HI-STORM 100U

PROPOSED RESOLUTION OF RAI#1 ISSUES, LAR 1014-6

3/20/2008

RESPONSE OVERVIEW

- THE SINGLE MODULE LS-DYNA NONLINEAR MODEL IS THE DESIGNATED DESIGN BASIS SOLUTION METHODOLOGY.
- THE NON LINEAR ASPECTS OF THE LS-DYNA MODEL WERE ENHANCED DURING THE 2005-2006 RAI –INSPIRED INTERACTIONS WITH THE SFST
- THE LS-DYNA MODEL'S CONSERVATISM HAS BEEN FIRMLY ESTABLISHED THROUGH COMPARISON WITH SASSI SOLUTIONS:

ATTRIBUTES OF THE LS-DYNA MODEL

- A SINGLE VVM IS MODELED ON A FOUNDATION PAD THAT CIRCUMSCRIBES ITS BASE, EVEN THOUGH THE ACTUAL PAD MAY EXTEND FAR BEYOND;
- THE SOIL SUBSTRATE EXTENDS BELOW THE PAD TO THE BEDROCK;
- THE CONTROL MOTION IS APPLIED AT BEDROCK;
- THE SUBGRADE SURROUNDING THE VVM IS PERMITTED TO EXHIBIT ELASTIC-PLASTIC BEHAVIOR
- THE IMPACT FORCES FROM RATTLING OF THE NON-FIXED MASSES, NAMELY, THE FUEL ASSEMBLIES, THE FUEL BASKET, MPC CONFINEMENT BOUNDARY, AND THE LID, ARE SIMULATED IN THE MODEL BY REALISTIC MODELING OF THE NON-FIXED INTERNALS.

LS-DYNA/SASSI COMPARISON

Item	LS-DYNA	SASSI	Ratio of LS-Dyna-to-SASSI results
Max CEC Primary STRESS	10 ksi	4.8 ksi	2.08
OVALITY (MEASURED AT MID-HEIGHT)	0.13 in	0.02 in	6.5
DISPLACEMENT DIFFERENCE BETWEEN TOP LID AND BASE OF VVM	3.87 in (include movement of lid relative to shell and rigid body rotation of shell)	0.155 in (includes some rigid body rotation of support pad)	25
PEAK PAD HORIZONTAL ACCELERATION AT BASE OF PAD DIRECTLY UNDER VVM CENTERLINE (UNFILTERED VALUE)	27 G"S (INCLUDES EFFECT OF IMPACTS)	0.692 G"S (NO IMPACT EFFECT)	39
PEAK FORCE ON PAD	612 kip (vertical) 257 kip (horizontal)	259.9 kip (vertical) 104.0 kip (horizontal)	2.35 2.47

NOTE: PAD FORCES FOR SASSI SOLUTION BASED ON LOADED VVM CENTROID ACCELERATIONS OF 1G HORIZONTAL AND 1.667 G VERTICAL

RESPONSE OVERVIEW (CONT.)

- THE ABILITY OF THE LS-DYNA NON-LINEAR MODEL DESCRIBED IN SUBSECTION 3.I.4.7.1 OF THE FSAR TO PROGNOSTICATE THE SYSTEM RESPONSE IN A CONSERVATIVE MANNER HAS BEEN CONFIRMED BY MAKING A SERIES OF PARALLEL SIMULATIONS ON SASSI (A LINEAR SSI CODE) AND SO DOCUMENTED IN THE FSAR.

- THE FSAR REQUIRES THAT, FOR A SPECIFIC ISFSI DESIGN, THE LS-DYNA MODEL WILL NEED TO MEET THE PROVISIONS OF ASCE 4-98 AND ASCE/SEI 43-05 THAT COULD BE APPLICABLE TO THE UNDERGROUND HI-STORM 100U, INCLUDING A REQUIREMENT FOR SENSITIVITY ANALYSIS.

RAI 3.1

- DIAMETER OF RECESSED REGION?
- HOLTEC RESPONSE (DWG. CHANGE):
  - 97.25" IS ADDED TO DWG. 4501. (NOTE THAT GAP IS INCLUDED IN NONLINEAR LSDYNA MODEL)

RAI 3.2

- PROVIDE COATING INFORMATION
- HOLTEC RESPONSE: (NO CHANGE TO FSAR OR DRAWING)
  - CEC SHELL AND CONCRETE INTERFACE ARE BOTH AT THE AMBIENT
  - STEEL AND CONCRETE HAVE ESSENTIALLY SAME COEFFICIENT OF THERMAL EXPANSION. THERFORE, NO MECHANISM EXISTS FOR MACRO-SLIPPAGE BETWEEN THE SHELL AND CONCRETE.
  - PAINT IS JUST ONE OF MANY BARRIERS (1/8" CORROSION ALLOWANCE EXCEEDS STANDARDS

RAI 3.3

- INLET SCREEN SIZE CONTROL
- HOLTEC RESPONSE (FSAR AND/OR DWG CHANGE):
  - VARIABLE INLET SCREEN SIZE ELIMINATED FROM FSAR; WORDING CHANGED TO SAY THAT " ALL INLET AND OUTLET AIR PASSAGES ARE EQUIPPED WITH SCREENS, AS IN THE ABOVEGROUND HI-STORM OVERPACKS....."

