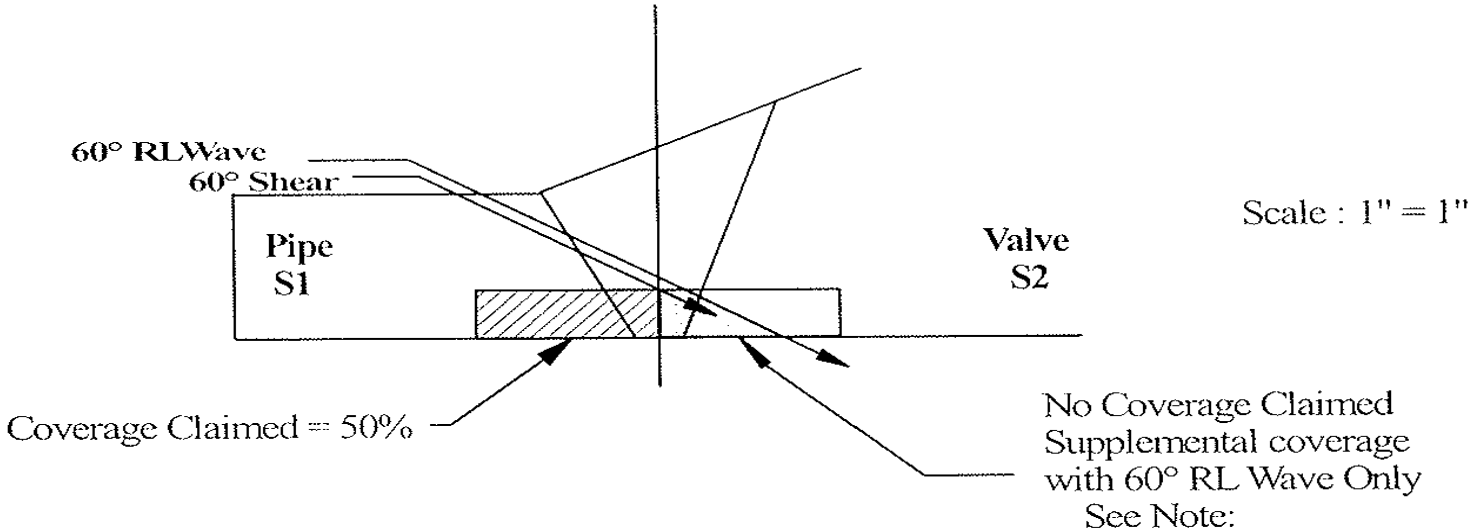
Examples of Typical Single Side Configurations

Item No. B09.011.020

Weld No. 1NC28-11



Note: 60° RL scan not included in percentage coverage due to requirements of 10CFR50.55a(b)(2)(xv)(A)(1). Best effort scan with 60° RL obtained 22.2% coverage in one axial direction.

