9 1 1 2 0 5 5 1 7 7 1

START

GROUT QUALITY VERIFICATION

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October, 1990

DEC 1990
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EDMC

Attachment #8

00120159

Grout Quality Verification

- Objective of Presentation
- PSW Grout Quality Verification
  - Work to date
  - Core sampling plans
- DST Grout Quality Verification
- Conclusions
- Recommendation

Objective

Establish requirements and agree on approach for quality verification of DST vaults

References:

- NOD comment 26
  - Core at least first mixed waste vault
  - Correlate coring to NDT

- Letter from Ecology to DOE, 11/21/89
  - Core first mixed wasted vault
  - Subsequent coring may be supended based on comparison to NDT

Waste Form Requirements (Ecology)

. Compressive Strength (60 psi)	Part B
. TCLP or EP Tox (Reduce to DW)	WAC 173-303
. Toxicity (Reduce to DW)	WAC 173-303

* PSW is undesignated under WAC 173-303 and RCRA

PSW Grout Quality Verification

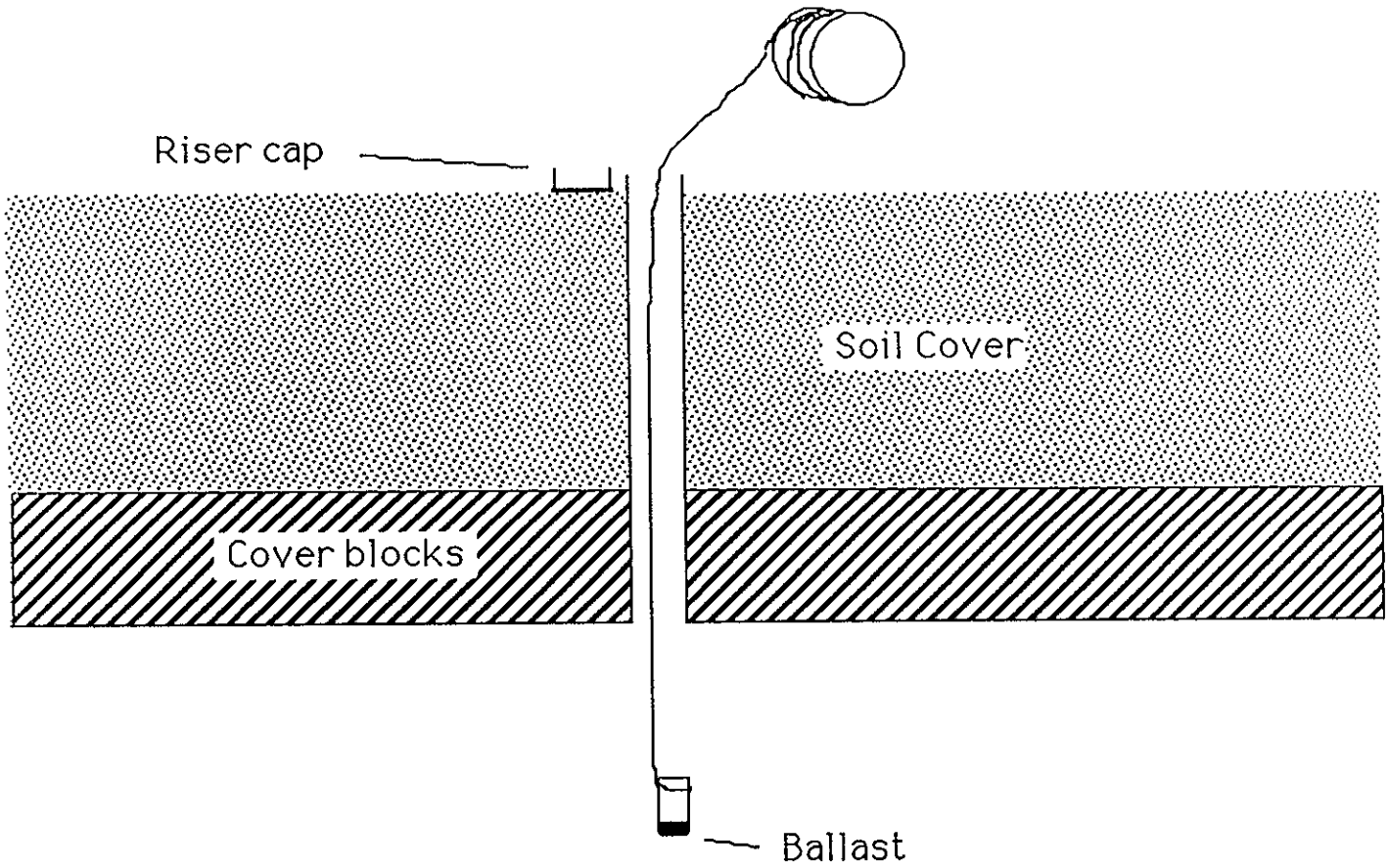
Scope of PSW Work Performed

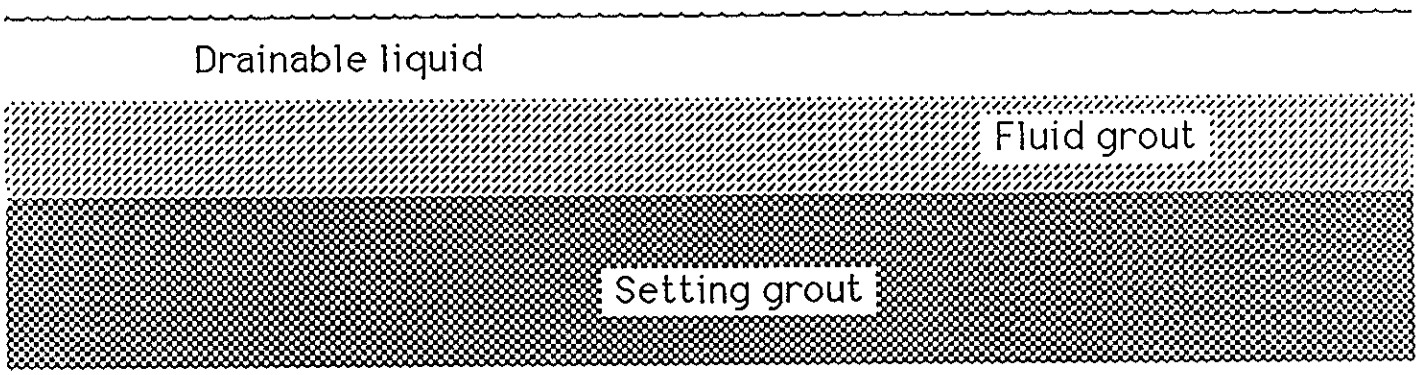
- Conducted pulse velocity, compressive strength, and leach testing
- Evaluated alternative grout sampling methods
- Investigated and identified viable nondestructive verification testing methods

