10 CFR 50.55a

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102-08286-BJR/TNW
July 29, 2021

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station Units 1, 2, and 3**
Docket Nos. STN 50-528, 50-529, and 50-530
Renewed Operating License Number NPF-41, NPF-51, and NPF-74
Relief Request 67 - Request for Alternative Frequency to Containment Unbonded Post-Tensioning System Inservice Inspection

Pursuant to Title 10 of the Code of Federal Regulations (10 CFR) 50.55a, *Codes and Standards*, paragraph (z)(1), Arizona Public Service Company (APS) requests Nuclear Regulatory Commission (NRC) approval of the enclosed request for relief from the requirements of Section XI, Subsection IWL of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code. Per the ASME BPV Code, the periodic visual examination and physical testing of containment building concrete are required in accordance with Table IWL-2500-1 (L-A), as well as physical testing of unbonded post-tensioning systems in accordance with Table IWL-2500-1 (L-B).

Examination and testing to date have indicated the post-tensioning system at Palo Verde Nuclear Generating Station (PVNGS) will continue to maintain its safety-related function through the period of extended operation. Therefore, APS proposes to extend the post-tensioning system examination and testing interval from 10 years to 20 years for Units 1 and 3. For Unit 2, the NRC approved a delay in performing the Unit 2 test for one year due to COVID-19 in Relief Request 66. The due date was extended from February 8, 2021, to February 8, 2022. As a result, the potential for an alternative examination schedule for the Unit 2 post-tensioning system examinations and tests will be evaluated after this data has been collected.

APS also proposes an alternative for PVNGS Units 1, 2, and 3 to limit the scope of tendons required to be detensioned for wire removal and examination, elongation measurement, and to eliminate the requirement of IWL-2523.2(b) to perform tendon wire tension testing.

The proposed alternatives are requested for the third and subsequent fourth intervals.

A pre-submittal meeting was held between APS and the NRC staff on June 16, 2021. APS requests approval of the relief request by June 30, 2022.

No new commitments are being made to the NRC by this letter. Should you need further information regarding this letter, please contact Matthew S. Cox, Licensing Section Leader, at (623) 393-5753.

Sincerely,

Rash, Bruce (Z77439)

Digitally signed by Rash, Bruce (Z77439)
DN: cn=Rash, Bruce (Z77439)
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BJR/TNW/mg

Enclosure: Relief Request 67 - Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1) for Inservice Inspection of the Containment Post-Tensioning System Components

cc:

	S. A. Morris	NRC Region IV Regional Administrator
	S. P. Lingam	NRC NRR Project Manager for PVNGS
	L. N. Merker	NRC Senior Resident Inspector for PVNGS

Enclosure

Relief Request 67

Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1) for Inservice Inspection of the Containment Post-Tensioning System Components

Arizona Public Service Company
Palo Verde Nuclear Generating Station - Units 1, 2, and 3
Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1) for Inservice Inspection of the Containment Post-Tensioning System Components

1. ASME CODE COMPONENTS AFFECTED:

Components:	Units 1, 2, and 3 Concrete Containments
Code Class:	Class CC
Examination Category:	Category L-B, Unbonded Post-Tensioning System
Code Item Numbers:	L2.10, L2.20, L2.30, L2.40, and L2.50
Description:	Examination of Concrete Containment Unbonded Post-Tensioning System Components

2. APPLICABLE CODE EDITION AND ADDENDA:

The applicable edition and addenda of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPV), Section XI for the third 10-year Containment Inservice Inspection Interval (IWL) is identified below.

Plant/Unit(s)	Applicable ASME Code, Section XI	Interval Start Date[(1)]	Interval End Date[(2)]
Palo Verde Units 1, 2, and 3	2013 Edition	08/01/2021	07/31/2031

Notes:

1. Inservice inspection plans for the third 10-year Containment Inservice Inspection Interval (IWL) are currently under development.
2. The inspection interval end date may be extended by as much as one year and may be reduced without restriction in accordance with IWA-2430(c)(1).

3. APPLICABLE CODE REQUIREMENTS:

3.1 IWL-2420 specifies scheduling requirements for unbonded post-tensioning systems. IWL-2421(b) provides alternative scheduling requirements for examination and testing of post-tensioning systems at sites with multiple plants that have met the conditions specified in IWL-2421(a), as follows:

> *(b) When the conditions of (a) are met, the inspection dates and examination requirements may be as follows.*
>
> *(1) For the containment with the first Structural Integrity Test, all examinations required by IWL-2520 shall be performed at 1, 3, and 10 years and every 10 years thereafter. In addition, the examinations required by IWL-2524 and IWL-2525 shall be performed at 5 and 15 years and every 10 years thereafter.*

(2) For each subsequent containment constructed at the site, all examinations required by IWL-2520 shall be performed at 1, 5, and 15 years and every 10 years thereafter. In addition, the examinations required by IWL-2524 and IWL-2525 shall be performed at 3 and 10 years and every 10 years thereafter.

Note: Attachment 1, Tables 1 and 3 show the schedules for IWL-2520 examinations during the Second (current) Containment Inservice Inspection Interval. Table 3 also shows the schedules for performing containment concrete examinations in accordance with IWL-2410, for which an alternative is not being requested.

3.2 IWL-2523.1 requires tendon detensioning and wire sample removal, as follows:

One sample tendon of each type shall be completely detensioned. A single wire or strand shall be removed from each detensioned tendon.

3.3 IWL-2523.2(b) requires that tension tests be performed on each removed wire or strand, as follows:

Tension tests shall be performed on each removed wire or strand: one at each end, one at midlength, and one in the location of the most corroded area, if any. The following information shall be obtained from each test:
(1) yield strength
(2) ultimate tensile strength
(3) elongation

Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3 currently perform physical and visual examinations of the post-tensioning system in accordance with the schedules specified in IWL-2421(b).

Table IWL-2500-1, Item Number L2.10 requires that selected tendon force and elongation be measured.

Table IWL-2500-1, Item Number L2.20 requires that tendon single wire samples be removed and examined for corrosion and mechanical damage as well as tested to obtain yield strength, ultimate tensile strength, and elongation on each removed wire. The selected tendons are subsequently retensioned as required per IWL-2523.3 because wire removal requires detensioning in order to safely obtain wire samples.

Table IWL-2500-1, Item Number L2.30 requires that a detailed visual examination be performed on selected tendon anchorage hardware and adjacent concrete extending 2 feet from the edge of the bearing plate. The quantity of free water released from the anchorage end cap as well as any which drains from the tendon during examination shall be documented.

Table IWL-2500-1, Item number L2.40 and L2.50 require that samples of selected tendon corrosion protection medium (CPM) and free water be obtained and analyzed.

4. REASON FOR REQUEST:

ASME Section XI, Subsection IWL requires periodic visual examination of Containment Building concrete as well as physical testing and visual examination of post-tensioning systems. The required schedules for these examinations and tests are shown in Tables 1 and 3, and comply with the requirements of the ASME BPV Code, Section XI, IWL-2410 and IWL-2421.

Post-tensioning system examinations and tests performed to date have indicated that the post-tensioning systems are expected to maintain their safety-related function through the period of extended operation for PVNGS Units 1, 2, and 3. For this reason, this relief request proposes to perform visual and physical examination of the Units 1 and 3 concrete containment post-tensioning systems in accordance with the schedules identified in Tables 2 and 4. For Unit 2, the NRC approved a delay in performing the Unit 2 test for one year due to COVID-19 in Relief Request 66. The due date was extended from February 8, 2021, to February 8, 2022. As a result, the potential for an alternative examination schedule for the Unit 2 post-tensioning system examinations and tests will be evaluated after this data has been collected.

While this relief request is based on maintaining an acceptable level of quality and safety, there are additional benefits to the proposed examination schedule. Physical testing requires exposing the test personnel to industrial safety hazards. Removing the tendon end caps and load testing or detensioning/retensioning the tendons also unnecessarily cycles the tendons and exposes the system to an unsealed environment during testing. Below are specific hazards and undesirable conditions that would be reduced by this proposed request:

1. Most tendons are located at heights well above ground level that require working at heights and the inherent risks associated with such work.
2. This work is often performed from hanging platforms open to outside weather conditions. The platform must be moved to a parked location in order to exit the platform safely.
3. Some areas are located in difficult-to-reach locations that have limited access.
4. The testing requires working with high pressure hydraulics.
5. Some areas are located in the vicinity of high energy plant systems.
6. The testing requires working with solvents and hot petroleum products and associated fumes.
7. The testing requires working with containers and pressurized lines filled with heated CPM.
8. The testing requires working in the vicinity of high levels of stored elastic energy in the tendons. Sudden rotation during force measurement has resulted in high-speed shim ejection.
9. The work includes handling of heavy loads (i.e., test equipment) that exposes test personnel and equipment to hazards.
10. While tendon testing is most often not performed in radiation areas, there are occasionally some tendons tested in areas that involve radiation fields.

Performing examination/testing on a reduced frequency reduces the repetitive loading required for force measurement or detensioning and retensioning. Reducing the population of tendon end caps removed will minimize tendon hardware exposure to environmental conditions and will reduce environmental waste (e.g., solvents, used CPM, other consumables).

This request also includes alternatives for PVNGS Units 1, 2, and 3 to limit the scope of tendons required to be detensioned for wire removal and examination, elongation measurement, and to eliminate the requirement of IWL-2523.2(b) to perform tendon wire

tension testing. Performing wire tension tests to confirm tendon wire material properties continue to meet the wire specification requirements is not warranted, based on examination results obtained since plant construction. Tendon wire visual examinations and elongation measurements should be limited to tendons that have detectable conditions (i.e., loss of effective wires in excess of that permitted by the design, or other conditions) that would justify performing these examinations.

5. PROPOSED ALTERNATIVES AND BASES FOR USE:

5.1 Alternative Proposed for Units 1 and 3:

In lieu of the requirement of IWL-2421(b), the following alternative is proposed for Units 1 and 3:

1. Unit 1 - For the containment with the first Structural Integrity Test (S.I.T), examinations required by IWL-2520 shall be performed at 50 years following completion of the S.I.T and every 20 years thereafter. Examinations required by IWL-2421(b)(1) to be performed in accordance with IWL-2524 and IWL-2525 at 45 years following completion of the S.I.T and every 10 years thereafter. Containment concrete examinations shall continue to be performed in accordance with IWL-2410.
2. Unit 3 - For the containment with the third S.I.T, examinations required by IWL-2520 shall be performed at 45 years following completion of the S.I.T and every 20 years thereafter. Examinations required by IWL-2421(b)(1) to be performed in accordance with IWL-2524 and IWL-2525 at 40 years following completion of the S.I.T and every 10 years thereafter. Containment concrete examinations shall continue to be performed in accordance with IWL-2410.

Use of this alternative shall be discontinued for any tendon group (vertical, wall hoop, or dome hoop)[1] in a unit if any of the following conditions occur:

- The tendon mean force for the tendon group is predicted to be less than the specified minimum required value (MRV) within 40 years following the required completion date of the previous surveillance in which Table IWL-2500-1, Examination Category L-B, Item L2.10 examinations were performed on that unit.
- Replacement of tendon load bearing components (i.e., anchorheads, shims, or complete tendons) in any tendon within a tendon group is required as a result of unacceptable conditions detected during IWL-2520 examinations or plant operation.

Use of this alternative shall also be discontinued for any unit if containment concrete repairs requiring pressure testing in accordance with IWL-5000 are performed on that unit as a result of unacceptable conditions detected during IWL-2510 examinations or plant operation.