RAI 3.4

- CEC BOTTOM PLATE TO CEC SHELL WELD COMMENT ON DWG.
- HOLTEC RESPONSE (DWG. CHANGE):
  - AMBIGUOUS VERBIAGE REMOVED FROM DWG.
  - SINCE GUSSET IS CHAMFERED, THERE WILL BE NO INTERFERENCE WITH THE WELD LINE.

RAI 3.5

- DISCUSS CHANGE IN ANALYSES FROM LAR 1014-3 TO LAR 1014-6
- HOLTEC RESPONSE:(NO DWG. OR FSAR CHANGES)
  - NO CHANGE IN ANALYSES. BOTH CONFIGURATIONS HAVE SAME VVM-TO-SUPPORT PAD RESTRAINT.
  - NO RESTRAINT OF VERTICAL RELATIVE MOTION IS INCLUDED IN EITHER ANALYSIS SINCE CLIPS IN LAR 1014-3 CONFIGURATION WERE ONLY FOR BOUYANCY RESISTANCE DURING CONSTRUCTION.

RAI 3.5 (CONTINUED)

- BOTH SOLUTIONS HAVE KEYED CONSTRUCTION VVM-TO-SUPPORT PAD KEYS TO LIMIT LATERAL EXCURSIONS OF VVM RELATIVE TO PAD. LAR 1014-6 HAS ENHANCED KEYED CONFIGURATION TO REDUCE INTERFACE STRESSES
- THE CONFIGURATION IN LAR 1014-6 INCLUDES SUBSTRATE BELOW THE PAD WITH CONTROL MOTION AT BEDROCK. THIS PRODUCES A SIMULATION REFLECTING THE TRUE SCENARIO AT MOST SITES.

RAI 3.6

- HOW IS INSULATION ATTACHED?
- HOLTEC RESPONSE (DWG. CHANGE):
  - STAINLESS STEEL STUDS WELDED TO DIVIDER SHELL, INSULATION PRESSED ONTO STUDS AND HELD ON WITH LOCK WASHERS.
  - CAPACITY OF STUDS MUCH LARGER THAN LOADING ON STUD.

RAI 3.7

- USE OF MINIMUM STIFFNESS AND OTHER MATERIAL PROPERTIES IN SASSI ANALYSIS
- HOLTEC RESPONSE (NO CHANGE TO FSAR OR DRAWING):
  - THE MINIMUM STIFFNESS IS NOT USED IN THE ILLUSTRATIVE EXAMPLES
  - BOTH ILLUSTRATIVE LS-DYNA SOLUTION AND SASSI CONFIRMATORY SOLUTION USE VALUES THAT MEET OR EXCEED THE VALUES IN TABLE 2.I.2.

RAI 3.7 (CONTINUED)

- TABLE 2.I.2 PROVIDES MINIMUM VALUES FOR UNDERPAD SUBSTRATE STIFFNESS AND NUMBER OF MPC GUIDES. REFERENCE VALUES FOR DENSITY AND TOP PAD THICKNESS ARE PROVIDED BASED ON ENGINEERING EXPERIENCE TO PROVIDE A ROBUST DESIGN.

RAI 3.8

- SHAKE 2000 RESULTS – HOW IS CONVERSION TO ELASTIC-PLASTIC PROPERTIES DONE?
- HOLTEC RESPONSE (FSAR CHANGE)
  - NO CONVERSION OF STRAIN COMPATIBLE PROPERTIES OBTAINED FROM SHAKE PROPERTIES IS REQUIRED.
  - ELASTIC-PERFECTLY PLASTIC SOIL ELEMENT REQUIRES AN ADDITION LIMIT STRESS VALUE ADDED.
  - LIMIT STRESS VALUE DETERMINED FROM ASCE 4-98 TABLE
  - SUBSECTION 3.I.4.7.1 I IS CLARIFIED TO INCLUDE LIMIT STRESS AND ITS COMPUTATION.

RAI 3.9

- REVISE FSAR TO INCLUDE GUIDANCE FROM ASCE DOCUMENTS
- HOLTEC RESPONSE (FSAR REVISION)
  - REFERENCES ADDED TO SUBSECTION 3.8
  - SUBSECTION 3.I.7.1 ADDS APPLICABLE SITE-SPECIFIC SEISMIC STRUCTURAL ANALYSIS ITEMS:

RAI 3.9 (CONTINUED)

MULTIPLE ACCELERATION-TIME HISTORY SETS SHALL BE DEVELOPED (AT LEAST TWO SETS) AS INPUT CONTROL MOTION AND THE BOUNDING RESULTS FROM EACH SET SHALL BE USED TO ESTABLISH THE SEISMIC/STRUCTURAL RESPONSE OF THE SITE SPECIFIC VVM's .