Sampling and Verification Methods Used to Date

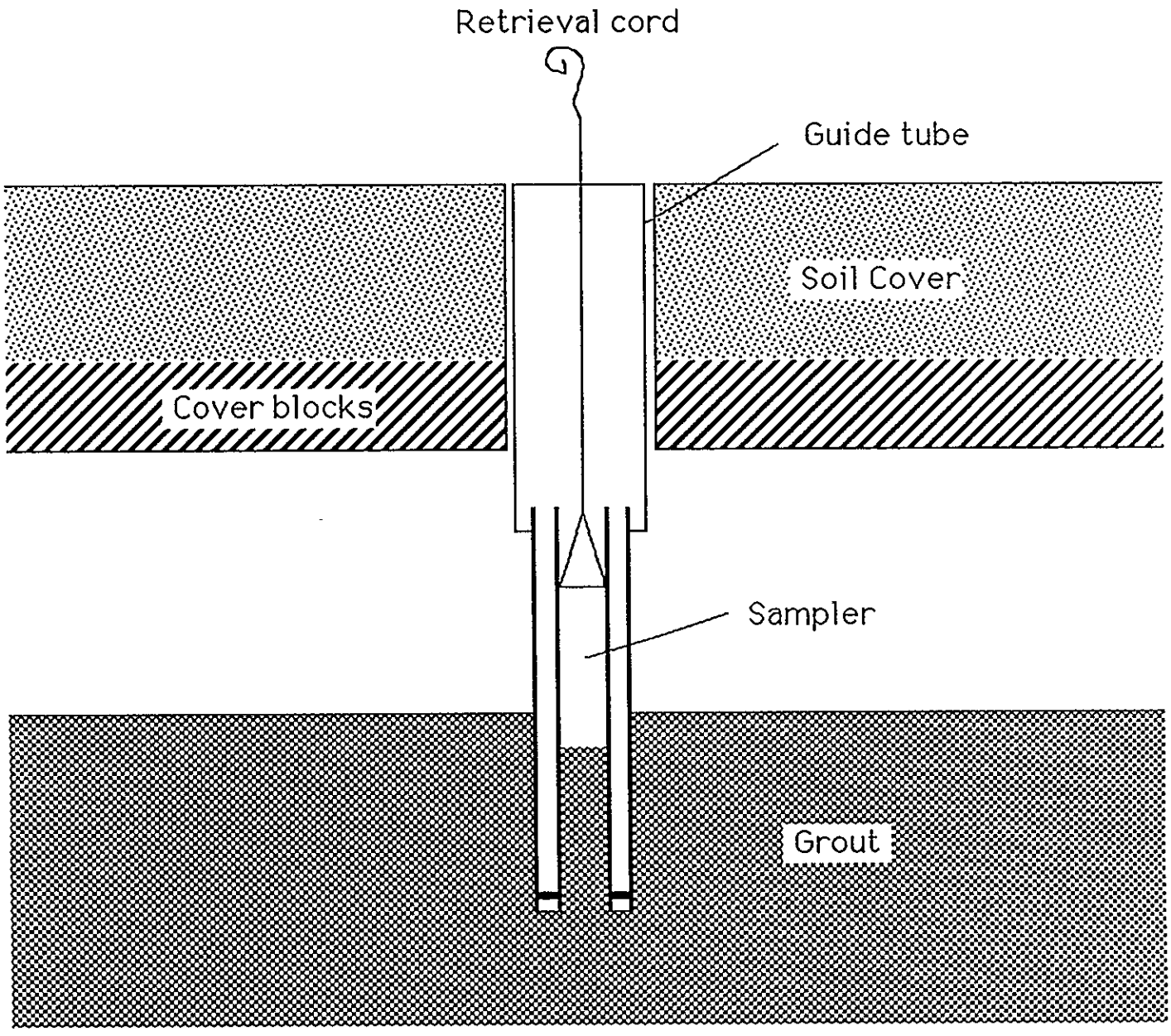
- Bottle-on-string
- Twin tube
- Nondestructive testing