The above proposed alternative relates only to pre-stressed tendon tests and the associated examinations that require close-in access to tendon end anchorage areas. Visual examination of the exposed areas of the containment concrete surface,

[1] The PVNGS concrete containments contain both vertical tendons (inverted U tendons) and hoop tendons. Hoop tendons include those located in the containment cylindrical shell (designated “wall hoop” tendons) and those located in the containment dome (designated as “dome hoop” tendons).

exposed areas of the tendon bearing plates, and tendon end caps will continue to be performed at 5-year intervals in accordance with ASME Section XI, Subsection IWL, Examination Category L-A.

The reduced frequency of physical testing of the Units 1 and 3 post-tensioning systems will continue to provide an acceptable level of quality and safety based on projected performance and implementation of physical testing should visual examination results indicate a need for such testing.

PVNGS Units 1, 2, and 3 shall continue to perform a General Visual examination and Detailed Visual examination (when required) of accessible concrete and exposed steel hardware as required by ASME Section XI, Table IWL-2500-1, Item Numbers L1.11 and L1.12, as modified by 10 Title 10 of the Code of Federal Regulations (10 CFR) 50.55a. The examination and physical testing requirements of ASME Section XI, Table IWL-2500-1, Item Numbers L2.10, L2.20, L2.30, L2.40, and L2.50 will also be performed if the General Visual examination and Detailed Visual examination identify conditions where observations indicate there could be degradation of tendon hardware, as documented by the Responsible Engineer in an engineering evaluation. Example conditions that could require removal of the tendon end cap and further examination per Item Numbers L2.10, L2.20, L2.30, L2.40, and L2.50 are:

- Evidence of possible damage to the enclosed post-tensioning hardware as indicated by conditions such as end cap deformation found during external visual examination. Conditions observed by removal of the end cap would determine the extent of additional examinations per Item Numbers L2.10, L2.20, L2.30, L2.40, or L2.50.
- Active corrosion on a bearing plate or end cap that requires further investigation as determined by the Responsible Engineer in an engineering evaluation.
- Evidence of corrosion protection medium leakage will be evaluated, and a plan developed that requires further investigation and corrective actions as defined in an engineering evaluation documented by the Responsible Engineer.

5.2 Additional Alternatives Proposed for Units 1, 2, and 3:

1. In lieu of the IWL-2523.1 requirement that one sample tendon of each type be completely detensioned and that a single wire or strand be removed from each detensioned tendon, APS proposes to detension a tendon and remove a single wire for examination only if a tendon anchorage visual examination in accordance with IWL-2524 detects a number of ineffective wires (i.e., broken/protruding wires or missing buttonheads) in excess of that permitted by the design, or if required as a result of an engineering evaluation performed in accordance with IWL-3300. Tendons with broken or unseated wires (or detached buttonheads) not documented and accepted during a previous examination shall be evaluated in accordance with IWL-3222.
2. In lieu of the IWL-2523.2(b) requirement to perform tension testing to determine the yield strength, ultimate tensile strength, and elongation of tendon wires, APS proposes to eliminate these test requirements. Visual examinations of tendon wires in accordance with IWL-2523.2(a) shall continue to be performed on any tendon requiring detensioning and elongation measurement in accordance with

the alternative proposed above.

5.3 The bases for use of the proposed alternatives are provided below, and are supported by the excellent examination history for these units. A summary of the examination history is provided below.

5.3.1 Summary of IWL-2522 Tendon Force and Elongation Measurements

Tendon Prestress Force

Figures shown in Attachment 2 illustrate the tendon force measurement history.

- Figures 1 through 5 illustrate the tendon force measurement history for Unit 1.
- Figures 6 through 10 illustrate the tendon force measurement history for Unit 3.
- Figure 11 illustrates the tendon force measurement history for the dome hoop tendons in Units 1 and 3. Because of the relatively small number of dome hoop tendons that have been examined on each unit, this figure is provided to show how the dome tendons are performing collectively in Units 1 and 3. Force measurements from Unit 2 are not included in this figure because dome hoop tendons were not in the selected at random from among the hoop tendons examined during the Unit 2 year 20 and year 25 surveillances.
- Figure 12 illustrates the tendon force measurement history for the wall hoop tendons in Units 1, 2, and 3. Force measurements from Table 7 (Unit 2) are included in this figure. This figure is provided to show how the wall hoop tendons are performing collectively in Units 1, 2, and 3.
- Figure 13 illustrates the tendon force measurement history for the vertical (inverted U) tendons in Units 1, 2, and 3. Force measurements from Table 7 (Unit 2) are included in this figure. This figure is provided to show how the vertical tendons are performing collectively in Units 1, 2, and 3.

One tendon (Unit 3 H21-005) has detected a lift-off force lower than the predicted lower limit for its tendon group. The measured force in this tendon was 98.6% of the predicted lower limit. Lift-off forces were measured in the adjacent tendons, and these measurements, along with those in tendon H21-005, met the applicable acceptance standards. Tendon H21-005 was then retensioned to an acceptable force.

The data shows that tendon force measurements have remained above the MRV, and that the predicted average tendon forces for each type of tendon will remain above the required minimum design prestress force well beyond the end of the plant life.

Tendon Elongation

Measured tendon elongations have either met the applicable acceptance standards, or have been evaluated to confirm that significant changes from previous examinations were not the result of broken tendon wires.

5.3.2 Summary of IWL-2523 Examination Results

Tendon Wire Visual Examinations

Visual examination of all wires removed from tendons in Units 1, 2, and 3 since initial tendon installation have shown no signs of corrosion or physical damage, demonstrating that the post-tensioning system corrosion protection medium (CPM) has continued to protect tendon wires from corrosion. There have been a few instances where CPM leakage has been identified on containment concrete surfaces, but these conditions have been evaluated and accepted, and the amount of grease loss from tendon sheathing has been minimal. CPM leakage has been attributed to thermal expansion, which has resulted in CPM leakage through construction joints in the containment concrete.

Tendon Wire Tension Testing

Results of tension tests on all wires removed from tendons in Units 1, 2, and 3 have met material specification requirements for ultimate tensile strength (≥ 240 ksi) and elongation (≥ 4% at failure).

These results support the proposed alternative not to require these physical tests on tendon wires. APS believes that continued testing of tendon wires is unnecessary and that visual examinations performed on wires removed from tendons is sufficient to determine if tendon wire degradation has occurred in that tendon.

5.3.3 Summary of IWL-2524 Examination Results

Tendon Anchorage Area Concrete Examinations

Tendon anchorage concrete examinations have been performed on anchorage areas of hoop tendons. Cracking of concrete adjacent to bearing plates has been observed, and crack mapping has been documented when such cracking has been detected. These conditions have been accepted by engineering. In a few locations, grout has been performed to fill voids or larger cracks that have been identified. These conditions are considered typical in structures of this age and do not represent evidence of abnormal degradation of the containment or its post-tensioning system.

Concrete surfaces at vertical tendon anchorage areas are covered by permanent steel plates that prohibit access for performing anchorage area concrete examinations.

Tendon Anchorage Hardware and Bearing Plate Examinations

The results of visual examinations of tendon anchorage hardware (anchorheads, shims, and buttonheads) and bearing plates have demonstrated that the condition of anchorage components remains acceptable. A limited number of undocumented missing buttonheads

have been detected during examinations performed to-date, indicating that corrosion and loss of wires has not been significant. With one exception, corrosion levels of level “C” or better have been detected in all examinations, with the majority of anchorage components found to have either corrosion level “A” or “B”. The single exception was noted on shims at the field end of Unit 1 Tendon H13-019, which had level “D” corrosion noted. This tendon was refilled with corrosion protection medium to prevent further corrosion.

Corrosion levels for tendon anchorage components have been defined as follows:

A - EXCELLENT CONDITION Bright, uniformly colored wire, but may be somewhat blackened; no foreign matter, visible rust, no pitting.

B - GOOD CONDITION Partial loss of color; little foreign matter and a small quantity of light rust may be present; no pitting.

C - FAIR CONDITION Major loss of color; much foreign matter and a large quantity of light rust may be present; no pitting.

D - USABLE CONDITION Almost total loss of color; much foreign matter and small quantities of heavy rust in the form of a red oxide dust; no pitting.

E - REJECTED CONDITION Areas of hard, crusty, scaly red oxide, when cleaned show definite signs of pitting. Pits are defined as indentations of a depth of 1/64” or deeper and a minimum of 1/32” in diameter.

Protruding buttonheads have been detected following tendon retensioning at Units 1, 2, and 3, but the number of effective wires in these tendons was reduced by no more than two (in addition to any wire removed from a tendon for examination), with the exception of the tendons identified below. Protruding buttonheads observed following retensioning have been attributed to friction forces in the tendon that prevented reseating of the buttonheads. Broken wires were not detected in these tendons, and no broken wires have been detected in any tendon as a result of conditions that have occurred since tendon installation.

Unit 1 Tendon V-40 (Year 10 Surveillance)

Shop and field end visual examinations detected 186 effective wires, prior to detensioning. Following retensioning, seven protruding wires were found at the shop end. Tendon elongation measurements were performed and were evaluated as acceptable. All other examination/test results were acceptable.

Unit 3 Tendon V-28 (Year 1 Surveillance)

Shop and field end visual examinations detected 186 effective wires, prior to detensioning. Following retensioning, three protruding buttonheads were detected at the shop end, and five protruding buttonheads were detected at the field end. All other examinations/tests were acceptable.

Unit 3 Tendon H21-005 (Year 3 Surveillance)

Shop and field end visual examinations detected 186 effective wires, prior to detensioning. Following retensioning, 12 protruding buttonheads were detected at the shop end (See Note). Elongation measurements were evaluated and were found to be acceptable. The prestress force in this tendon was measured to be 98.6% of the prescribed lower limit, and examinations of adjacent tendons was performed that confirmed that the tendon forces remained acceptable. Tendon H21-005 was subsequently retensioned to an acceptable force. All other examinations/tests for this tendon were acceptable.

Note: A wire was not required to be removed from this tendon during this surveillance.

5.3.4 Summary of IWL-2525 Examination Results

Tendon Corrosion Protection Medium Analyses

Results of tendon CPM tests at PVNGS Units 1, 2, and 3 have met acceptance standards during all examinations, except as noted below.

The results of CPM testing for several surveillances early in the plant life were not located.

Tendon Free Water Collection and Analysis

Free water has not been detected during surveillances of vertical and hoop tendons at PVNGS Units 1, 2, and 3.

5.3.5 Summary of IWL-2526 Requirements

IWL-2526(b) requires that the total amount of CPM replaced in each tendon sheath be recorded following surveillance activities, and the difference between the amount removed and the amount replaced shall be documented.

There have been a few instances where the difference in the amount of CPM installed and that removed from a tendon exceeded 10% of the tendon net duct volume. In these cases, an evaluation was performed to document the acceptability of this condition, and these tendons have been refilled to ensure that tendon wires and anchorage components continue to be adequately protected from corrosion.

5.3.6 Additional Information

Tendon Corrosion Protection Medium (CPM) Leakage

Tendon CPM leakage has not been a significant issue at PVNGS. CPM leakage from tendon end caps has been insignificant, and only a few instances of grease leakage have been detected on exterior surfaces of the containment concrete shell, primarily at construction cold joints. Tendon sheathing is not impermeable, and cracking in concrete can allow for propagation of tendon CPM to leak from tendon sheaths, especially during CPM installation by pumping at high temperature and pressure, or as a result of thermal expansion during periods of extremely hot weather (not atypical for Arizona).