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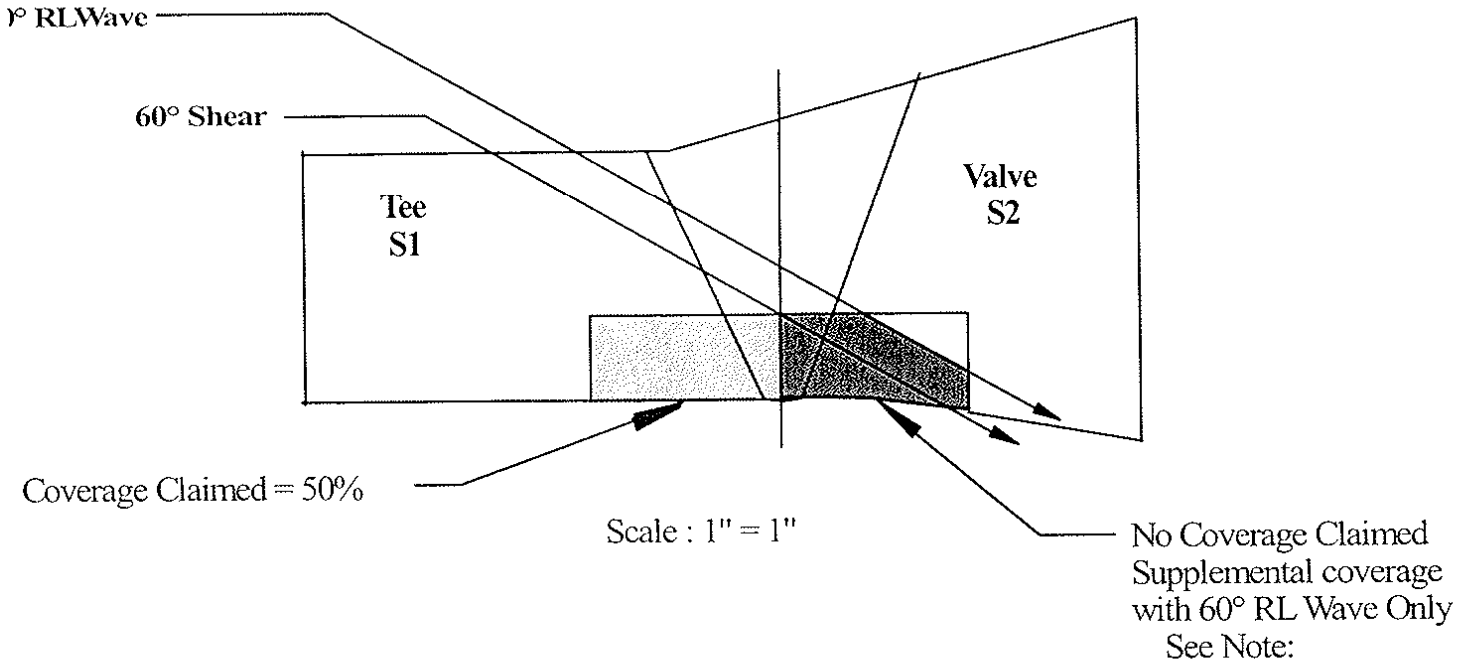
Examples of Typical Single Side Configurations

Item No. B09.011.063 Weld No. 1NI148-10



Note: 60° RL scan not included in percentage coverage due to requirements of 10CFR50.55a(b)(2)(xv)(A)(1). Best effort scan with 60° RL obtained 41.5% coverage in one axial direction.

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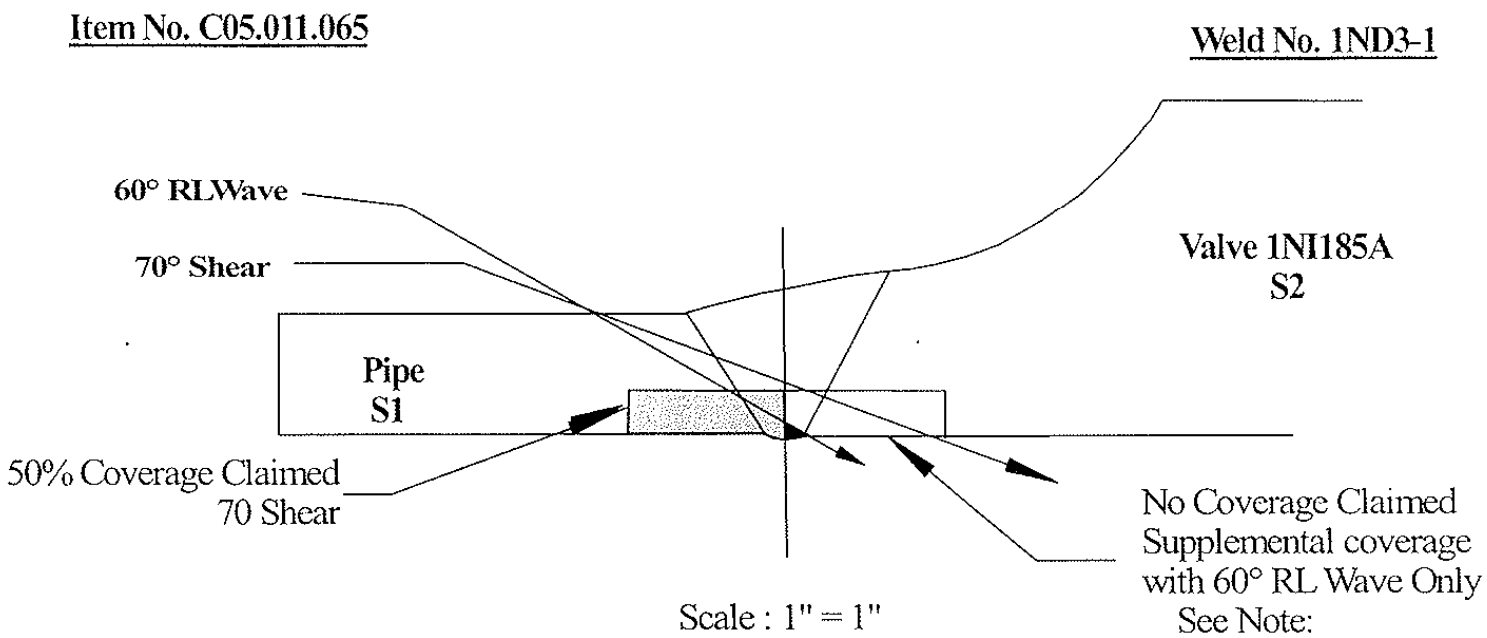
Examples of Typical Single Side Configurations