Bottle-on-String Sampling Method

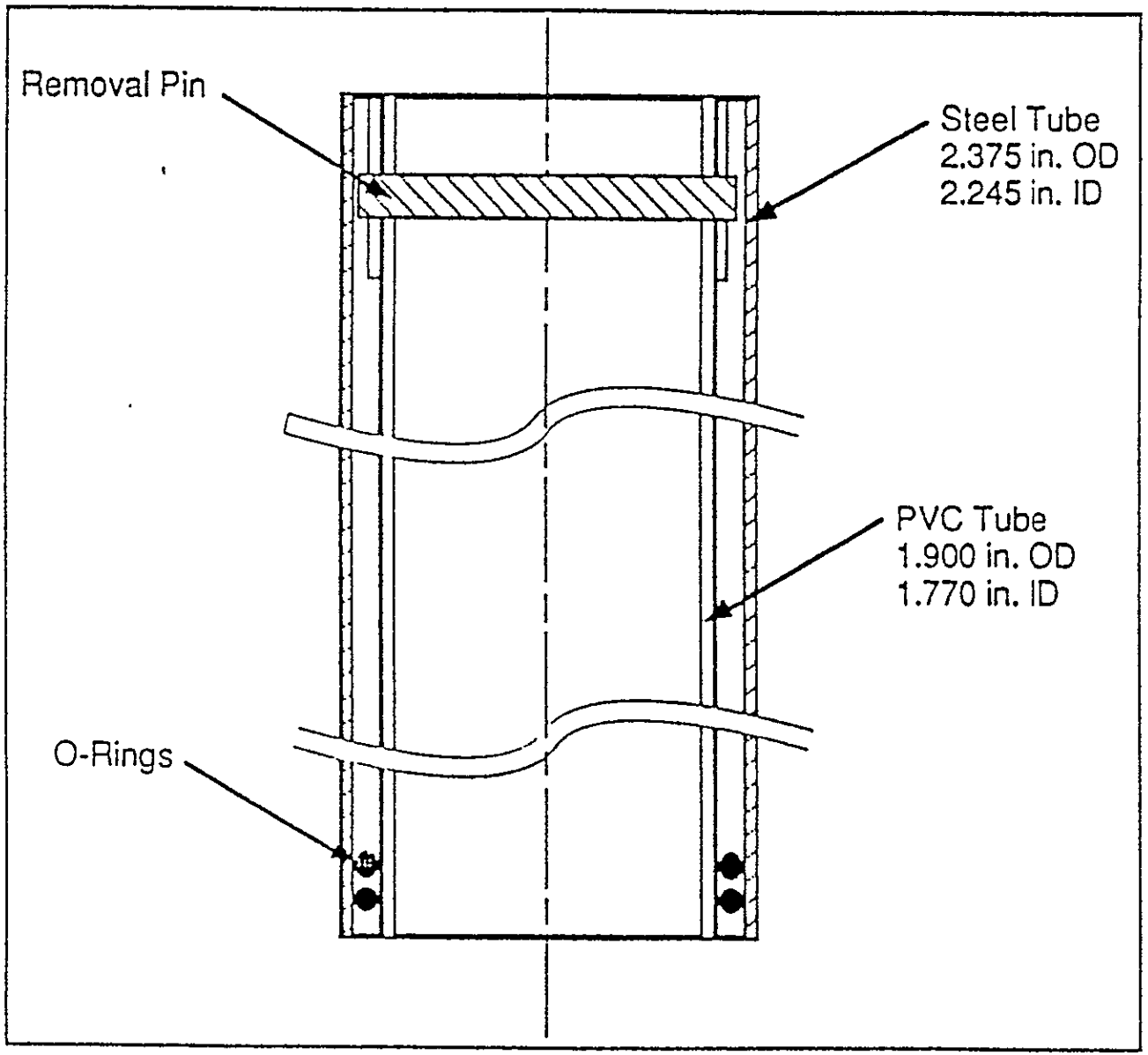




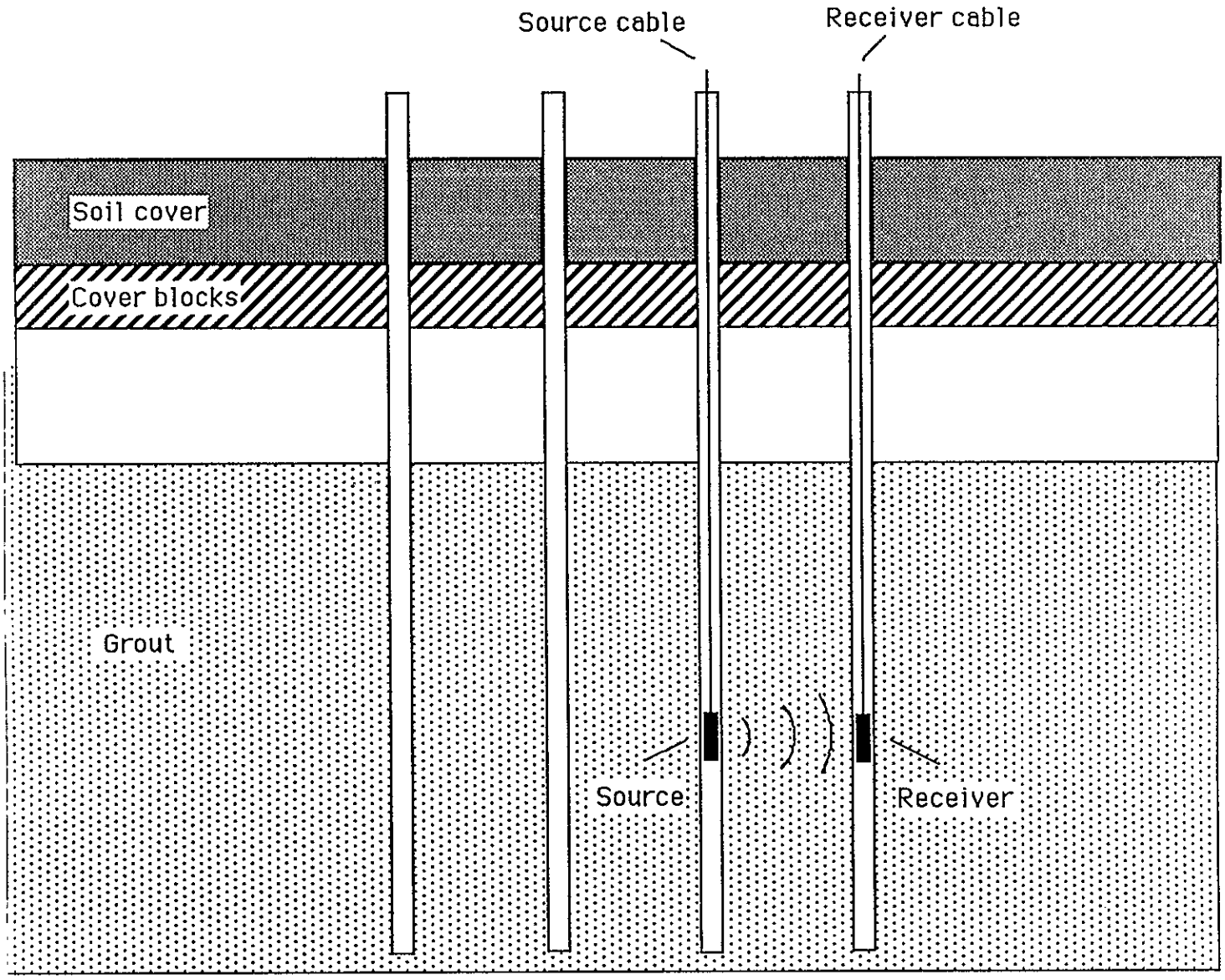
Installed Twin Tube Sampler