THE LOWER BOUNDARY OF THE MODEL MAY BE PLACED AT A LAYER AT WHICH THE SHEAR WAVE VELOCITY EXCEEDS 3500 FT./SEC. OR AT A SUBSTRATE LAYER THAT HAS A MODULUS AT LEAST 10 TIMES THE MODULUS OF THE SOIL LAYER IMMEDIATELY BELOW THE FOUNDATION SUPPORT PAD. THE LOWER BOUNDARY MAY BE ASSUMED TO BE RIGID.

RAI 3.9 (CONTINUED)

UNCERTAINTIES IN SSI ANALYSIS SHALL BE ACCOUNTED FOR BY VARYING THE BEST ESTIMATE LOW STRAIN SHEAR MODULUS OF THE SUBSTRATES BETWEEN THE BEST ESTIMTE VALUES TIMES (1+C) AND THE BEST ESTIMATE VALUE DIVIDED BY (1+C). IF SUFFICIENT, ADEQUATE SOIL INVESTIGATION DATA ARE AVAILABLE, THEN C MAY BE ESTABLISHED BASED ON THE MEAN AND STANDARD DEVIATION. THE MINIMUM VALUE OF C IN THIS CASE IS 0.5. WHEN SUFFICIENT DATA ARE NOT AVAILABLE, C = 1.

RAI 3.9 (CONTINUED)

- THE LOCATION AND TYPE OF LATERAL BOUNDARIES SHALL BE SELECTED SO AS NOT TO SIGNIFICANTLY AFFECT THE VVM RESPONSE AT THE LOCATIONS OF INTEREST. APPROPRIATE BOUNDARY CONDITIONS SHALL BE APPLIED.

- SUBSTRATE ELEMENT SIZE SHALL BE SELECTED TO ADEQUATELY REPRODUCE STATIC AND DYNAMIC EFFECTS AND THE NUMBER OF ELEMENTS IN THE VICINITY OF THE SUPPORT FOUNDATION SHALL BE CHOSEN TO ADEQUATELY REPRODUCE THE STATIC STRESS DISTRIBUTION BENEATH THE FOUNDATION SUPPORT PAD AND FINE ENOUGH TO ADEQUATELY MODEL ROCKING.

- TIME STEP CONTROL SHALL BE SUFFICIENTLY SMALL TO ACCURATELY DEFINE THE APPLIED DYNAMIC FORCES AND TO ASSURE CONVERGENCE AND STABILITY.

RAI 3.10

- JUSTIFY OMMISSION OF UNCERTAINTY IN SAR SAMPLE PROBLEMS
- HOLTEC RESPONSE:(SAR CHANGE)
  - NOT CONSIDERED IN ILLUSTRATIVE AND CONFIRMATORY SOLUTIONS AS THEY ARE NOT THE DBSM FOR ANY SITE SPECIFIC CASE.
  - PER RESPONSE TO RAI 3.9, ADDED REQUIREMENT TO DBSM.

RAI 3.11

- PROVIDE SUBSTRATE LAYER SLIDING AND SEPARATION REFERENCES
- HOLTEC RESPONSE (SAR REVISION)
  - PER RAI 3.9, THE ENHANCED DBSM COMMITMENT FOLLOWS APPLICABLE REQUIREMENTS FROM ASCE GUIDANCE DOCUMENTS. THEREFORE, THE STATEMENT IN QUESTION IS REMOVED.

RAI 3.12

- PROVIDE SUPPORT FOUNDATION MOMENT AND SHEAR CALCULATIONS
- HOLTEC RESPONSE (SAR REVISION)
  - HOLTEC RESPECTFULLY BELIEVES QUESTION AS PHRASED IS NOT APPROPRIATE. FOUNDATION SUPPORT PAD IS AN "INTERFACING SSC". REGULATIONS AND PRIOR PRECEDENCE SUGGEST THAT ANALYSIS OF THESE STRUCTURES IS OUTSIDE THE PURVIEW OF THE SAR.
  - HOWEVER, WE DESCRIBE THE HISTORICAL METHODOLOGY, APPLIED TO ABOVE GROUND ISFSI PADS, THAT IS USED HERE TO DETERMINE THE PAD MOMENT AND SHEAR.

RAI 3.12 (CONTINUED)

- INTERFACE FORCE-TIME HISTORIES ARE OBTAINED FROM DBSM. FOR EXAMPLE, FIGURES 15 AND 16 FROM CALCULATION 7 IN THE SUPPORTING CALCULATION PACKAGE PROVIDE THE INFORMATION FOR THE ILLUSTRATIVE LS-DYNA SOLUTION (INTERFACE VERTICAL AND LATERAL LOAD TIME HISTORIES).
- INTERFACE LOADS ARE CONVERTED TO PRESSURE AND SURFACE SHEAR STRESS AND APPLIED TO FINITE ELEMENT MODEL OF THE SITE SPECIFIC FOUNDATION SUPPORT PAD ON THE APPROPRIATE SUBSTRATE FOUNDATION.
- HISTORICALLY,ALL VVM LOCATIONS ARE CONSERVATIVELY SUBJECT TO SAME SURFACE LOADING.