Note: 60° RL scan not included in percentage coverage due to requirements of 10CFR50.55a(b)(2)(xv)(A)(1). Best effort scan with 60° RL obtained 3.5% coverage in one axial direction.

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Summary

- While dissimilar metal weld qualified techniques may be effective on examination of the far side of some austenitic pipe welds their application will be limited to very few locations and the coverage may not be substantially increased
- Preparation of welds will result in a high level of radiation exposure with very little increase in safety or a significant reduction in relief requests
- The effect of inside surface geometry may challenge the characterization techniques contained in the qualified dissimilar metal weld procedures

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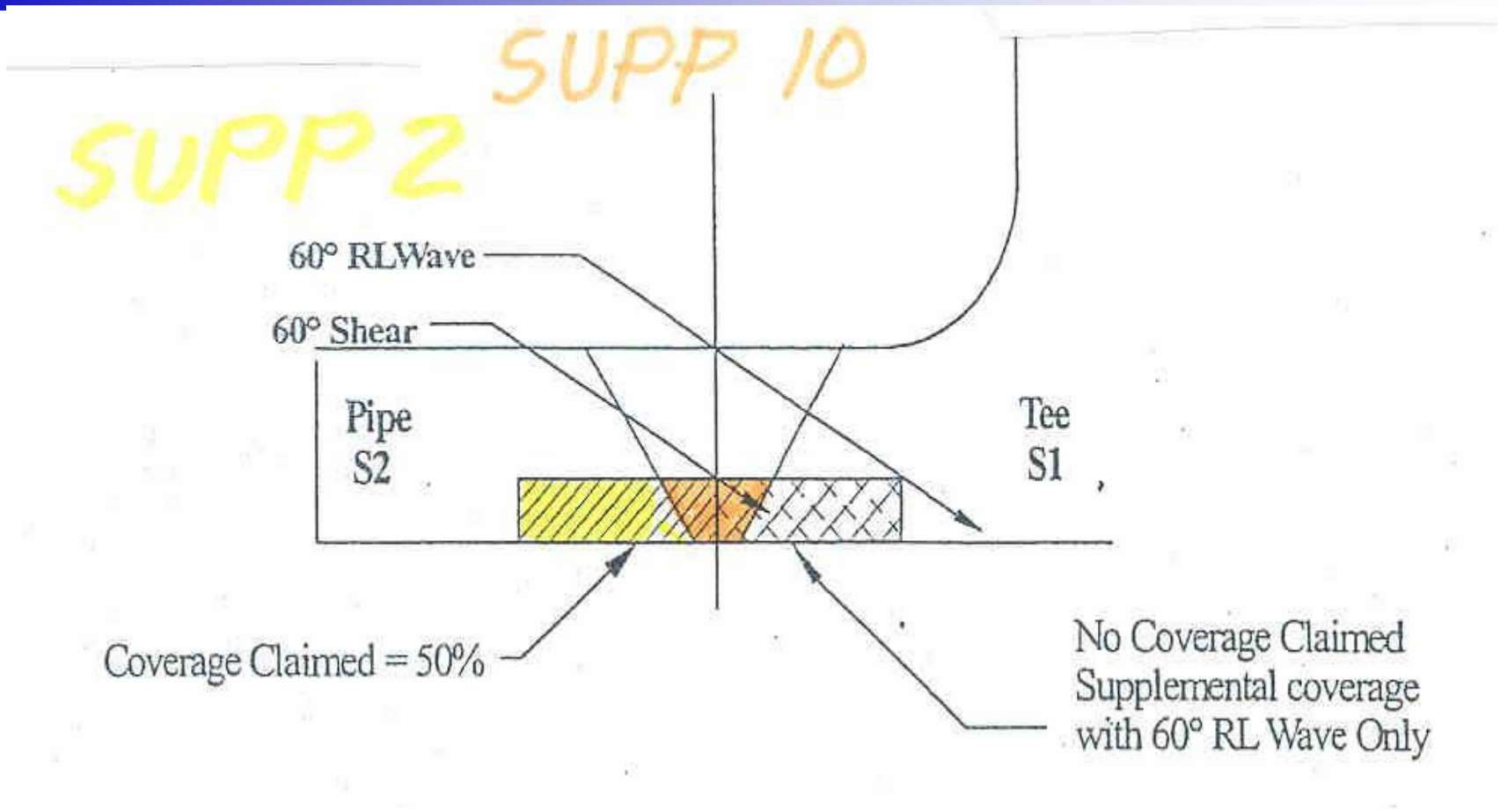
NRC Slides