Schematic of Twin Tube Sampler



Crosshole Sonic Logging



NDT Record

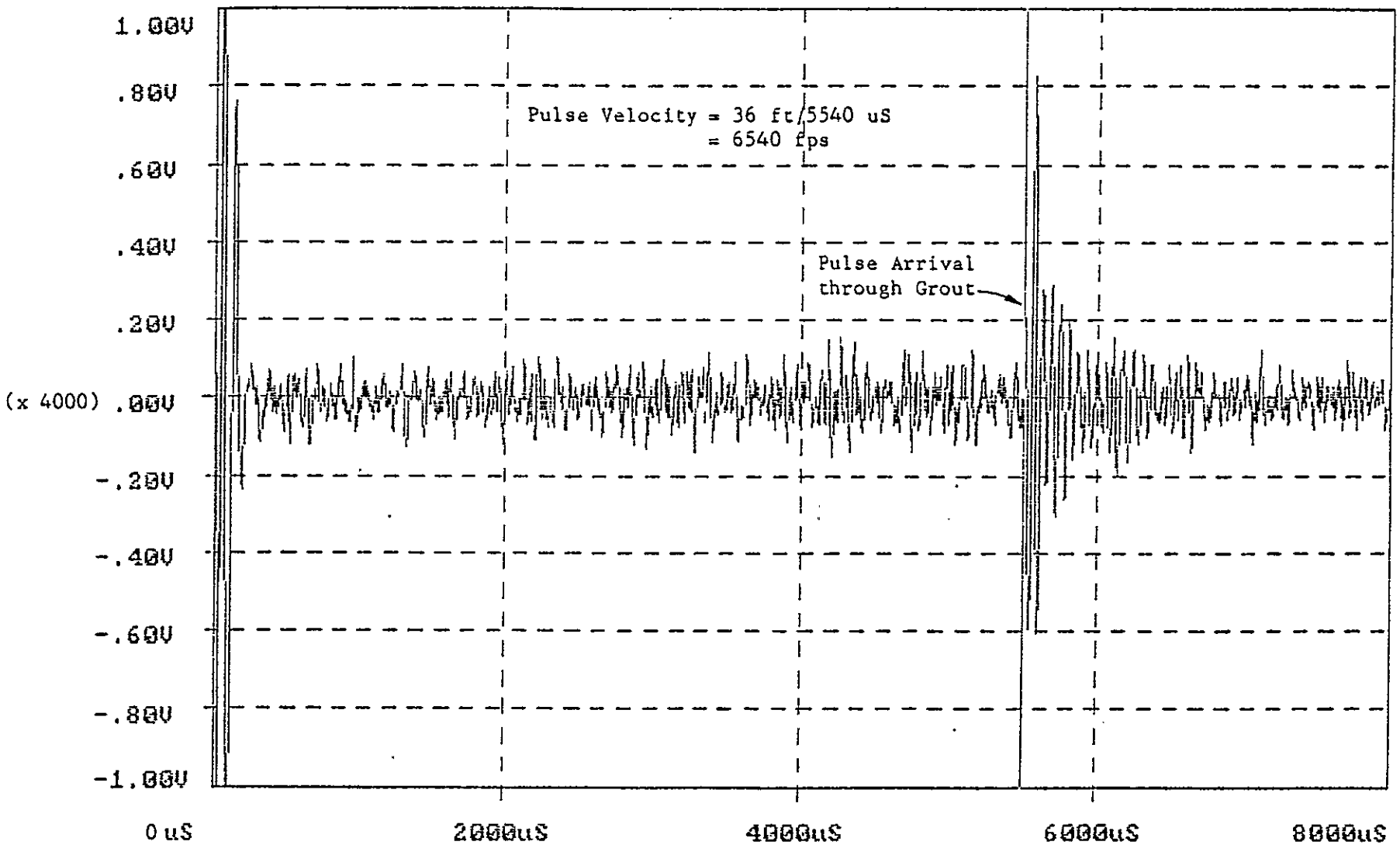
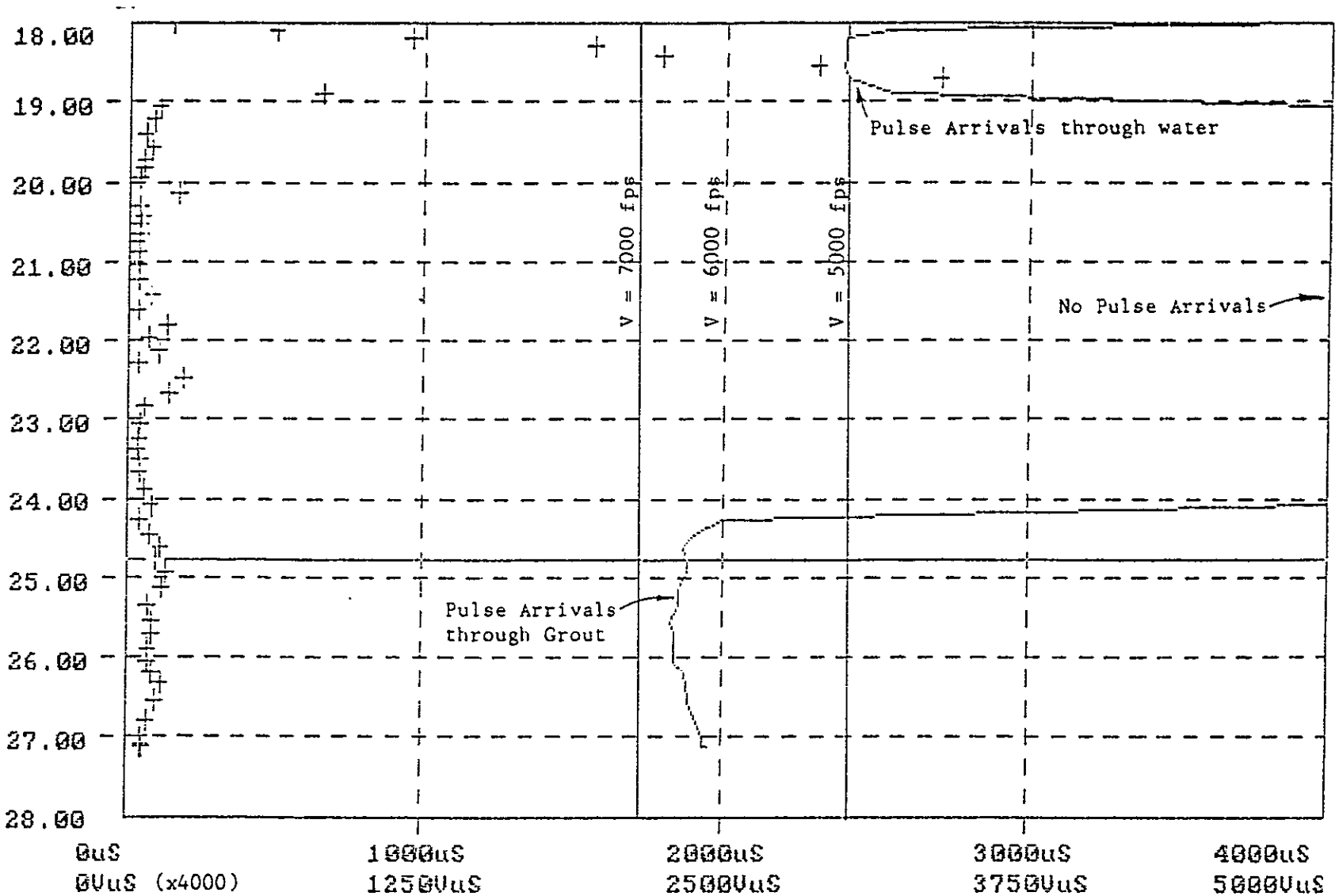