RAI 3.13

- CALCULATION/DISCUSSION OF SASSI ISSUES: CONCRETE CRACKING STRAIN; EFFECT OF MESH DENSITY ON FOUNDATION STIFFNESS; EFFECT ON RESPONSE FROM UPPER BOUND FOUNDATION STIFFNESS

RAI 3.13 (CONTINUED)

- HOLTEC RESPONSE (NO SAR OR DRAWING CHANGE)
  - THE SASSI SIMULATION IS A CONFIRMATORY ANALYSIS, IS NOT PART OF THE DESIGN BASIS, AND IS PERFORMED SOLELY TO ADDRESS THE STAFF CONCERN ABOUT MULTIPLE VVMS AND THE CONSERVATISM OF THE DBSM. AS SUCH, SENSITIVITY STUDIES ON CONCRETE CRACKING, MESH SIZE, AND PAD STIFFNESS ARE BEYOND THE PLANNED SCOPE OF THE SASSI SOLUTION.
  - NOT WITHSTANDING THE ABOVE:

RAI 3.13 (CONTINUED)

- **(1) RELEVANT PARTS OF FIGURES 9.2-1 AND 9.2-2 FROM SASSI CALCULATION PACKAGE ARE USED AND CALCULATION PERFORMED TO ESTIMATE THE STRAIN FROM THE PAD SHAPE:**

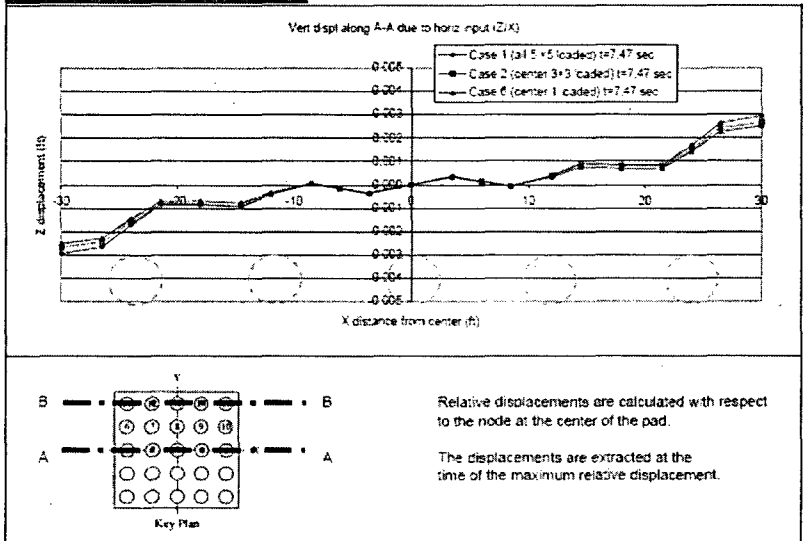


Figure 9.2-1 Vertical Displacement of Concrete Pad at Time of Maximum Vertical Displacement

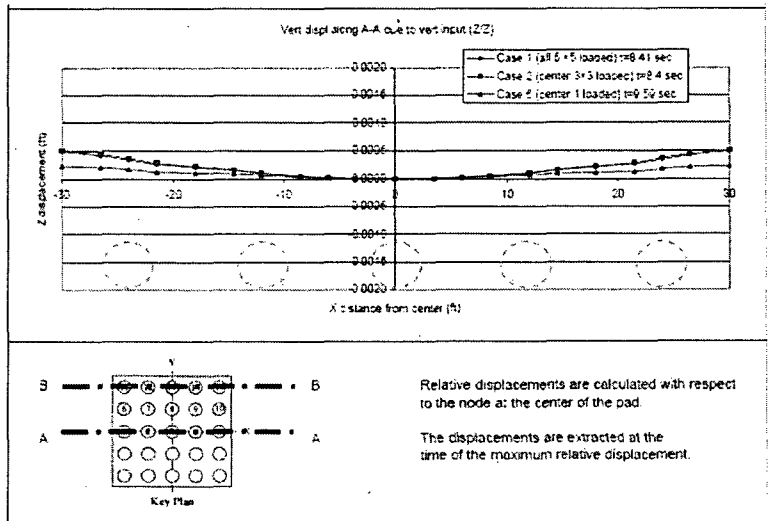


Figure 9.2-2 Vertical Displacement of Concrete Pad at Time of Maximum Vertical Displacement

RAI 3.13 (CONTINUED)

- RESULTING CALCULATION PROVIDED IN WRITTEN RAI RESPONSE SHOWS SAFETY FACTOR AGAINST CONCRETE CRACKING IS 4.25.

- (2) THE FOCUS OF THE SASSI CONFIRMATORY ANALYSIS IS NOT ON THE PREDICTION OF THE STRESS DISTRIBUTION IN THE FOUNDATION SUPPORT PAD, BUT ON THE INTERACTION BETWEEN VVMS IN A POSTULATED MULTI-VVM INSTALLATION. THE FOUNDATION SUPPORT PAD IS EFFECTIVELY SIMULATED WITH THE MODELING ACCURACY CONSISTENT WITH A CONTINUOUS "STIFF" LAYER OF SUBSTRATE AT THE BASE OF THE VVM.
- USING A FINER MESH THROUGH THE THICKNESS MAY DECREASE THE PAD STIFFNESS.