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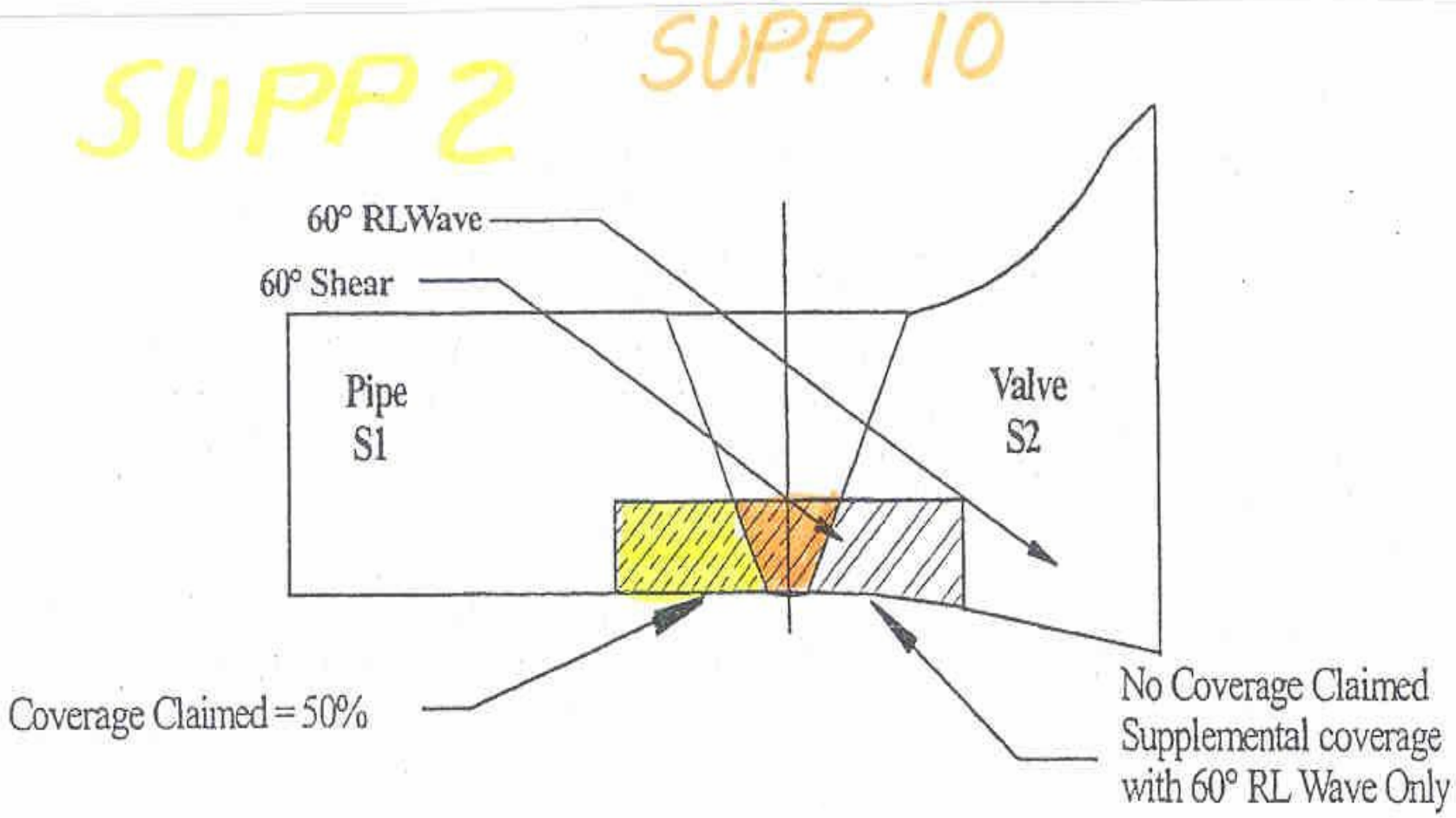
NRC Slides