FIG. 6-22 CSL RECORD 64 OF LOG WZ009

NDT Log

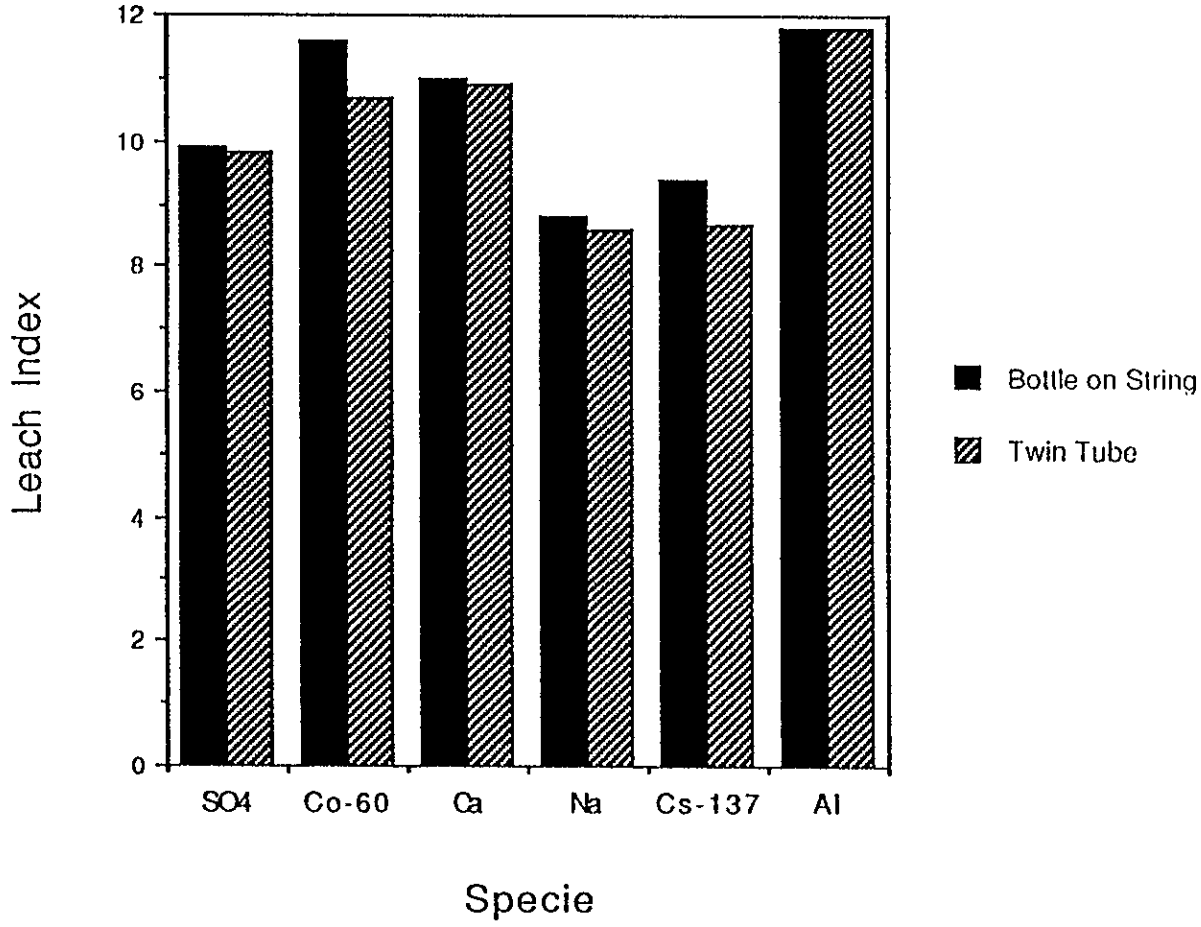

18.00
19.00
20.00
21.00
22.00
23.00
24.00
25.00
26.00
27.00
28.00
V = 7000 fps
V = 6000 fps
V = 5000 fps
Pulse Arrivals through water
No Pulse Arrivals
Pulse Arrivals through Grout
0uS
0VuS (x4000)
1000uS
1250VuS
2000uS
2500VuS
3000uS
3750VuS
4000uS
5000VuS

PSW Data Analysis

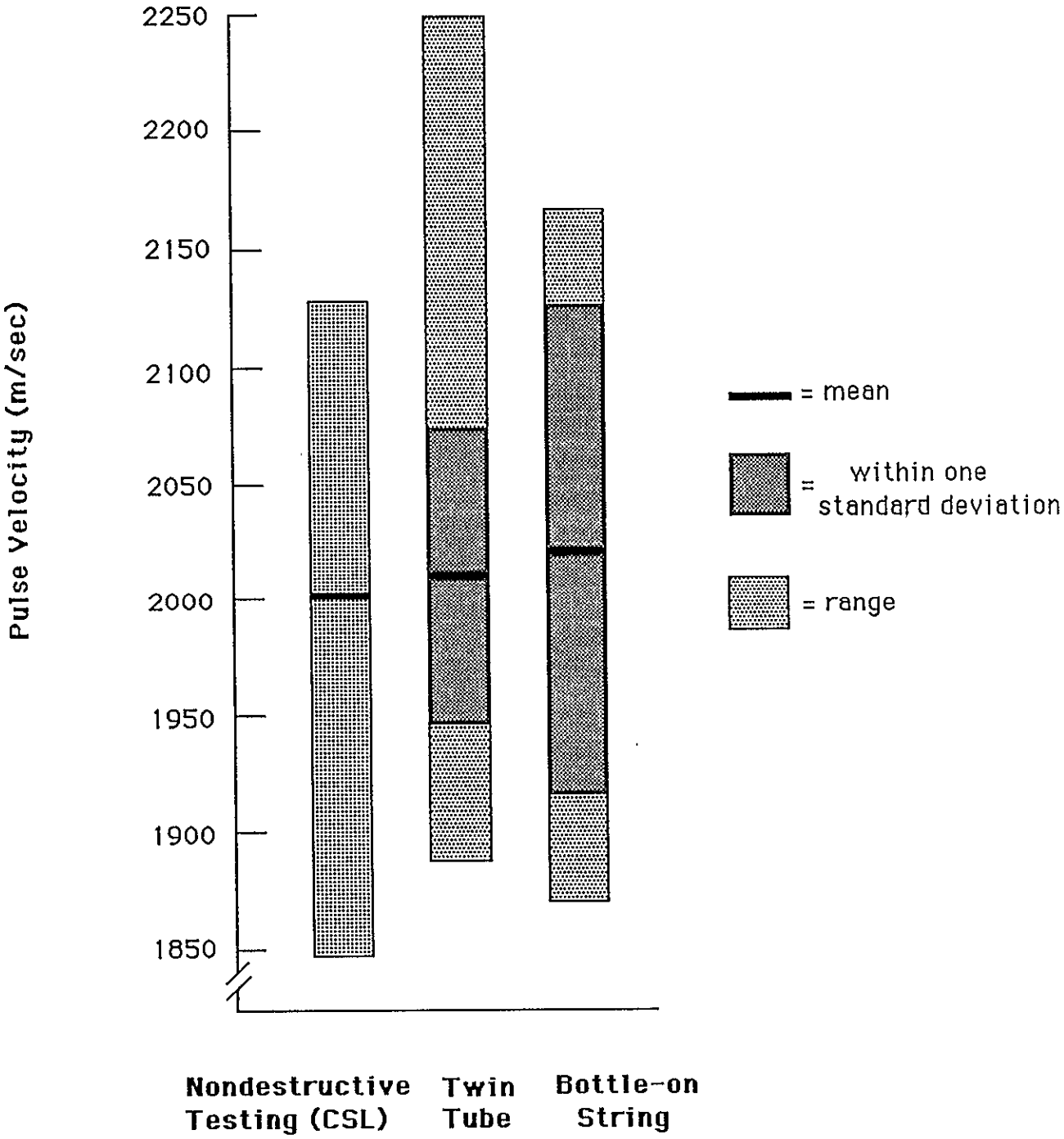
Summary of Physical Property Results

Physical Property	Bott.-on-str. (± 1 sd)	Tube in tube (± 1 sd)	CSL (range)
Compressive Strength (psi)	414±95	408±140	
Bulk Density (g/mL)	1.390±0.06	1.400±0.06	
Pulse Velocity (m/sec)	2021±105	2010±64	1860-2130