Unit 2 Post-tensioning System Examinations

Unit 2 post-tensioning system examinations shall continue to be performed in accordance with IWL-2421. In the event that unacceptable conditions are detected during future post-tensioning system examinations performed on any unit (including Unit 2), an engineering evaluation shall be performed in accordance with IWL-3310 and shall address the applicability of the identified condition to other plants at the same site, as required by IWL-3310(b). Additional examinations, tests, or evaluations shall be performed if specified as a result of the engineering evaluation.

Prior to the 20th year surveillance, only visual examinations were performed on Unit 2. As a result, sufficient data has not yet been obtained to support seeking an alternative to the tendon examination frequency for Unit 2.

Selection of Hoop Tendons for Examination (Units 1, 2, and 3)

APS has established two tendon types for implementing requirements of Subsection IWL. These tendon types include vertical tendons (inverted U tendons) and hoop tendons (located in the containment cylindrical shell and dome).

Dome hoop tendons are included in the population of hoop tendons selected at random for examination during surveillances in accordance with Table IWL-2521-1. Using Table IWL-2521-1, Note (2), the required hoop tendon sample size is three, based on a total population of hoop tendons equal to 150 (approximately 30 dome hoop and 120 wall hoop tendons). In the event that the random selection does not include at least one dome hoop tendon, a dome hoop tendon shall be selected at random and shall be added to required hoop tendon sample. In the unlikely event the random selection does not include at least two hoop tendons located in the cylindrical shell, additional wall hoop tendons shall be selected at random and added to required hoop tendon sample. This will ensure that both dome and wall hoop tendons will be selected for examination, allowing APS to obtain data for trending future prestress losses in each of these tendon groups.

Alternative to the requirement of IWL-2523.1

Targeting the IWL-2522 and IWL-2523 examinations and elongation measurements to those tendons whose visual examinations have detected an unacceptable number of ineffective wires, or when required as a result of an engineering evaluation, is appropriate because IWL-2522 and IWL-2523 examinations performed to-date have not detected unacceptable conditions at PVNGS. If unacceptable conditions are detected as a result of anchorage visual examinations, these conditions would require an engineering evaluation, and detensioning of a tendon for wire removal and examination may be required by the engineering evaluation to aid in the evaluation of the tendon condition.

5.4 The results of the inservice examinations conducted at PVNGS, Units 1, 2, and 3 have demonstrated that the post-tensioning systems are continuing to perform their intended function. These post-tensioning systems can be expected to continue to perform the

specified design functions until well past the June 1, 2045 (Unit 1), April 24, 2046 (Unit 2), and November 25, 2047 (Unit 3) expiration of the extended operating licenses. Visual examinations performed every five years in accordance with ASME Section XI, Table IWL-2500-1, Item Numbers L1.11 and L1.12 will be adequate to determine if additional physical testing and examination per Examination Category L-B is required. For these reasons, APS requests authorization to use the proposed alternatives pursuant to 10 CFR 50.55a(z)(1) on the basis that the proposed alternatives provide an acceptable level of quality and safety.

6. DURATION OF PROPOSED ALTERNATIVES:

The proposed alternatives are requested for use during the PVNGS Units 1, 2, and 3 third 10-year containment Inservice Inspection Interval and during the fourth 10-year containment Inservice Inspection Interval, provided the edition of the ASME BPV Code, Section XI required to be used during the fourth Inservice Inspection Interval does not impose requirements that are more stringent than those of the alternatives approved by the NRC in this relief request.

7. PRECEDENTS

7.1 **Agencywide Documents Access and Management System (ADAMS) Accession Number ML20287A471**. NRC approved dated October 20, 2020. Millstone Power Station, Unit 2, “Proposed Alternative Request RR-05-05, Containment Unbonded Post-Tensioning System Inservice Inspection Requirements”, dated December 17, 2019 (ML19352B898).

7.2 **ADAMS Accession Number ML19182A077**. NRC approved dated July 11, 2019. Vogtle Electric Generating Plant, Units 1 and 2, “Proposed ISI Alternative VEGP-ISI-ALT-19-01 for Tendon Inservice Inspection Extension”, dated February 18, 2019 (ML19049A017).

7.3 **ADAMS Accession Number ML19226A023**. NRC approved dated September 19, 2019. Three Mile Island Nuclear Station, Unit 1, “Submittal of Relief Request RR-18-01 Concerning Containment Unbonded Post-Tensioning System Inservice Inspection Requirements”, dated October 16, 2018 (ML18289A363).

7.4 **ADAMS Accession Number ML20206L135**. Submittal of Relief Request I4R-11 for Braidwood Station, Units 1 and 2, and Relief Request I4R-18 for Byron Station, Units 1 and 2, Concerning Containment Unbonded Post-Tensioning System Inservice Inspection Requirements, dated July 24, 2020.

8. REFERENCES:

8.1 ASME BPV Code, Section XI, Subsection IWL, 2013 Edition

8.2 Palo Verde Unit 1, 2nd Inspection Interval Containment Inservice Inspection Program, Subsection IWL, Program No. 2INT-IWL-1

8.3 Palo Verde Unit 2, 2nd Inspection Interval Containment Inservice Inspection Program, Subsection IWL, Program No. 2INT-IWL-2

8.4 Palo Verde Unit 3, 2nd Inspection Interval Containment Inservice Inspection Program, Subsection IWL, Program No. 2INT-IWL-3

Attachment 1
(Tables)

Table 1

Post-Tensioning System Examination Schedules (Using IWL-2421)

Unit 1	2nd Interval		3rd Interval		4th Interval	
	30th Year	35th Year	40th Year	45th Year	50th Year	55th Year
All IWL-2520 Exams/Tests Required(1)	Yes(3)		Yes		Yes	
Only IWL-2524/IWL-2525 Exams/Tests Required(2)		Yes(3)		Yes		Yes

Unit 2	2nd Interval		3rd Interval		4th Interval	
	30th Year	35th Year	40th Year	45th Year	50th Year	55th Year
All IWL-2520 Exams/Tests Required(1)		Yes		Yes		Yes
Only IWL-2524/IWL-2525 Exams/Tests Required(2)	Yes(3)		Yes		Yes	

Unit 3	2nd Interval		3rd Interval		4th Interval	
	25th Year	30th Year	35th Year	40th Year	45th Year	50th Year
All IWL-2520 Exams/Tests Required(1)	Yes(3)		Yes		Yes	
Only IWL-2524/IWL-2525 Exams/Tests Required(2)		Yes(3)		Yes		Yes

Notes:

1. Includes all examinations and tests required by IWL-2522, -2523, -2524, -2525, and -2526 (Table IWL-2500-1, Examination Category L-B).
2. Includes only those examinations and tests specified in Table IWL-2500-1, Examination Category L-B, Item Number L2.30 (Visual Examination Tendon Anchorage Hardware and Concrete), Item Number L2.40 (Examination of Corrosion Protection Medium) and Item Number L2.50 (Examination of Free Water).
3. These examinations have been completed.

Table 2

Post-Tensioning System Examination Schedules Using IWL-2421 for Unit 2 and Proposed Alternative Schedules for Units 1 and 3

	2nd Interval		3rd Interval		4th Interval	
Unit 1	**30th Year**	**35th Year**	**40th Year**	**45th Year**	**50th Year**	**55th Year**
All IWL-2520 Exams/Tests Required(1)	Yes(4)		No		Yes	
Only IWL-2524/IWL-2525 Exams/Tests Required(2)		Yes(4)		Yes		Yes

	2nd Interval		3rd Interval		4th Interval	
Unit 2(3)	**30th Year**	**35th Year**	**40th Year**	**45th Year**	**50th Year**	**55th Year**
All IWL-2520 Exams/Tests Required(1)		Yes		Yes		Yes
Only IWL-2524/IWL-2525 Exams/Tests Required(2)	Yes(4)		Yes		Yes	

	2nd Interval		3rd Interval		4th Interval	
Unit 3	**25th Year**	**30th Year**	**35th Year**	**40th Year**	**45th Year**	**50th Year**
All IWL-2520 Exams/Tests Required(1)	Yes(4)		No		Yes	
Only IWL-2524/IWL-2525 Exams/Tests Required(2)		Yes(4)		Yes		Yes

Notes:

1. Includes all examinations and tests required by IWL-2522, -2523, -2524, -2525, and -2526 (Table IWL-2500-1, Examination Category L-B).
2. Includes only those examinations and tests specified in Table IWL-2500-1, Examination Category L-B, Item Number L2.30 (Visual Examination Tendon Anchorage Hardware and Concrete), Item Number L2.40 (Examination of Corrosion Protection Medium) and Item Number L2.50 (Examination of Free Water).
3. The Unit 2 schedule will continue to follow the schedule required by IWL-2421 in the 2013 Edition during the 3rd Interval.
4. These examinations have been completed.

Table 3
Palo Verde Units 1, 2, and 3
Containment Concrete and Post-Tensioning System Examination Schedules Using IWL-2410 and IWL-2421

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Unit 1 (S.I.T. Date: 12/25/1982)																								
			40th yr All IWL-2520 Exams 12/25/2021-12/25/2023					45th yr IWL-2524/2525 Exams Only 12/25/2026-12/25/2028					50th yr All IWL-2520 Exams 12/25/2031-12/25/2033					55th yr IWL-2524/2525 Exams Only 12/25/2036-12/25/2038						
		IWL-2410 Concrete Exams 09/04/2020 - 09/04/2022(1)					IWL-2410 Concrete Exams 09/04/2025 - 09/04/2027					IWL-2410 Concrete Exams 09/04/2030 - 09/04/2032					IWL-2410 Concrete Exams 09/04/2035 - 09/04/2037							
Unit 2 (S.I.T. Date: 02/08/1985)																								
	35th yr All IWL-2520 Exams 02/08/2019-02/08/2022(2)					40th yr IWL-2524/2525 Exams Only 02/08/2024-02/08/2026					45th yr All IWL-2520 Exams 02/08/2029-02/08/2031					50th yr IWL-2524/2525 Exams Only 02/08/2034-02/08/2036					55th yr All IWL-2520 Exams 02/08/2039-02/08/2041			
		IWL-2410 Concrete Exams 09/06/2020 - 09/06/2022(1)					IWL-2410 Concrete Exams 09/06/2025 - 09/06/2027					IWL-2410 Concrete Exams 09/06/2030 - 09/06/2032					IWL-2410 Concrete Exams 09/06/2035 - 09/06/2037					IWL-2410 Concrete Exams 09/06/2040 - 09/06/2042		
Unit 3 (S.I.T. Date: 09/16/1986)																								
		35th yr All IWL-2520 Exams 09/16/2020-09/16/2022					40th yr IWL-2524/2525 Exams Only 09/16/2025-09/16/2027					45th yr All IWL-2520 Exams 09/16/2030-09/16/2032					50th yr IWL-2524/2525 Exams Only 09/16/2035-09/16/2037							
		IWL-2410 Concrete Exams 09/07/2020 - 09/07/2022(1)					IWL-2410 Concrete Exams 09/07/2025 - 09/07/2027					IWL-2410 Concrete Exams 09/07/2030 - 09/07/2032					IWL-2410 Concrete Exams 09/07/2035 - 09/07/2037							

Notes:

(1) IWL-2410 examination schedule is based on the initial IWL-2410 examinations having been completed in September, 2001.

(2) Date extended from 02/08/2021 to 02/08/2022, ADAMS Accession No.: ML21089A010.