RAI 3.13 (CONTINUED)

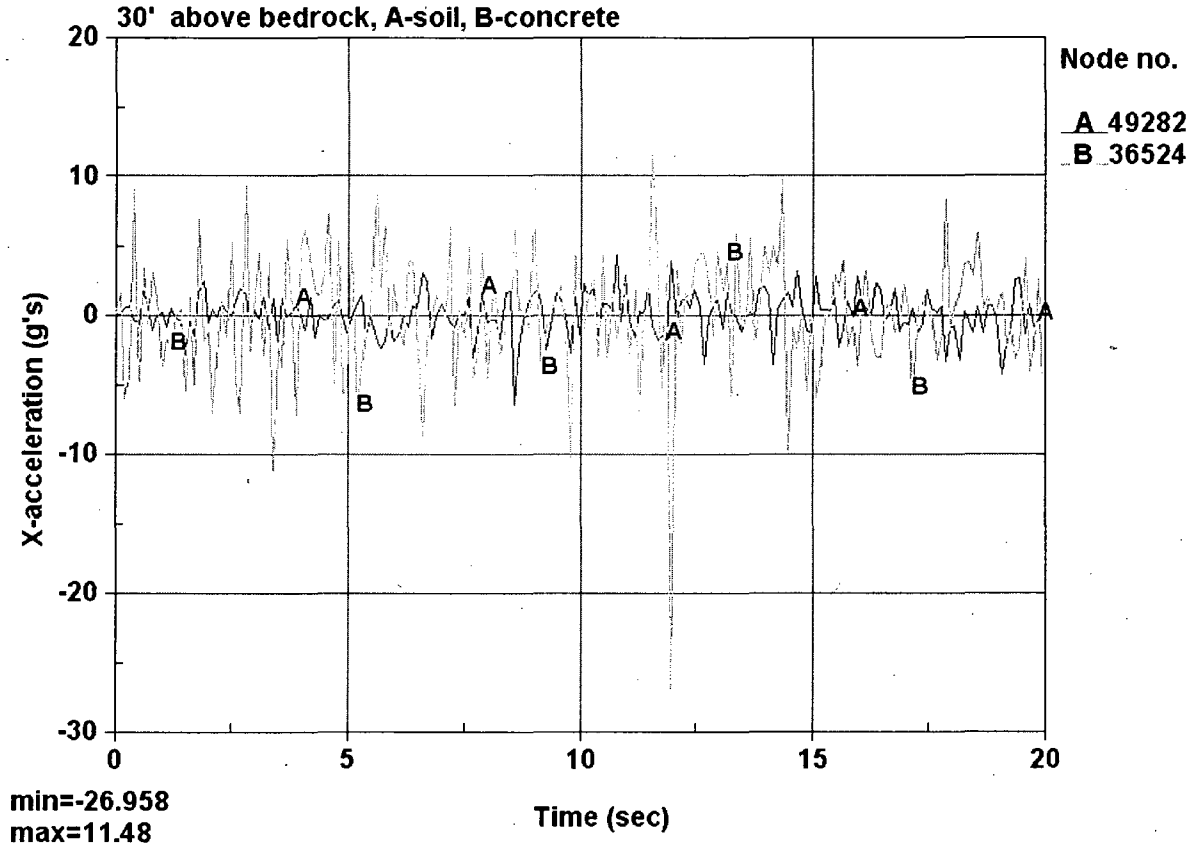
- (3) UPPER BOUND STIFFNESS PROVIDES MAXIMUM OVERTURNING ON TOTAL CONTINUOUS PAD SINCE ALL VVMS ARE "GLUED" TO PAD. DIFFERENCES IN RESPONSE BETWEEN VVMs AT DIFFERENT LOCATIONS ARE MAXIMIZED. FOR PURPOSE OF CONFIRMATORY ANALYSIS, THIS IS GOOD!

RAI 3.14

- COMPARE SUPPORT PAD ACCELERATIONS FROM ILLUSTRATIVE LS-DYNA SOLUTION AND CONFIRMATORY SASSI SOLUTION
- HOLTEC RESPONSE (NO CHANGE IN SAR OR DRAWINGS) REQUESTED INFORMATION IS PROVIDED AND COMPARED IN THE FOLLOWING:

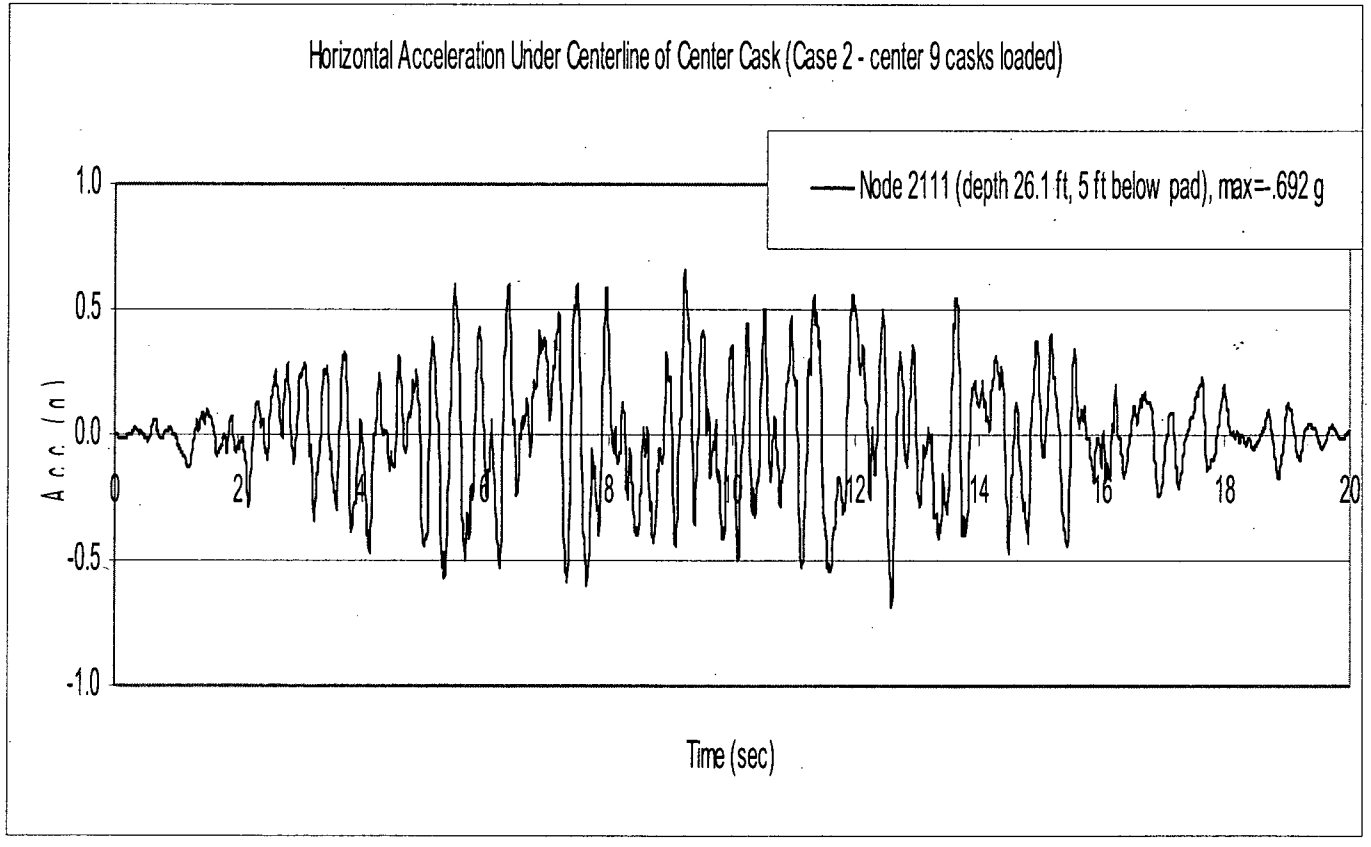
RAI 3.14 (CONTINUED)

- **LSDYNA**



RAI 3.14 (CONTINUE)

- SASSI



RAI 3.14 (CONTINUED)

COMPARISONS:

- LSDYNA PAD AND SOIL LAYER HAS LARGER PEAK G'S. WELL ABOVE 1.0. SASSI PEAK G'S BELOW 1.0.
- RESULTS NOT UNEXPECTED BECAUSE CEC-TO-PAD IMPACTS NOT SIMULATED IN SASSI

RAI 3.15

- JUSTIFY 30" PAD THICKNESS IN SSI ANALYSES
- HOLTEC RESPONSE (NO SAR OR DRAWING CHANGE):
  - THE VALUE USED IS NOT PART OF THE DESIGN BASIS.
  - THE CHOICE OF A 30" PAD THICKNESS FOR THE ILLUSTRATIVE LS-DYNA SOLUTION AND THE CONFIRMATORY SASSI SOLUTION IS BASED ON THE THICKNESS RANGE (24"-36") OF EXISTING ABOVE GROUND ISFSI INSTALLATIONS.

RAI 3.15 (CONTINUE)

- THERE IS NO REASON TO MATCH FOUNDATION PAD STIFFNESS. THE LS-DYNA SOLUTION HAS A PADLET MEANT TO MAXIMIZE VVM ROTATIONS AND PROVIDE THE MOST DEMAND ON THE VVM, WHILE THE SASSI SIMULATION HAS A CONTINUOUS PAD OF THE EXTENT NECESSARY TO ENCOMPASS THE 5 X 5 VVM ARRAY.