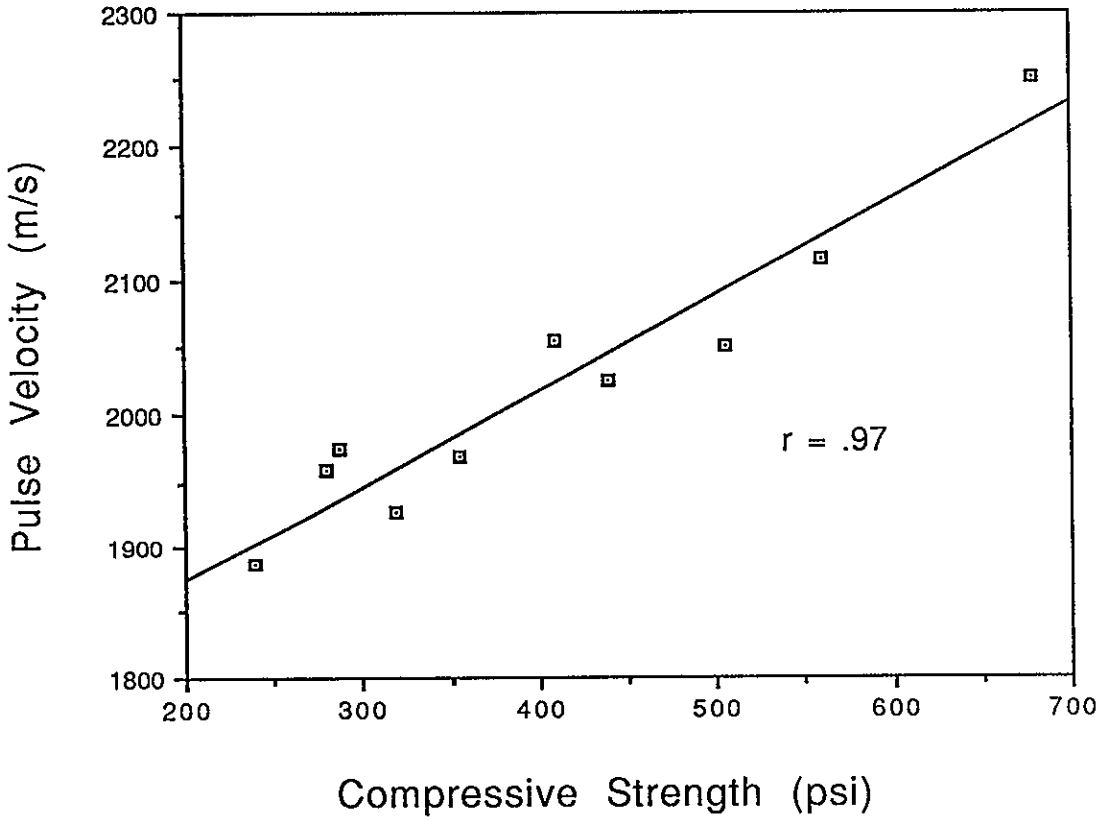
PSW Vault Grout Leach Indices (ANS 16.1)