Table 4
Palo Verde Units 1, 2, and 3
Containment Concrete and Post-Tensioning System Examination Schedule Using Proposed Alternative to IWL-2421 (Units 1 and 3 Only)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Unit 1 (S.I.T. Date: 12/25/1982)																								
			40th yr No IWL-2520 Exams 12/25/2021-12/25/2023					45th yr IWL-2524/2525 Exams Only 12/25/2026-12/25/2028					50th yr All IWL-2520 Exams 12/25/2031-12/25/2033						55th yr IWL-2524/2525 Exams Only 12/25/2036-12/25/2038					
		IWL-2410 Concrete Exams 09/04/2020 - 09/04/2022(1)					IWL-2410 Concrete Exams 09/04/2025 - 09/04/2027(1)					IWL-2410 Concrete Exams 09/04/2030 - 09/04/2032(1)					IWL-2410 Concrete Exams 09/04/2035 - 09/04/2037(1)						
Unit 2 (S.I.T. Date: 02/08/1985)																								
	35th yr All IWL-2520 Exams 02/08/2019-02/08/2022(2)(3)					40th yr IWL-2524/2525 Exams Only 02/08/2024-02/08/2026(3)					45th yr All IWL-2520 Exams 02/08/2029-02/08/2031(3)					50th yr IWL-2524/2525 Exams Only 02/08/2034-02/08/2036(3)					55th yr All IWL-2520 Exams 02/08/2039-02/08/2041(3)			
		IWL-2410 Concrete Exams 09/06/2020 - 09/06/2022(1)					IWL-2410 Concrete Exams 09/06/2025 - 09/06/2027(1)					IWL-2410 Concrete Exams 09/06/2030 - 09/06/2032(1)					IWL-2410 Concrete Exams 09/06/2035 - 09/06/2037(1)					IWL-2410 Concrete Exams 09/06/2040 - 09/06/2042(1)	
Unit 3 (S.I.T. Date: 09/16/1986)																								
		35th yr No IWL-2520 Exams 09/16/2020-09/16/2022					40th yr IWL-2524/2525 Exams Only 09/16/2025-09/16/2027					45th yr All IWL-2520 Exams 09/16/2030-09/16/2032					50th yr IWL-2524/2525 Exams Only 09/16/2035-09/16/2037							
		IWL-2410 Concrete Exams 09/07/2020 - 09/07/2022(1)					IWL-2410 Concrete Exams 09/07/2025 - 09/07/2027(1)					IWL-2410 Concrete Exams 09/07/2030 - 09/07/2032(1)					IWL-2410 Concrete Exams 09/07/2035 - 09/07/2037(1)						

Notes:

(1) IWL-2410 examination schedule is based on the initial IWL-2410 examinations having been completed in September, 2001. An alternative to this schedule is not being requested.

(2) Date extended from 02/08/2021 to 02/08/2022, ADAMS Accession No.: ML21089A010.

(3) The Unit 2 post-tensioning examination schedule shall continue to be performed in accordance with the schedule established during the Second Inspection Interval that complies with IWL-2421.

Table 5
Palo Verde Unit 1 Hoop Tendon Force Data (See Notes 2 and 3)
Structural Integrity Test (S.I.T.) Date: 12/25/1982

Tendon	Surveillance Year	Initial Tensioning Date	Surveillance Date	Tendon Group[1]	Shop End Measured Force (kips)	Field End Measured Force (kips)	Average Measured Force (kips)	Length of Time Since S.I.T. (Days)	Time Since Initial Tensioning (Days)	Time Since Initial Tensioning (Years)
H21-044	Year 01 (1984)	3/10/1981	2/28/1984	Dome Hoop	1517	1508	1513	430	1085	2.97
H13-007	Year 01 (1984)	1/25/1982	1/27/1984	Wall Hoop	1366	1393	1380	398	732	2.00
H21-037	Year 01 (1984)	12/15/1981	2/28/1984	Wall Hoop	1453	1471	1462	430	805	2.20
H13-021	Year 01 (1984)	12/11/1981	3/1/1984	Wall Hoop	1446	1496	1471	432	811	2.22
H32-016	Year 01 (1984)	4/13/1981	3/7/1984	Wall Hoop	1370	1387	1379	438	1059	2.90
H32-030	Year 01 (1984)	3/25/1981	3/7/1984	Wall Hoop - Common	1492	1502	1497	438	1078	2.95
H21-042	Year 03 (1985)	3/11/1981	1/3/1986	Dome Hoop	1468	1622	1545	1105	1759	4.82
H32-009	Year 03 (1985)	1/27/1982	12/18/1985	Wall Hoop	1483	1464	1474	1089	1421	3.89
H13-025	Year 03 (1985)	12/11/1981	1/2/1986	Wall Hoop	1410	1486	1448	1104	1483	4.06
H32-030	Year 03 (1985)	3/25/1981	1/2/1986	Wall Hoop - Common	1487	1516	1502	1104	1744	4.77
H32-033	Year 03 (1985)	12/18/1981	1/2/1986	Wall Hoop	1402	1505	1454	1104	1476	4.04
H21-011	Year 03 (1985)	1/21/1982	1/6/1986	Wall Hoop	1440	1451	1446	1108	1446	3.96
H32-044	Year 05 (1988)	2/27/1981	3/26/1988	Dome Hoop	1486	1557	1522	1918	2584	7.07
H32-023	Year 05 (1988)	12/21/1981	3/26/1988	Wall Hoop	1442	1458	1450	1918	2287	6.26
H32-030	Year 05 (1988)	3/25/1981	3/26/1988	Wall Hoop - Common	1479	1493	1486	1918	2558	7.00
H21-028	Year 05 (1988)	3/13/1981	4/18/1988	Wall Hoop	1462	1419	1441	1941	2593	7.10
H13-019	Year 05 (1988)	1/22/1982	4/26/1988	Wall Hoop	1364	1420	1392	1949	2286	6.26
H21-003	Year 05 (1988)	1/22/1982	4/26/1988	Wall Hoop	1507	1419	1463	1949	2286	6.26
H32-041	Year 10 (1992)	12/18/1981	8/14/1992	Dome Hoop	1413	1466	1440	3520	3892	10.66
H32-030	Year 10 (1992)	3/25/1981	8/14/1992	Wall Hoop - Common	1465	1483	1474	3520	4160	11.39
H13-008	Year 10 (1992)	6/10/1981	8/27/1992	Wall Hoop	1380	1389	1385	3533	4096	11.21
H32-015	Year 15 (1998)	1/27/1982	6/2/1998	Wall Hoop	1367	1442	1405	5638	5970	16.34
H32-030	Year 15 (1998)	3/25/1981	6/2/1998	Wall Hoop - Common	1463	1463	1463	5638	6278	17.19
H21-006	Year 15 (1998)	6/11/1981	6/11/1998	Wall Hoop	1303	1484	1394	5647	6209	17.00
H32-026	Year 25 (2008)	3/26/1981	9/13/2008	Wall Hoop	1333	1414	1374	9394	10033	27.47
H32-030	Year 25 (2008)	3/25/1981	9/13/2008	Wall Hoop - Common	1424	1413	1419	9394	10034	27.47
H13-014	Year 25 (2008)	6/10/1981	9/16/2008	Wall Hoop	1399	1426	1413	9397	9960	27.27
H13-043	Year 30 (2013)	12/8/1981	1/28/2013	Dome Hoop	1304	1405	1355	10992	11374	31.14
H32-030	Year 30 (2013)	3/25/1981	1/31/2013	Wall Hoop - Common	1426	1416	1421	10995	11635	31.85
H21-001	Year 30 (2013)	1/22/1982	2/13/2013	Wall Hoop	1396	1457	1427	11008	11345	31.06

Notes:
1. APS treats the dome hoop and wall hoop tendons as a single group and has selected a "Common Tendon" from this group of tendons.
2. Tendon sample sizes for surveillances in years 25 and 30 were determined in accordance with Table IWL-2521-1, based on a population of 150 hoop tendons. Tendon sample sizes for earlier surveillances were determined in accordance with plant Technical Specifications.
3. Relief from the performance of the Year 20 examination was granted by the NRC via Relief Request, ADAMS Accession No. ML003758134.

Table 6
Palo Verde Unit 1 Vertical Tendon Force Data (See Notes 1 and 2)
Structural Integrity Test (S.I.T.) Date: 12/25/1982

Tendon	Surveillance Year	Initial Tensioning Date	Surveillance Date	Tendon Group	Shop End Measured Force (kips)	Field End Measured Force (kips)	Average Measured Force (kips)	Length of Time Since S.I.T. (Days)	Time Since Initial Tensioning (Days)	Time Since Initial Tensioning (Years)
V-32	Year 01(1984)	11/2/1981	1/9/1984	Vertical	1338	1462	1400	380	798	2.18
V-75	Year 01 (1984)	10/29/1981	1/10/1984	Vertical - Common	1438	1468	1453	381	803	2.20
V-62	Year 01 (1984)	10/26/1981	1/12/1984	Vertical	1453	1468	1461	383	808	2.21
V-43	Year 01 (1984)	8/20/1981	1/20/1984	Vertical	1391	1517	1454	391	883	2.42
V-75	Year 03 (1985)	10/29/1981	2/7/1986	Vertical - Common	1474	1471	1473	1140	1562	4.28
V-18	Year 03 (1985)	8/25/1981	2/9/1986	Vertical	1473	1355	1414	1142	1629	4.46
V-55	Year 03 (1985)	9/26/1980	2/10/1986	Vertical	1445	1462	1454	1143	1963	5.37
V-02	Year 03 (1985)	7/23/1981	2/15/1986	Vertical	1495	1440	1468	1148	1668	4.57
V-11	Year 05 (1988)	9/2/1981	2/26/1988	Vertical	1452	1477	1465	1889	2368	6.48
V-75	Year 05 (1988)	10/29/1981	2/26/1988	Vertical - Common	1468	1454	1461	1889	2311	6.33
V-36	Year 05 (1988)	11/2/1981	2/29/1988	Vertical	1363	1515	1439	1892	2310	6.32
V-86	Year 05 (1988)	6/23/1981	4/12/1988	Vertical	1492	1474	1483	1935	2485	6.80
V-75	Year 10 (1992)	10/29/1981	9/16/1992	Vertical - Common	1461	1442	1452	3553	3975	10.88
V-53	Year 10 (1992)	9/26/1981	9/17/1992	Vertical	1390	1416	1403	3554	4009	10.98
V-40	Year 10 (1992)	9/14/1981	9/18/1992	Vertical	1538	1533	1536	3555	4022	11.01
V-75	Year 15 (1998)	10/29/1981	7/16/1998	Vertical - Common	1409	1448	1429	5682	6104	16.71
V-72	Year 15 (1998)	10/27/1981	7/17/1998	Vertical	1390	1402	1396	5683	6107	16.72
V-37	Year 15 (1998)	11/4/1981	7/24/1998	Vertical	1376	1434	1405	5690	6106	16.72
V-15	Year 25 (2008)	9/3/1981	1/25/2008	Vertical	1403	1332	1368	9162	9640	26.39
V-08	Year 25 (2008)	8/24/1981	2/22/2008	Vertical	1405	1385	1395	9190	9678	26.50
V-75	Year 25 (2008)	10/29/1981	2/22/2008	Vertical - Common	1422	1421	1422	9190	9612	26.32
V-54	Year 30 (2013)	9/10/1981	2/14/2013	Vertical	1420	1304	1362	11009	11480	31.43
V-75	Year 30 (2013)	10/29/1981	2/19/2013	Vertical - Common	1388	1384	1386	11014	11436	31.31
V-29	Year 30 (2013)	11/3/1981	2/20/2013	Vertical	1373	1441	1407	11015	11432	31.30

Notes:

1. Tendon sample sizes for surveillances in years 25 and 30 were determined in accordance with Table IWL-2521-1, based on a population of 90 vertical tendons. Tendon sample sizes for earlier surveillances were determined in accordance with plant Technical Specifications.
2. Relief from the performance of the Year 20 examination was granted by the NRC via Relief Request, ADAMS Accession No. ML003758134.