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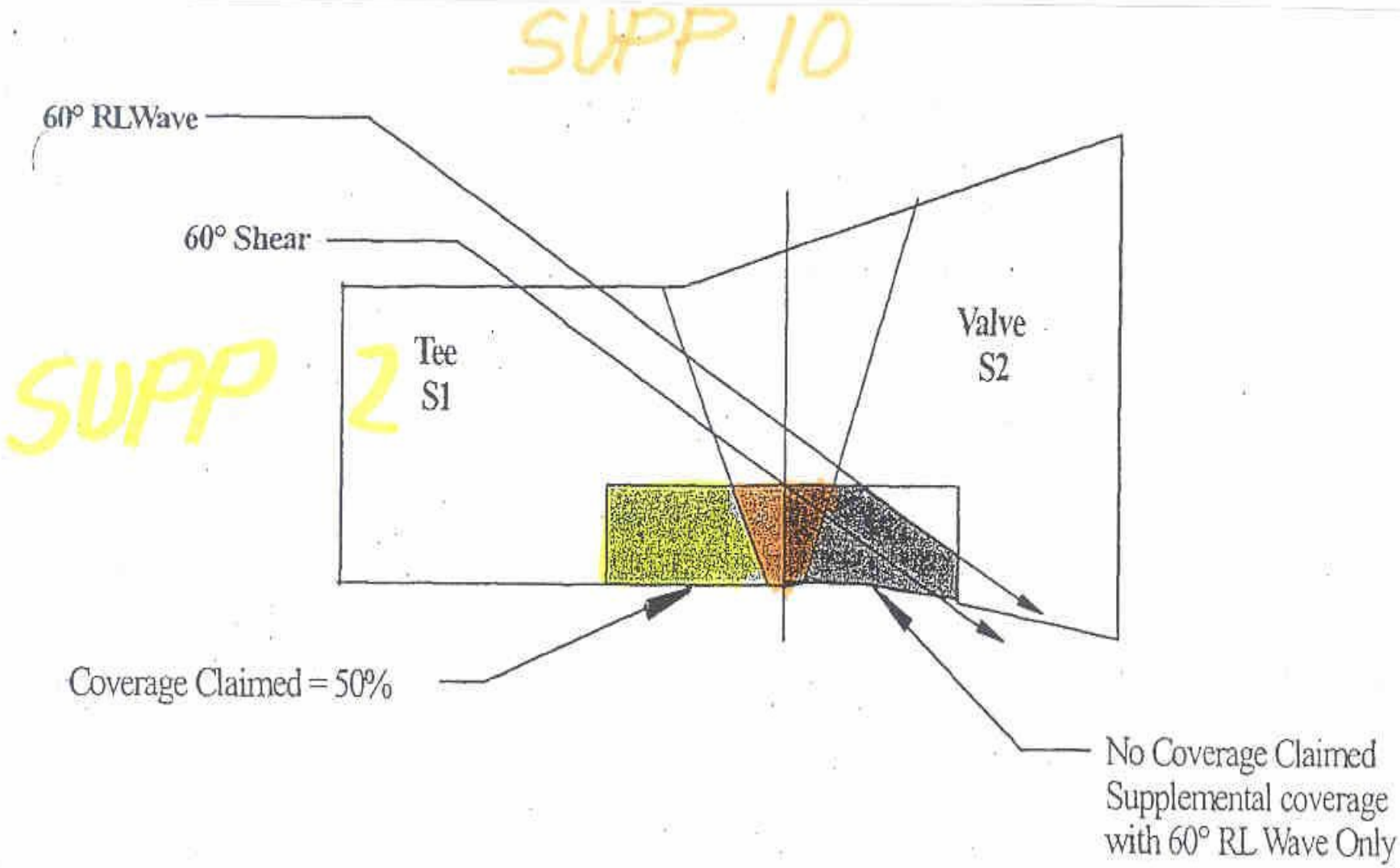
SUPP 10
60° RLWave
60° Shear
SUPP 2
Tee
S1
Valve
S2
Coverage Claimed = 50%
No Coverage Claimed
Supplemental coverage
with 60° RL Wave Only

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