Pulse Velocity of PSW Grout



Compressive Strength vs. Pulse Velocity for PSW Twin Tube Samples



Pulse Velocity

Provides a direct correlation to grout density and compressive strength

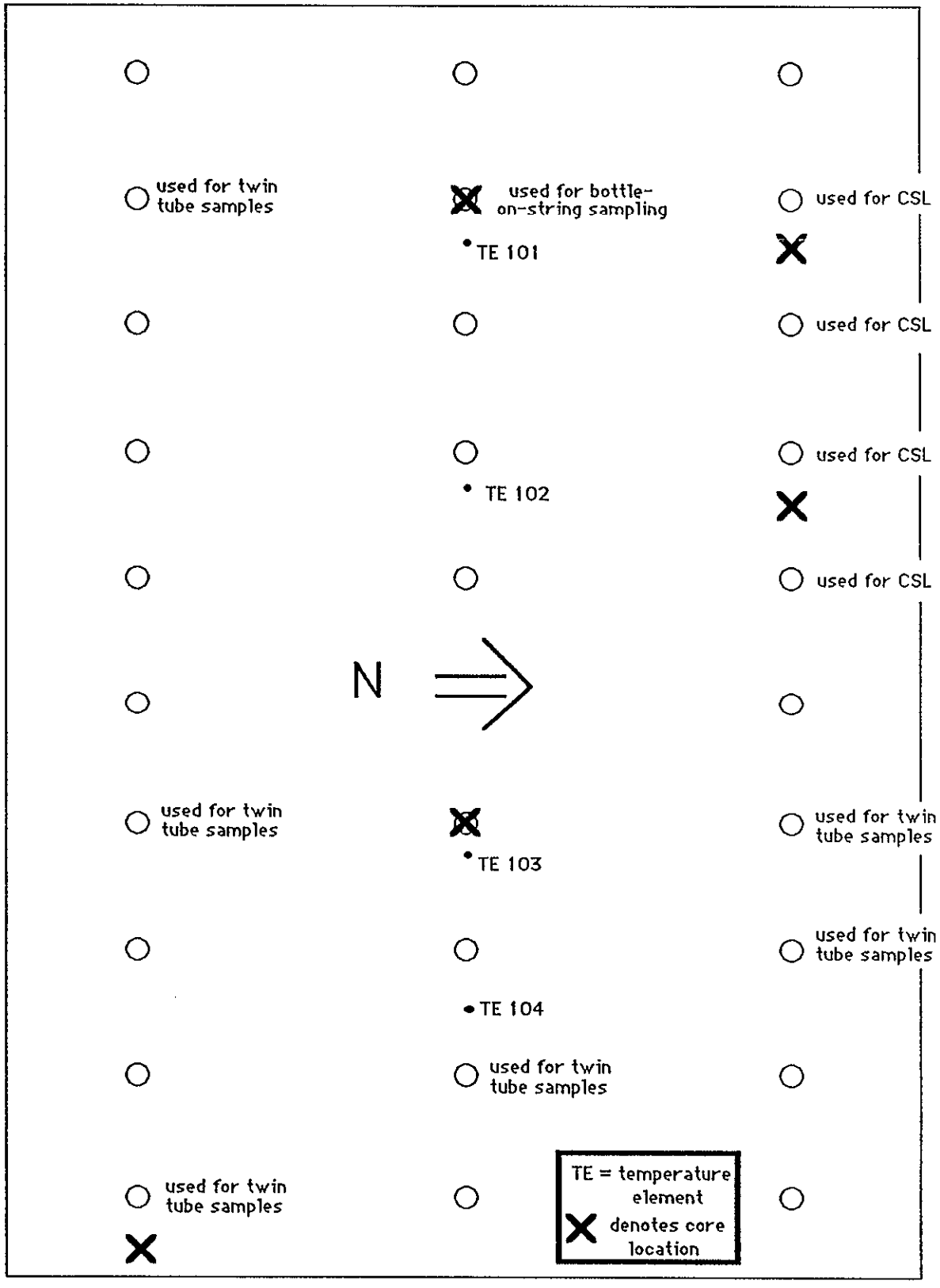
PSW Core Sampling Objectives

- Characterize PSW vault grout
- Evaluate grout properties as a function of thermal conditions
  - Core near thermocouples
  - Core near center and near wall to bound thermal conditions
- Test cores and analyze data
- Compare with data from other techniques
  - Nondestructive testing
  - Bottle-on-string samples
  - Twin tube samples

PSW Core Analyses

- Compressive strength
- Bulk density
- Pulse velocity
- ANS. 16.1 leach
- Scanning electron microscopy

PSW VAULT SAMPLING LOCATIONS



0 1 7 1 5 2 1 1 6

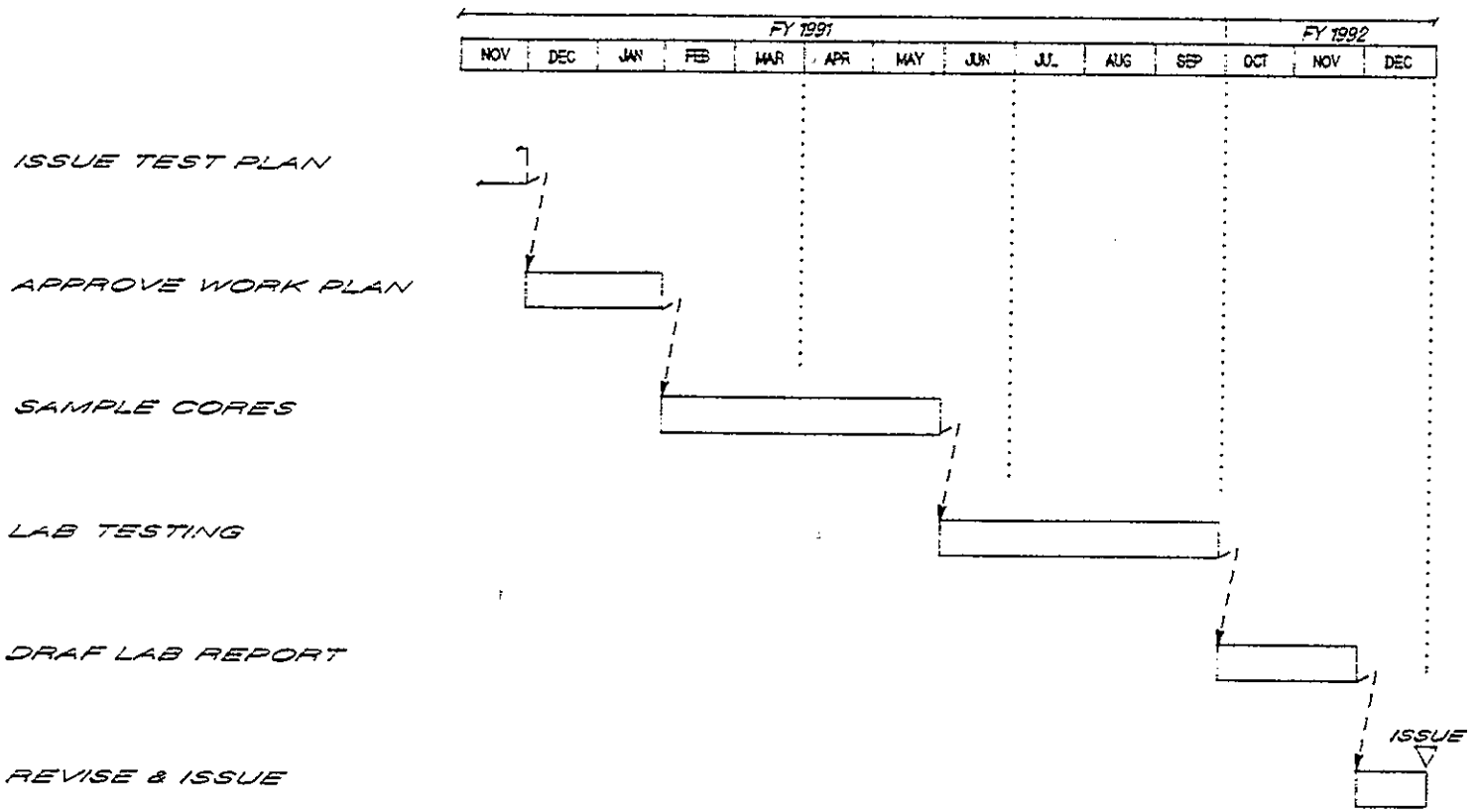
WESTINGHOUSE
HANFORD COMPANY

DEFENSE WASTE MANAGEMENT DIVISION

DRAFT

GROUT DISPOSAL PROGRAM

PHOSPHATE SULFATE WASTE (PSW) CORE SAMPLING



PSW Quality Verification Conclusions

- Compressive strength data for bottle-on-string and twin tube are comparable
- Pulse Velocity for bottle-on-string, twin tube, and NDT are all comparable
- Leach indices for bottle-on-string and twin tube are comparable
- Pulse velocity and compressive strength correlate well

9 1 1 2 0 5 5 1 7 0 3

DST GROUT QUALITY VERIFICATION

Waste Form Requirements (Ecology)

. Compressive Strength (60 psi)	Part B
. TCLP or EP Tox (Reduce to DW)	WAC 173-303
. Toxicity (Reduce to DW)	WAC 173-303

DST Grout Quality Verification Options

- Nondestructive testing
- Bottle-on-string
- Twin tube sampler
- Core sampling

Nondestructive Testing

- Benefits
  - Low exposure
  - Demonstrates solidification
  - Correlates with compressive strength
  - Broad ranges of vault can be examined
  - Initial curing may be tracked
- Risks
  - Not physical sample
  - Can't predict leach behavior
- Impacts
  - 35-50K/vault