Table 7
Palo Verde Unit 2 Tendon Force Data (See Notes)
Structural Integrity Test (S.I.T.) Date: 02/08/1985

Tendon	Surveillance Year	Initial Tensioning Date	Surveillance Date	Tendon Group	Shop End Measured Force (kips)	Field End Measured Force (kips)	Average Measured Force (kips)	Length of Time Since S.I.T. (Days)	Time Since Initial Tensioning (Days)	Time Since Initial Tensioning (Years)
V-26	Year 20 (2005)	8/13/1982	9/8/2005	Vertical	1380	1298	1339	7517	8427	23.07
V-67	Year 20 (2005)	8/16/1982	8/30/2005	Vertical	1479	1338	1408	7508	8415	23.04
V-75	Year 20 (2005)	8/24/1982	9/1/2005	Vertical - Common	1400	1430	1415	7510	8409	23.02
H21-040	Year 20 (2005)	5/3/1982	7/7/2005	Wall Hoop	1402	1368	1385	7454	8466	23.18
H32-012	Year 20 (2005)	6/15/1982	7/1/2005	Wall Hoop	1351	1301	1326	7448	8417	23.04
H32-030	Year 20 (2005)	5/20/1982	7/1/2005	Wall Hoop – Common[(4)]	1297	1358	1328	7448	8443	23.12
V-08	Year 25 (2011)	8/19/1982	9/14/2010	Vertical	1517	1406	1461	9349	10253	28.07
V-15	Year 25 (2011)	8/8/1982	9/13/2010	Vertical	1483	1419	1451	9348	10263	28.10
V-75	Year 25 (2011)	8/24/1982	9/13/2010	Vertical - Common	1416	1426	1416	9348	10247	28.05
H13-014	Year 25 (2011)	6/15/1982	9/9/2010	Wall Hoop	1440	1403	1422	9344	10313	28.24
H32-026	Year 25 (2011)	5/21/1982	9/1/2010	Wall Hoop	1411	1345	1378	9336	10330	28.28
H32-030	Year 25 (2011)	5/20/1982	9/2/2010	Wall Hoop – Common[(4)]	1325	1342	1334	9337	10332	28.29

Notes:

1. Prior to the Year 20 Surveillance, Unit 2 post-tensioning system examinations were performed in accordance with plant licensing requirements, which did not require physical testing of Unit 2 tendons.
2. Unit 2 examinations performed during the Year 20 surveillance included tendon force measurements. Following this “baseline” inspection, the alternative requirements of IWL-2421 were implemented.
3. Tendon sample sizes for surveillances in years 20 and 25 were determined in accordance with Table IWL-2521-1, based on a population of 90 vertical tendons and 150 hoop tendons.
4. APS treats the dome hoop and wall hoop tendons as a single group and has selected a “Common Tendon” from this group of tendons.

Table 8
Palo Verde Unit 3 Hoop Tendon Force Data (See Note 3)
Structural Integrity Test (S.I.T.) Date: 09/16/1986

Tendon	Surveillance Year	Initial Tensioning Date	Surveillance Date	Tendon Group[1]	Shop End Measured Force (kips)	Field End Measured Force (kips)	Average Measured Force (kips)	Length of Time Since S.I.T. (Days)	Time Since Initial Tensioning (Days)	Time Since Initial Tensioning (Years)
H13-044	Year 01 (1987)	10/18/1983	10/15/1987	Dome	1457	1490	1474	394	1458	3.99
H13-010	Year 01 (1987)	3/28/1984	10/13/1987	Wall Hoop	1415	1471	1443	392	1294	3.54
H13-036	Year 01 (1987)	10/21/1983	10/17/1987	Wall Hoop - Common	1392	1401	1397	396	1457	3.99
H21-007	Year 01 (1987)	4/9/1984	12/15/1987	Wall Hoop	1414	1442	1428	455	1345	3.68
H32-013	Year 01 (1987)	4/5/1984	10/20/1987	Wall Hoop	1466	1433	1450	399	1293	3.54
H32-021	Year 01 (1987)	4/3/1984	10/20/1987	Wall Hoop	1448	1453	1451	399	1295	3.55
H13-036	Year 03 (1989)	10/21/1983	1/6/1990	Wall Hoop - Common	1363	1375	1369	1208	2269	6.21
H21-004	Year 03 (1989)	3/30/1984	1/24/1990	Wall Hoop	1403	N/A[2]	1403	1226	2126	5.82
H21-005	Year 03 (1989)	4/10/1984	1/2/1990	Wall Hoop	1349	1392	1371	1204	2094	5.73
H21-006	Year 03 (1989)	3/29/1984	2/22/1990	Wall Hoop	1352	1434	1393	1254	2156	5.90
H21-009	Year 03 (1989)	4/9/1984	1/2/1990	Wall Hoop	1387	1431	1409	1204	2095	5.73
H32-018	Year 03 (1989)	3/11/1984	12/16/1989	Wall Hoop	1483	1453	1468	1187	2106	5.77
H32-029	Year 03 (1989)	11/1/1983	12/16/1989	Wall Hoop	1444	1410	1427	1187	2237	6.13
H32-042	Year 05 (1992)	10/20/1983	8/5/1991	Dome	1468	1500	1484	1784	2846	7.79
H13-009	Year 05 (1992)	4/9/1984	8/9/1991	Wall Hoop	1361	1469	1415	1788	2678	7.33
H13-036	Year 05 (1992)	10/21/1983	8/9/1991	Wall Hoop - Common	1368	1394	1381	1788	2849	7.80
H21-004	Year 05 (1992)	3/30/1984	8/9/1991	Wall Hoop	1394	1314	1354	1788	2688	7.36
H21-025	Year 05 (1992)	3/30/1984	8/14/1991	Wall Hoop	1370	1396	1383	1793	2693	7.37
H13-016	Year 05 (1992)	3/27/1984	8/19/1991	Wall Hoop	1354	1479	1417	1798	2701	7.39
H13-036	Year 10 (1997)	10/21/1983	12/11/1996	Wall Hoop - Common	1342	1371	1357	3739	4800	13.14
H13-024	Year 10 (1997)	3/26/1984	12/11/1996	Wall Hoop	1314	1458	1386	3739	4643	12.71
H21-010	Year 10 (1997)	3/28/1984	12/11/1996	Wall Hoop	1324	1313	1319	3739	4641	12.71
H21-043	Year 15 (2002)	10/27/1983	8/16/2002	Dome	1408	1456	1432	5813	6868	18.80
H21-022	Year 15 (2002)	3/26/1984	8/16/2002	Wall Hoop	1317	1345	1331	5813	6717	18.39
H13-036	Year 15 (2002)	10/21/1983	8/16/2002	Wall Hoop - Common	1330	1315	1323	5813	6874	18.82
H13-042	Year 25 (2012)	10/20/1983	5/21/2012	Dome	1404	1473	1439	9379	10441	28.59
H21-020	Year 25 (2012)	3/27/1984	5/15/2012	Wall Hoop	1334	1406	1370	9373	10276	28.13
H13-036	Year 25 (2012)	10/21/1983	5/24/2012	Wall Hoop - Common	1334	1363	1349	9382	10443	28.59

Notes:

1. APS treats the dome hoop and wall hoop tendons as a single group and has selected a “Common Tendon” from this group of tendons.
2. Data obtained only from tendon shop end.
3. Tendon sample sizes for surveillances in years 15 and 25 were determined in accordance with Table IWL-2521-1, based on a population of 150 hoop tendons. Tendon sample sizes for earlier surveillances were determined in accordance with plant Technical Specifications.

Table 9
Palo Verde Unit 3 Vertical Tendon Force Data (See Note 2)
Structural Integrity Test (S.I.T.) Date: 09/16/1986

Tendon	Surveillance Year	Initial Tensioning Date	Surveillance Date	Tendon Group	Shop End Measured Force (kips)	Field End Measured Force (kips)	Average Measured Force (kips)	Length of Time Since S.I.T. (Days)	Time Since Initial Tensioning (Days)	Time Since Initial Tensioning (Years)
V-28	Year 01 (1987)	2/9/1984	12/10/1987	Vertical	1428	1485	1457	450	1400	3.83
V-49	Year 01 (1987)	1/20/1984	10/24/1987	Vertical	1353	1527	1440	403	1373	3.76
V-07	Year 01 (1987)	12/19/1983	11/3/1987	Vertical	1520	N/A(1)	1520	413	1415	3.87
V-09	Year 01 (1987)	1/23/1984	10/24/1987	Vertical	1442	1533	1488	403	1370	3.75
V-15	Year 01 (1987)	1/17/1984	11/3/1987	Vertical	1491	N/A(1)	1491	413	1386	3.79
V-16	Year 01 (1987)	2/3/1984	10/26/1987	Vertical - Common	1404	1558	1481	405	1361	3.73
V-20	Year 01 (1987)	2/3/1984	12/12/1987	Vertical	1574	1486	1530	452	1408	3.85
V-16	Year 03 (1989)	2/3/1984	10/31/1989	Vertical - Common	1379	1550	1465	1141	2097	5.74
V-39	Year 03 (1989)	12/20/1983	11/1/1989	Vertical	1398	1471	1435	1142	2143	5.87
V-59	Year 03 (1989)	1/16/1984	10/31/1989	Vertical	1387	1485	1436	1141	2115	5.79
V-66	Year 03 (1989)	2/7/1984	11/1/1989	Vertical	1435	1481	1458	1141	2094	5.73
V-71	Year 05 (1992)	2/9/1984	9/12/1991	Vertical	1468	1558	1513	1822	2772	7.59
V-16	Year 05 (1992)	2/3/1984	9/13/1991	Vertical - Common	1410	1543	1477	1823	2779	7.61
V-33	Year 05 (1992)	2/16/1984	9/18/1991	Vertical	1456	1598	1527	1828	2771	7.59
V-48	Year 05 (1992)	12/22/1983	9/18/1991	Vertical	1305	1445	1375	1828	2827	7.74
V-16	Year 10 (1997)	2/3/1984	7/31/1996	Vertical - Common	1366	1524	1445	3606	4562	12.49
V-82	Year 10 (1997)	12/22/1983	8/2/1996	Vertical	1394	1478	1436	3608	4607	12.61
V-13	Year 10 (1997)	2/6/1984	8/14/1996	Vertical	1405	1507	1456	3620	4573	12.52
V-57	Year 15 (2002)	2/7/1984	7/10/2002	Vertical	1378	1520	1449	5776	6728	18.42
V-16	Year 15 (2002)	2/3/1984	7/11/2002	Vertical - Common	1367	1517	1442	5777	6733	18.43
V-41	Year 15 (2002)	1/24/1984	7/16/2002	Vertical	1419	1542	1481	5782	6748	18.48
V-02	Year 25 (2012)	12/21/1983	6/4/2012	Vertical	1445	1428	1437	9393	10393	28.45
V-87	Year 25 (2012)	1/25/1984	6/5/2012	Vertical	1363	1387	1375	9394	10359	28.36
V-16	Year 25 (2012)	2/3/1984	6/12/2012	Vertical - Common	1338	1495	1417	9401	10357	28.36

Notes:
1. Data obtained only from tendon shop end.
2. Tendon sample sizes for surveillances in years 15 and 25 were determined in accordance with Table IWL-2521-1, based on a population of 90 vertical tendons. Tendon sample sizes for earlier surveillances were determined in accordance with plant Technical Specifications.