RAI 3.16

- BASIS FOR SELECTING ELASTIC-PLASTIC VOLUME IN LS-DYNA SOLUTION
- HOLTEC RESPONSE (NO FSAR OR DRAWING CHANGE)
  - THE BASIS IS TO INSURE THAT SOIL RESULTS DO NOT PROVIDE EXCESSIVE AND UNREALISTIC SUPPORT TO THE VVM
  - THE BASIS IS FOUNDED ON A SOLUTION AVAILABLE IN ASCE STANDARD 4-98, WHERE THE MAXIMUM SOIL PRESSURE AGAINST A FIXED WALL IS DETERMINED AS A FUNCTION OF THE SEISMIC ACCELERATION.

RAI 3.17

- EXPLAIN HIGH PLASTIC STRAIN RESULTS
- HOLTEC RESPONSE (NO CHANGE TO SAR OR DRAWINGS)

— A REVIEW OF THE FINITE ELEMENT MODEL SUGGESTS THAT THE LOCALIZED HIGH STRAIN CONCENTRATION OBSERVED AT THE BOTTOM OF THE ELASTIC-PLASTIC SOIL VOLUME ALONG THE SHARP EDGE OF THE CONCRETE PAD IS MODELING RELATED. THIS EDGE EFFECT AT THE SOIL/CONCRETE CONTACT INTERFACE IS DUE TO THE GEOMETRIC CONFIGURATION OF THE ANALYZED PROBLEM AND THE SIGNIFICANT STIFFNESS DIFFERENCE BETWEEN THE SOIL AND THE CONCRETE PAD AND THE ABRUPT CHANGE IN ADJACENT SUBSTRATE PROPERTIES.

— THIS LOCAL STRAIN CONCENTRATION HAS NEGLIGIBLE EFFECT ON THE GLOBAL RESPONSE OF THE VVM.

RAI 3.18

- PROVIDE SAR DISCUSSION AS NEEDED AND TS VERBIAGE TO INSURE MEETING OF SEC. 5.1.6 OF NUREG-0612
- HOLTEC RESPONSE (SAR MODIFICATION)
  - APPROPRIATE VERBIAGE IN SAR AND TS IS ADDED TO MEET STAFF REQUEST.

RAI 3.19

- ADJUSTMENT OF OUTLET VENT HEIGHT AND CONTROL OF LIMITS
- HOLTEC RESPONSE (SAR AND DRAWING REVISION):
  - PROVISIONS ELIMINATED. ONLY SCREENS INCLUDED ARE PERFORATED PLATES, WHICH ARE IDENTICAL TO THOSE USED IN ABOVE GROUND HI-STORMS.

RAI 3.20

- DISCUSS RELEVANCY OF LS-DYNA AND SASSI COMPARISONS GIVEN DRASTIC DIFFERENCES IN MODELS
- HOLTEC RESPONSE (NO SAR OR DRAWING CHANGES)
  - COMPARISON IS RELEVANT. BOTH MODEL THE SAME PHYSICAL INSTALLATION.

RAI 3.20 (CONTINUED)

Item	DBSM	SASSI	Remarks
ZPA at Bedrock	0.5 (Horizontal); 0.333 (Vertical)	0.5 (Horizontal); 0.333 (Vertical)	Seismic time history inputs are identical and applied at the top of bedrock
Depth to Top of Bedrock	Approximately 51'	Approximately 51'	Bedrock elevation the same
Substrate Material	Exactly match the strain compatible values used in the SASSI simulation (except for elastic-plastic soil elements surrounding the VVM)	Figure 3.1.13 is the strain compatible data (constant with depth in the two substrates) that is an input to SASSI	No SHAKE analysis performed as simulations assumed that property values were already strain compatible
Support Pad Thickness	30"	30"	-
Extent of Foundation Support Pad	Single Padlet surrounded and supported by substrate	Single Pad sized to support up to 5 x 5 array	SASSI pad sized to maintain same pad extent regardless of number of loaded VVMs
Pad Compressive Strength	4 ksi	4 ksi	-
Pad Material Behavior	Nonlinear	Linear Elastic	SASSI restricted to linear elastic behavior
VVM/Substrate Interface	Separation and Sliding permitted	Bonded contact	SASSI restricted to linear elastic behavior
Gaps	Included per licensing drawings	No gaps permitted	SASSI is a linear code.

RAI 3.20 (CONTINUED)

- COMPARISON IS RELEVANT BECAUSE CONTINUOUS FOUNDATION SUPPORT PADS AND SINGLE PADLETS ARE BOTH PERMITTED IN THE 100U DESIGN BASIS.

- COMPARISON IS RELEVANT SINCE ILLUSTRATIVE LS-DYNA SOLUTION INCLUDES ALL REAL WORLD NONLINEARITIES, RATTLING CONTENTS AND INCORPORATES A FOUNDATION SUPPORT PADLET THAT PUTS GREATEST DEMAND ON VVM STEEL STRUCTURE BECAUSE OF INCREASED IMPACTS AND ROTATION.