Bottle-on-String Sampling

- Benefits
  - Physical sample
  - Shipping container identified
- Risks
  - Operator exposure
  - Samples not cured in-situ
  - Hot cell handling
- Impact
  - 200K + 220K/vault

Twin Tube Sampling

- Benefits
  - Provides physical sample
  - Cured in-situ
- Risks
  - Operator exposure
  - Grout somewhat disturbed during sampling
  - Design required (shielding, handling, shipping)
  - Hot cell handling
- Impact
  - 525K + 350K/vault
  - Schedule impact likely

Core Sampling

- Benefits
  - Physical sample
  - Cured in-situ
- Risks
  - Operator exposure
  - Potential sample degradation
  - Hot cell handling

Core Sampling Continued

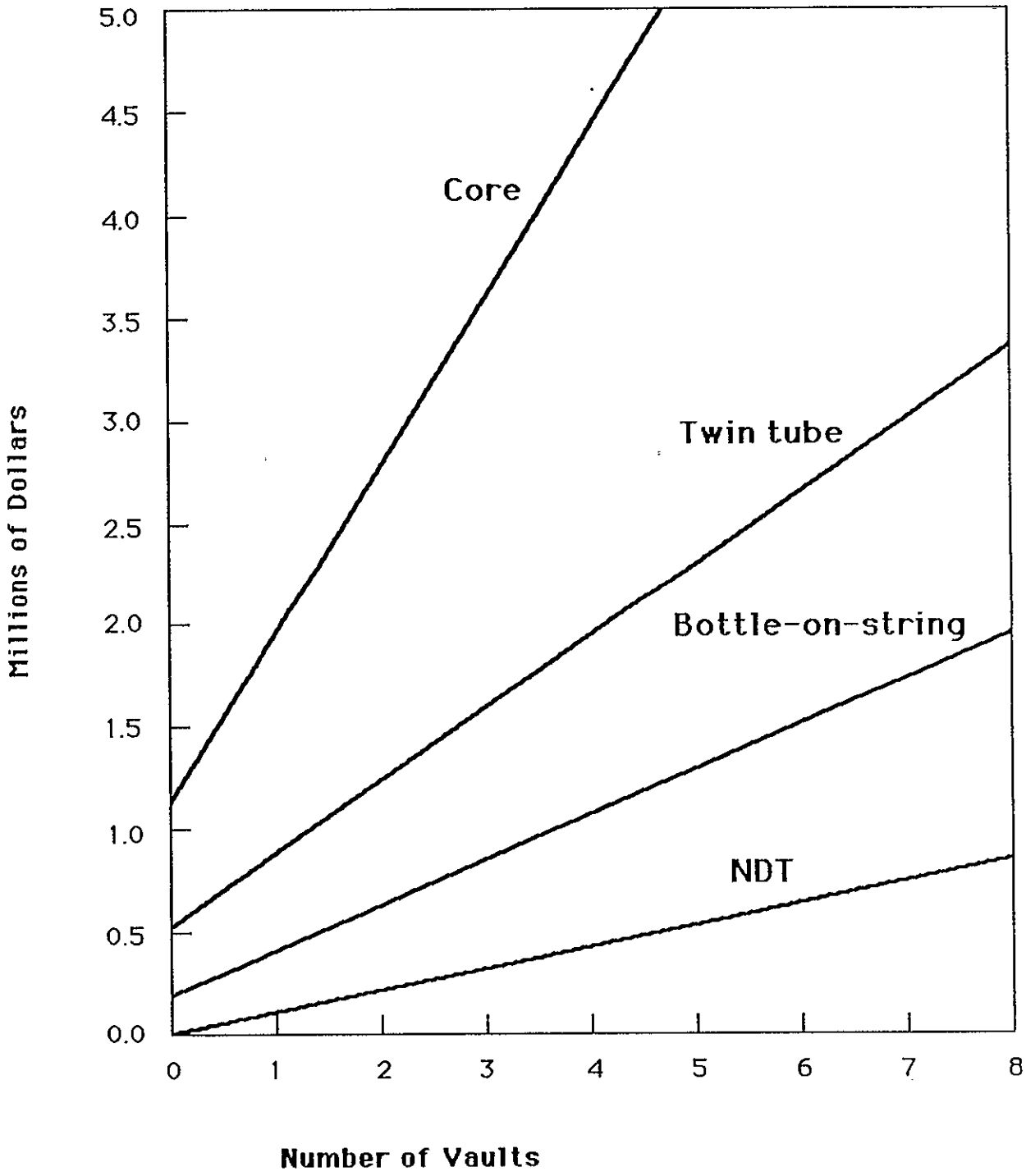
- Impacts
  - Use existing equipment:

    860K/vault + 2 month slip (per vault) in M-10 TPA milestones, DST & HWVP engineering studies

  - Procure dedicated equipment:

    $1.2 M capital (plus 860K/vault), 6-8 month slip in pouring vault 103, plus 860K/vault

Quality Verification Costs



Conclusions

- Four verification methods analyzed
  - NDT has least health/safety, schedule, and cost impacts
  - Coring provides the most favorable physical sample

Recommendation

- Utilize NDT and Bottle-on-string sampling to verify requirements
- Core if questionable zones are detected by NDT

How the Recommendation Satisfies the Requirements

- NDT provides compressive strength information by means of pulse velocity correlation.
- Leachability and toxicity are determined by pre-campaign laboratory testing.
- Bottle-on-string sampling provides a reasonably efficient method to verify compressive strength and TCLP.

It is recommended that Ecology and EPA support the use of NDT and Bottle-on-string to verify DST grout quality.

Cost of Procuring Grout Drilling Equipment

. In house design, drawings	150
. Truck, drilling rig, & shielding	400
. Shipping casks (10K ea)	570
. Support trailer	10
. Contingency (10%)	110
	1240

Cost Estimate for Bottle-on-String Sampling

. Equipment (sample pigs, 20 @ 10K)	200
. Sample Truck	30
. Contingency (10%)	23
	253

Expense (per vault)

. Personnel (3 @ 15 days)	15
. Packaging & transport	10
. Lab analysis	100
. Decon (15 @ 5K ea)	75
. Contingency (10%)	20
	220

Cost Estimate for Twin Tube Sampling

. Design, Fab/procure, procedures, training	225
. Shopping casks (25)	250
. Sample Truck	30
. Contingency (10%)	50
	555

Cost per vault

. Labor	40
. Packaging & transport	20
. Lab analysis	115
. Decon/disposal	150
. Contingency (10%)	35
	360

DST Vault Core Sampling (per Vault)

Based on 5 cores, 30 days of sampling

. Equipment (bits, liners & stoppers, etc.)	200
. Personnel (13)	164
. Packaging and Transport	20
. Lab Analysis	115
. Decontamination of core barrels and shipping casks (@ 5K ea)	285
. Contingency (10%)	75
Total per vault	860