Attachment 2
(Figures)

Figure 1
Palo Verde Unit 1
Wall Hoop Tendons

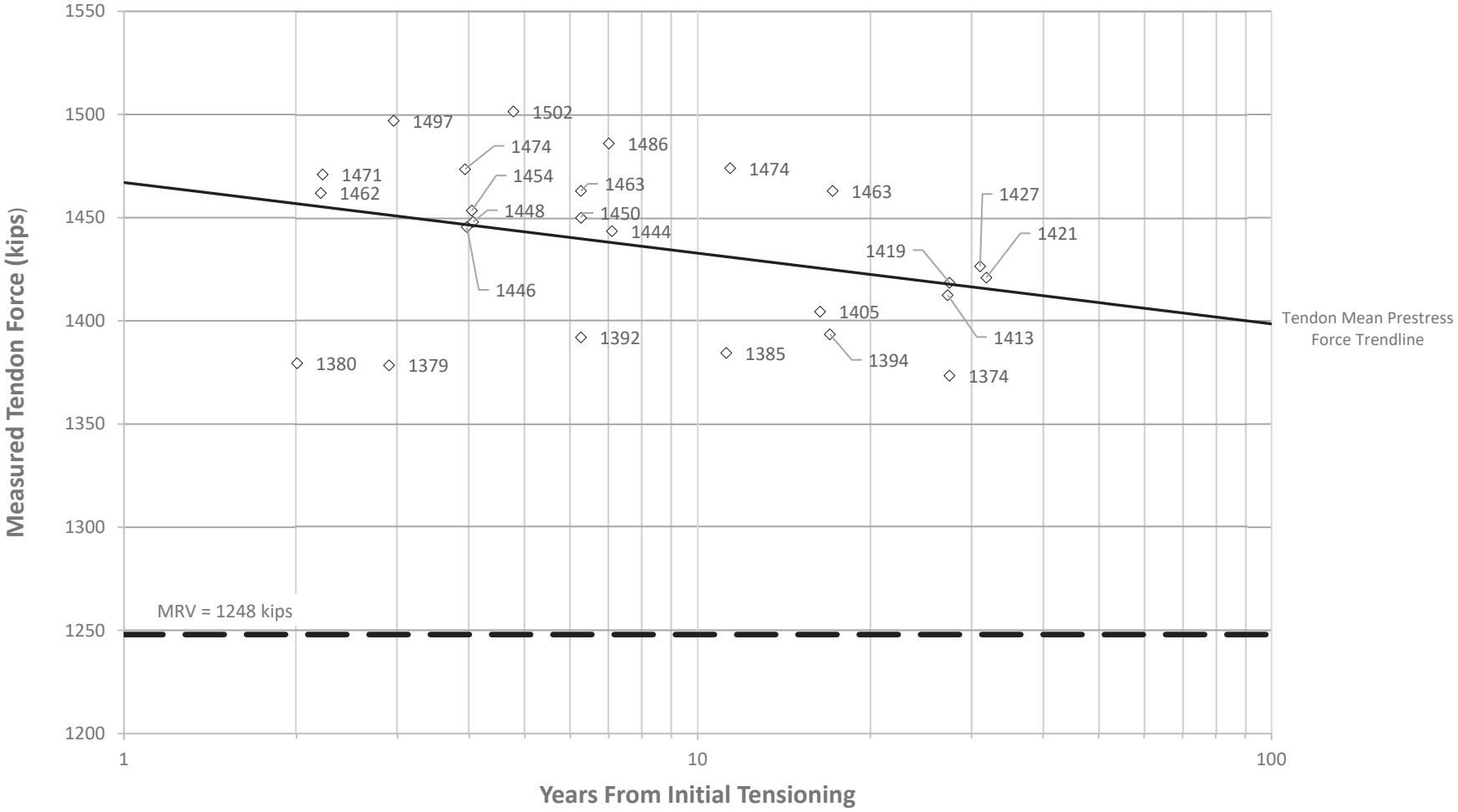

Figure 2
Palo Verde Unit 1
Wall Hoop Common Tendon H32-30

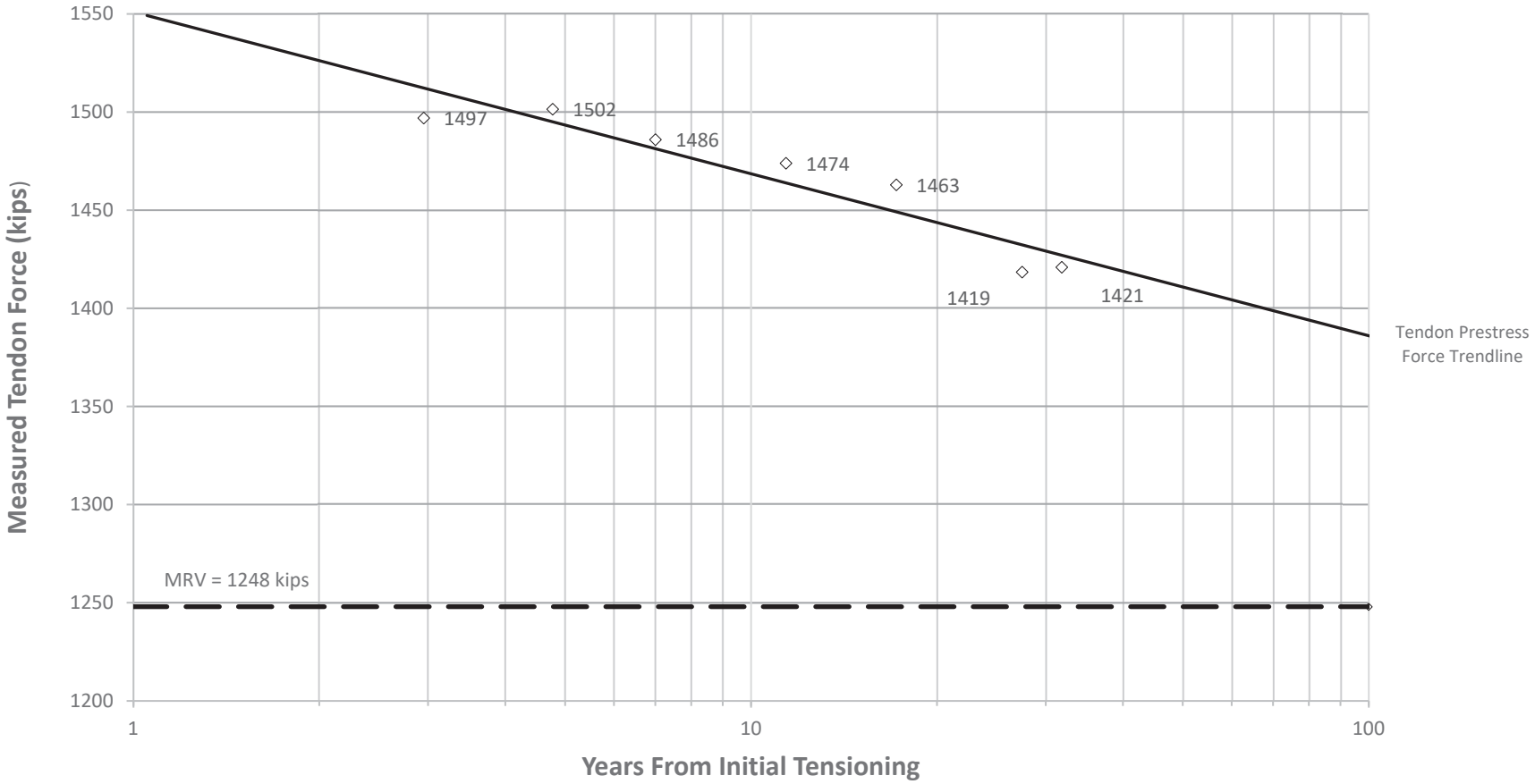

Figure 3
Palo Verde Unit 1
Dome Hoop Tendons

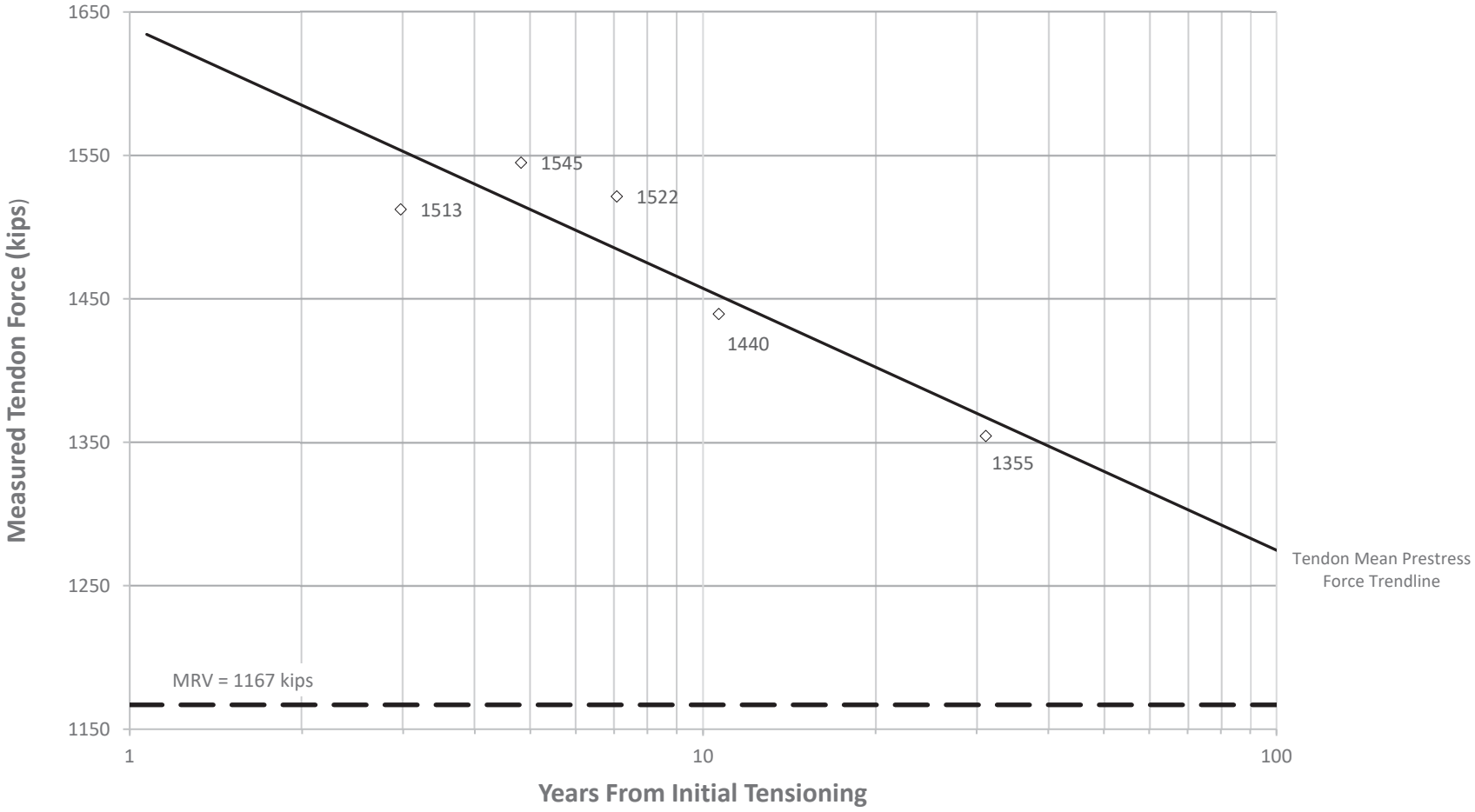