RAI 3.20 (CONTINUED)

- THE CONFIRMATORY SOLUTION INCLUDES CONTINUOUS SUPPORT PAD AND MULTIPLE VVMs. EVEN THOUGH CONFIRMATORY SOLUTION NOT A DESIGN BASIS, IT PROVIDES VEHICLE FOR ASSERTING VALIDITY OF DBSM AS A DESIGN TOOL FOR SEISMIC QUALIFICATION OF THE 100U AT ANY SITE.

- THE COMPARISON OF STRESS IN THE VVM FROM THE TWO SOLUTIONS IS RELEVANT AS IT ESTABLISHES THE ASSERTED CONSERVATISM OF THE DBSM.

RAI 3.20 (CONTINUED)

- THE COMPARISON OF OVALITY AT THE MID-HEIGHT IS RELEVANT AS IT CONFIRMS AN EXPECTED CONCLUSION. THE DIFFERENCE IS NOT DUE TO AN INCONSISTENCY IN THE APPLIED CONSTRAINT, BUT IS BECAUSE OF THE INABILITY OF SASSI TO SIMULLATE A NONLINEAR GEOMETRY.

- THE RESULTS FROM THE COMPARISON SUPPORT THE ASSERTIONS THAT IS THE LINCHPIN OF THE DBSM:
  - THE SINGLE PADLET CARRYING A SINGLE VVM NONLINEAR SOLUTION PROVIDES THE BOUNDING DEMAND ON THE VVM
  - MULTIPLE VVMs ON A CONTINUOUS SUPPORT PAD DOES NOT INDUCE SIGNIFICANT DIFFERENCES IN THE RESPONSE OF ANY LOADED VVM .

TECH SPEC CONSIDERATIONS

- VERBIAGE FOR THE HI-STORM 100U SHOULD PARALLEL THAT FOR HI-STORM 100 ABOVE GROUND INSTALLATION
- INCLUDE ONLY VERBIAGE THAT APPLIES SOUND ENGINEERING JUDGEMENT AND EXPERIENCE.
- DO NOT OVER REGULATE

CURRENT TECH SPEC FOR ABOVE GROUND HI-STORM 100

- PROVIDES EMPIRICAL LIMITS THAT, IF MET, ALLOW PLACEMENT OF FREE STANDING CASKS ON ISFSI PAD.
- IF LIMITS ARE NOT MET, DYNAMIC ANALYSIS OF SITE-SPECIFIC CONFIGURATION IS PERMITTED
- RECOGNIZES SITE SPECIFIC NATURE OF PRODUCT
- NO RESTRICTIONS OR INTRUSION INTO ISFSI PAD DESIGN

HOLTEC TECH SPEC LANGUAGE

- FOLLOWS HISTORICAL PRECEDENT IN PERMITTING DYNAMIC ANALYSIS, BUT GOES EVEN FURTHER AND REQUIRES IT FOR EVERY SITE
- TECH SPEC DOES NOT IMPOSE OVERLY RESTRICTIVE LIMITS ON CONFIGURATION, WHICH IS COUNTER TO PAST PRACTICE

TECH SPEC LIMITS

- ILLUSTRATIVE SOLUTION SHOULD NOT BE ELEVATED TO THE STATUS OF A DESIGN BASIS
  - NO REASON FOR A SQUARE CONFIGURATION RESTRICTION
  - NO REASON FOR ABSOLUTE MATERIAL THICKNESS CONTROL (CHANGE TO A THINNER WALL STAINLESS STEEL WOULD BE PROHIBITED!!!)

PROPOSED TECH SPEC LIMITS

- ADDITION OF TABLE 2.I.2 WOULD BE APPROPRIATE SINCE THAT TABLE SETS SOME LIMITS BASED ON SOUND ENGINEERING JUDGEMENT AND PRIOR EXPERIENCE

TABLE 2.I.2 FROM SUBSECTION 2.I

Table 2.I.2
CRITICAL CHARACTERISTICS FOR INTERFACING SSCs AND MPC GUIDES

	Item	Value	Symbol	Comment
1.	Minimum vertical stiffness of the Support Foundation and Undergirding Subgrade (lb/inch)	2.0E+06	K	The minimum stiffness is based on limiting the immediate elastic settlement at the TOF (based on the interface load listed in Table 3.I.5 and the weight of the Closure Lid per Table 3.I.1). This minimum prescribed stiffness prevents excessive Support Foundation settlement under load.
2.	Reference thickness of the VVM Interface Pad (inch)	28	T	This thickness is used in shielding analysis in Supplement 5.I; use of a larger value will enhance shielding even further.
3.	Average density of the VVM Interface Pad (lb/ft^3)	140	Υ	This density is used in shielding analysis in Supplement 5.I; use of a different value will results in a change in the computed dose results.
4.	Average density of subgrade adjacent to CEC (lb/ft^3)	106	Υ_s	The average density is used in shielding analysis in Supplement 5.I; use of a greater value will enhance shielding even further. The maximum value, used in the reference seismic analysis, is given in Table 2.I.4
5	Minimum Number of Upper/Lower MPC Guides	4 / 6	Ng	The MPC Guides transfer impact loads from the MPC to the Divider Shell.