Figure 4
Palo Verde Unit 1
Vertical Tendons

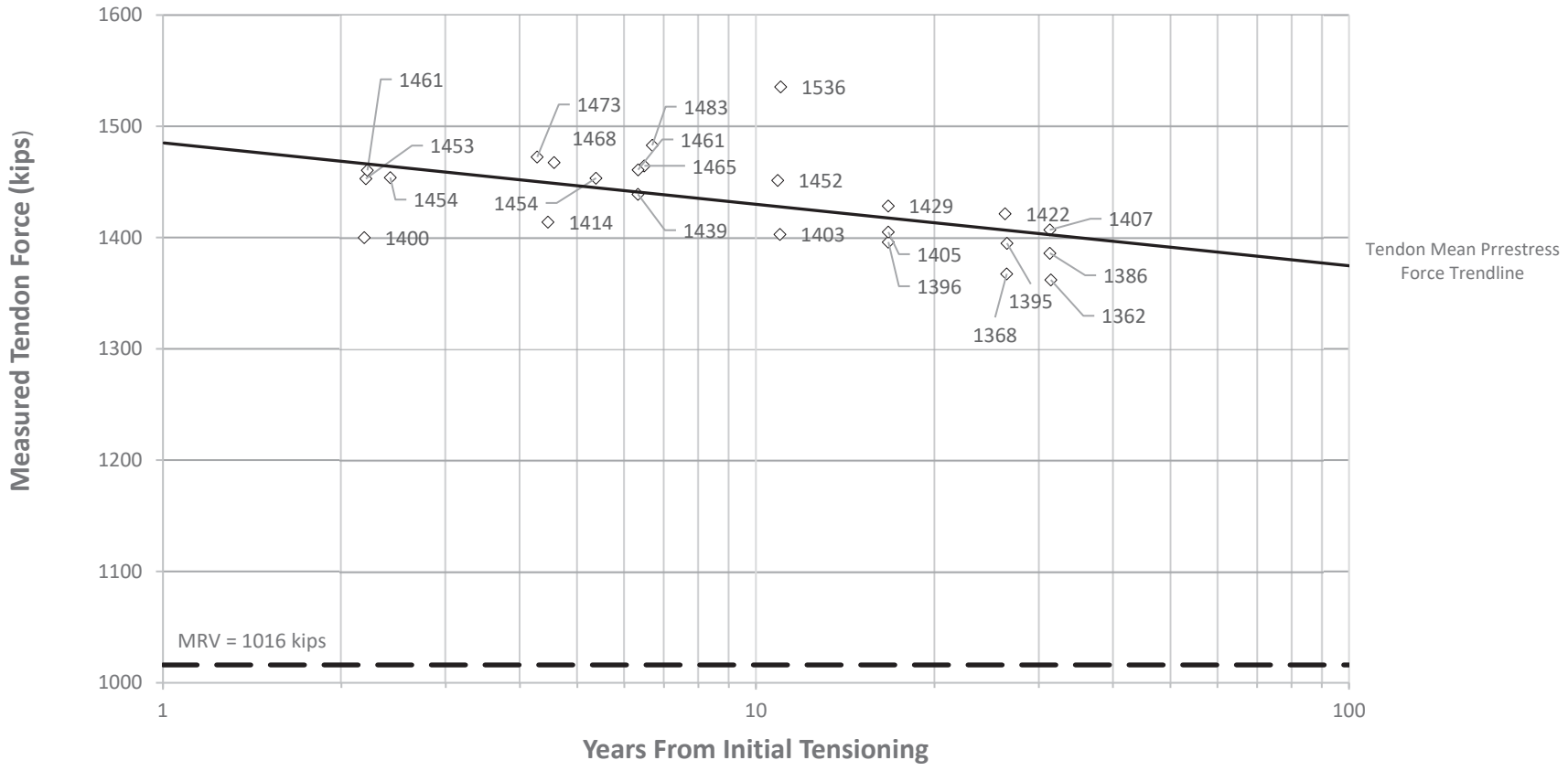

Figure 5
Palo Verde Unit 1
Vertical Common Tendon V-75

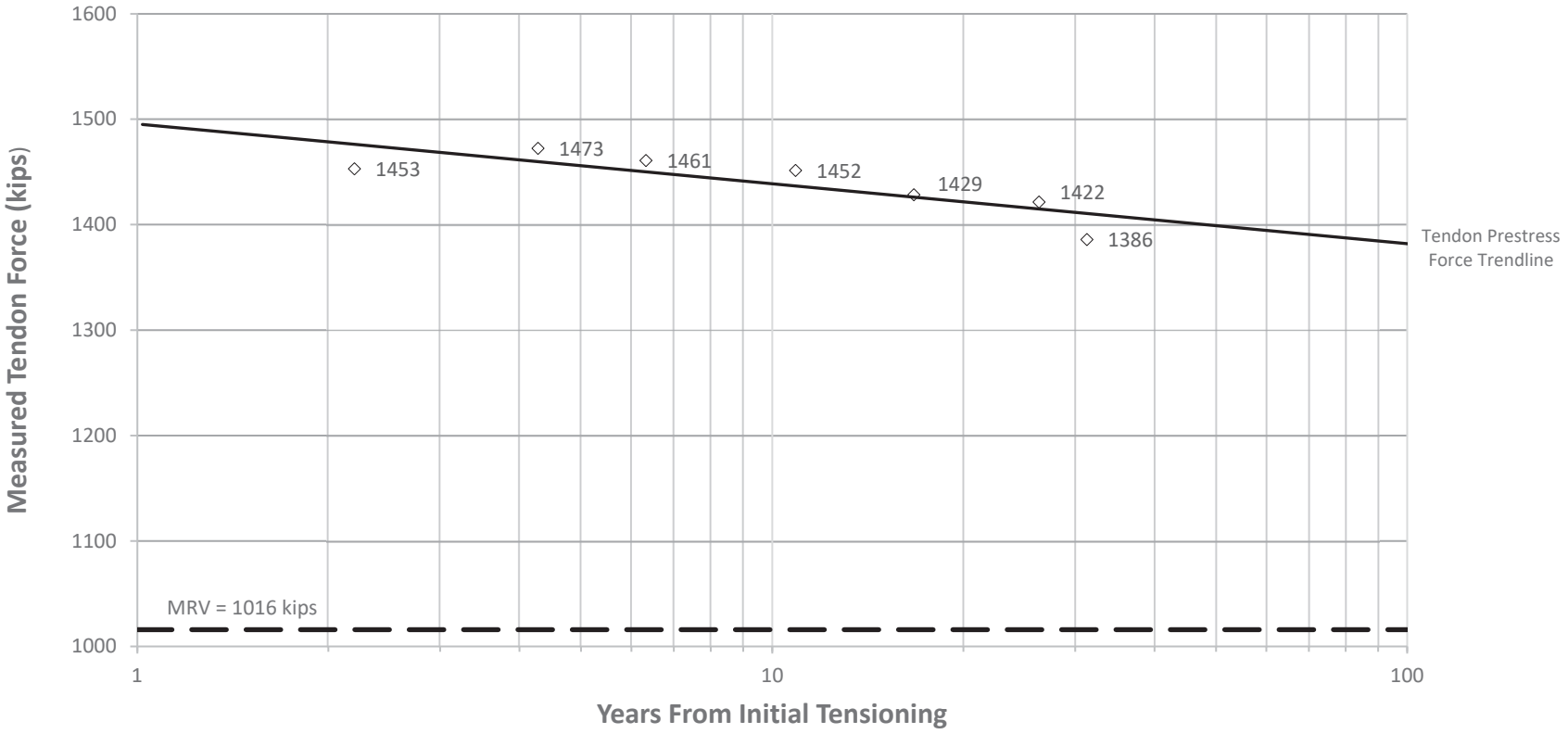

Figure 6
Palo Verde Unit 3
Wall Hoop Tendons

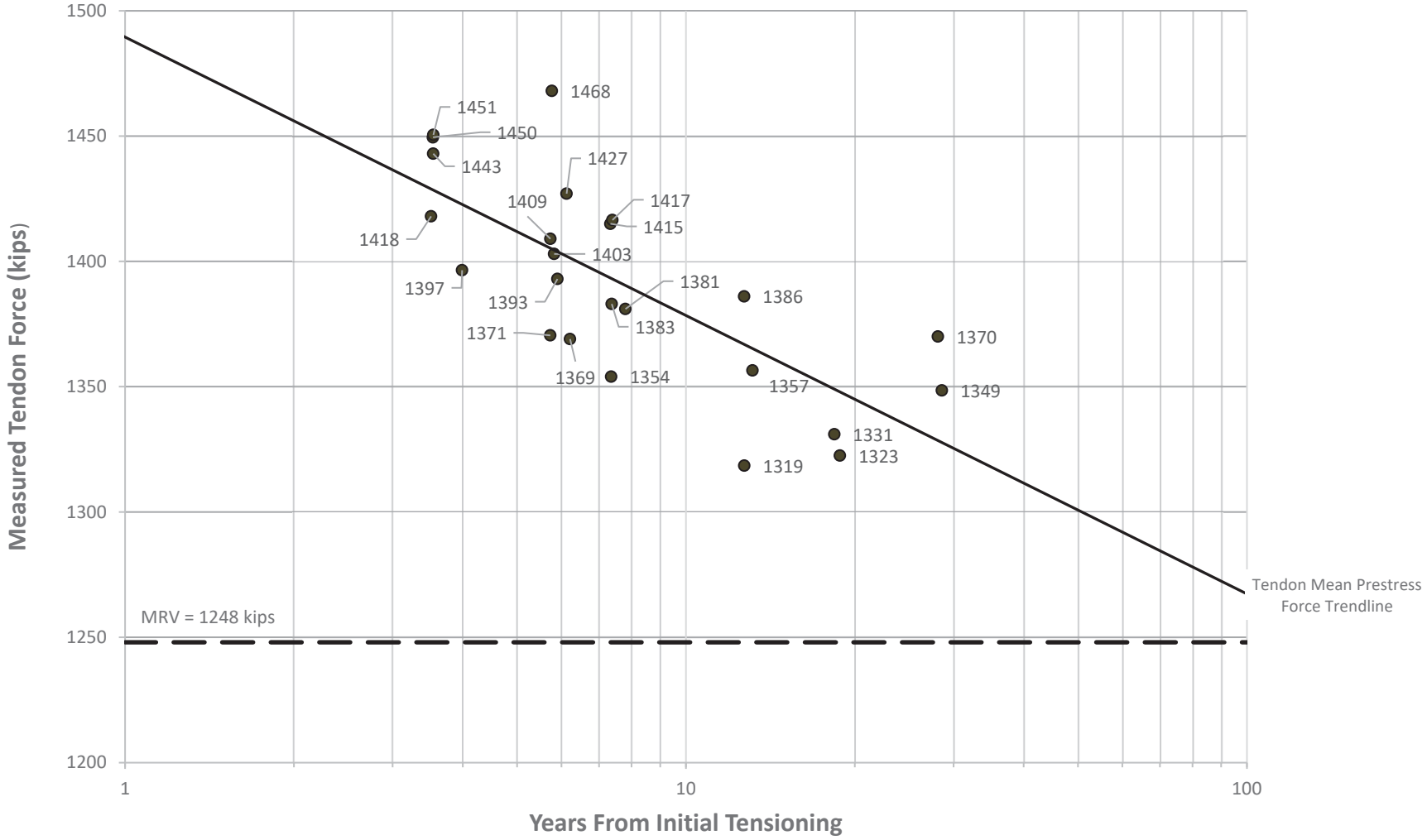

Figure 7
Palo Verde Unit 3
Wall Hoop Common Tendon H13-036

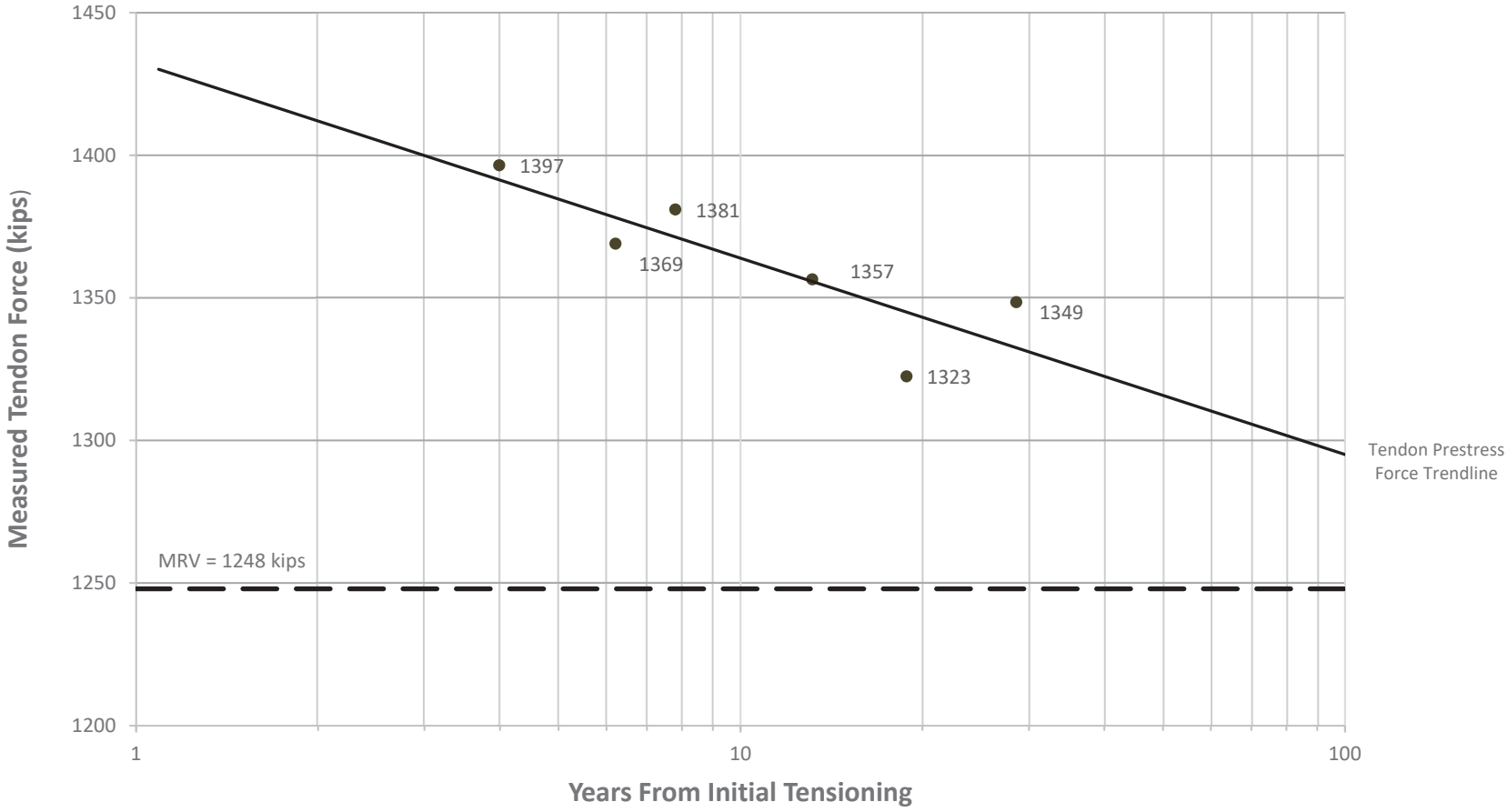

Figure 8
Palo Verde Unit 3
Dome Hoop Tendons

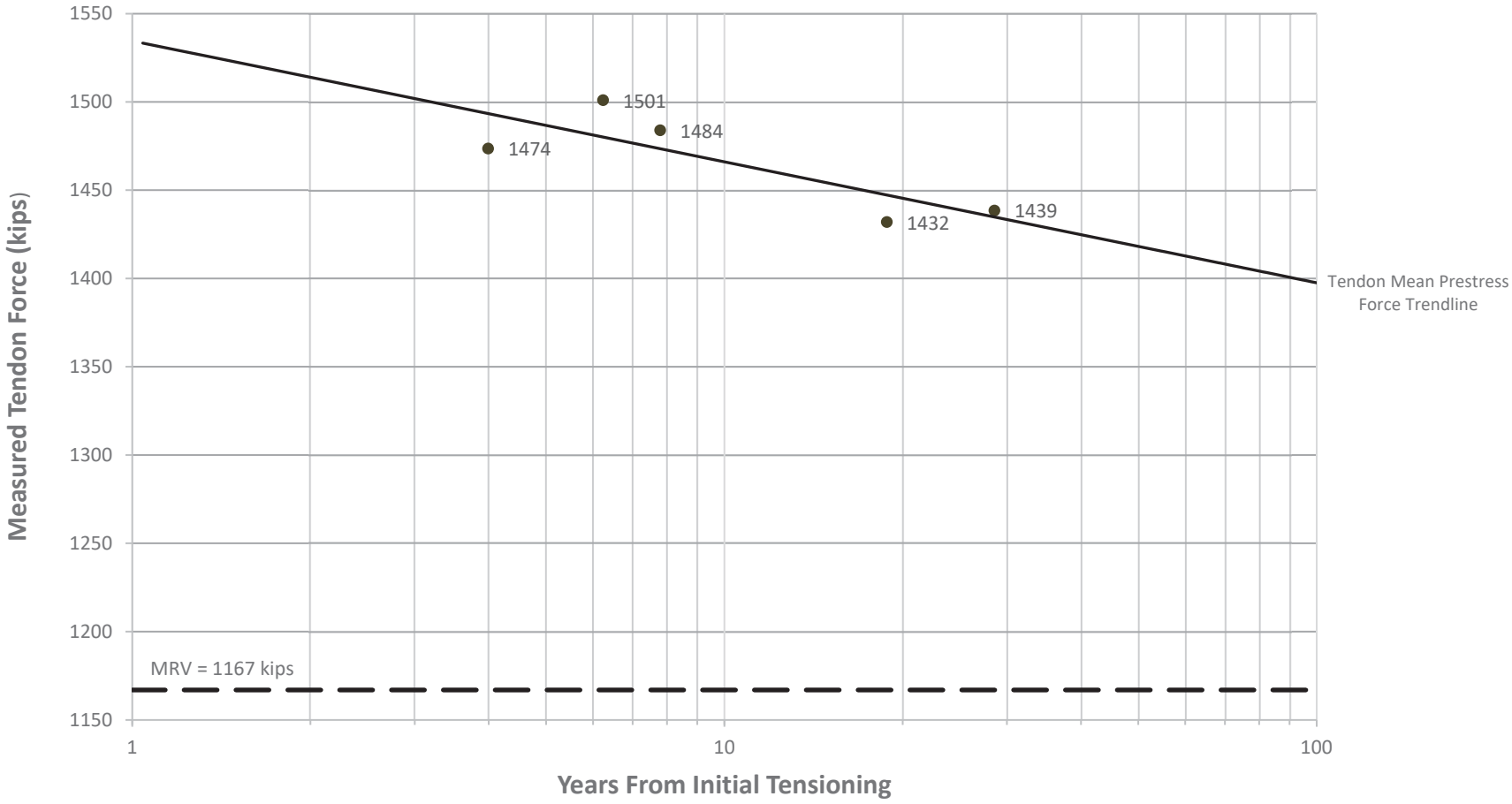

Figure 9
Palo Verde Unit 3
Vertical Tendons

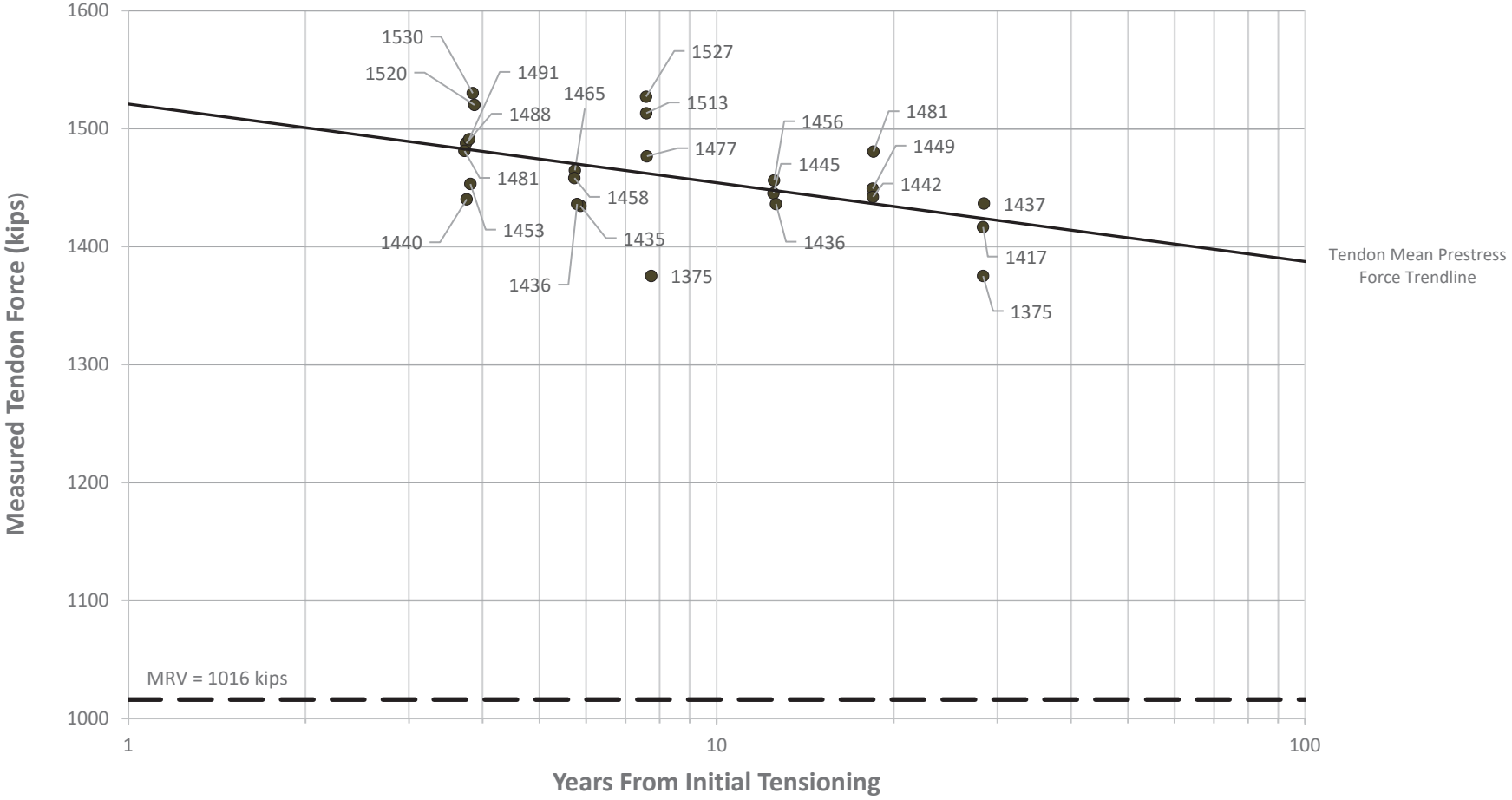

Figure 10
Palo Verde Unit 3
Vertical Common Tendon V-16

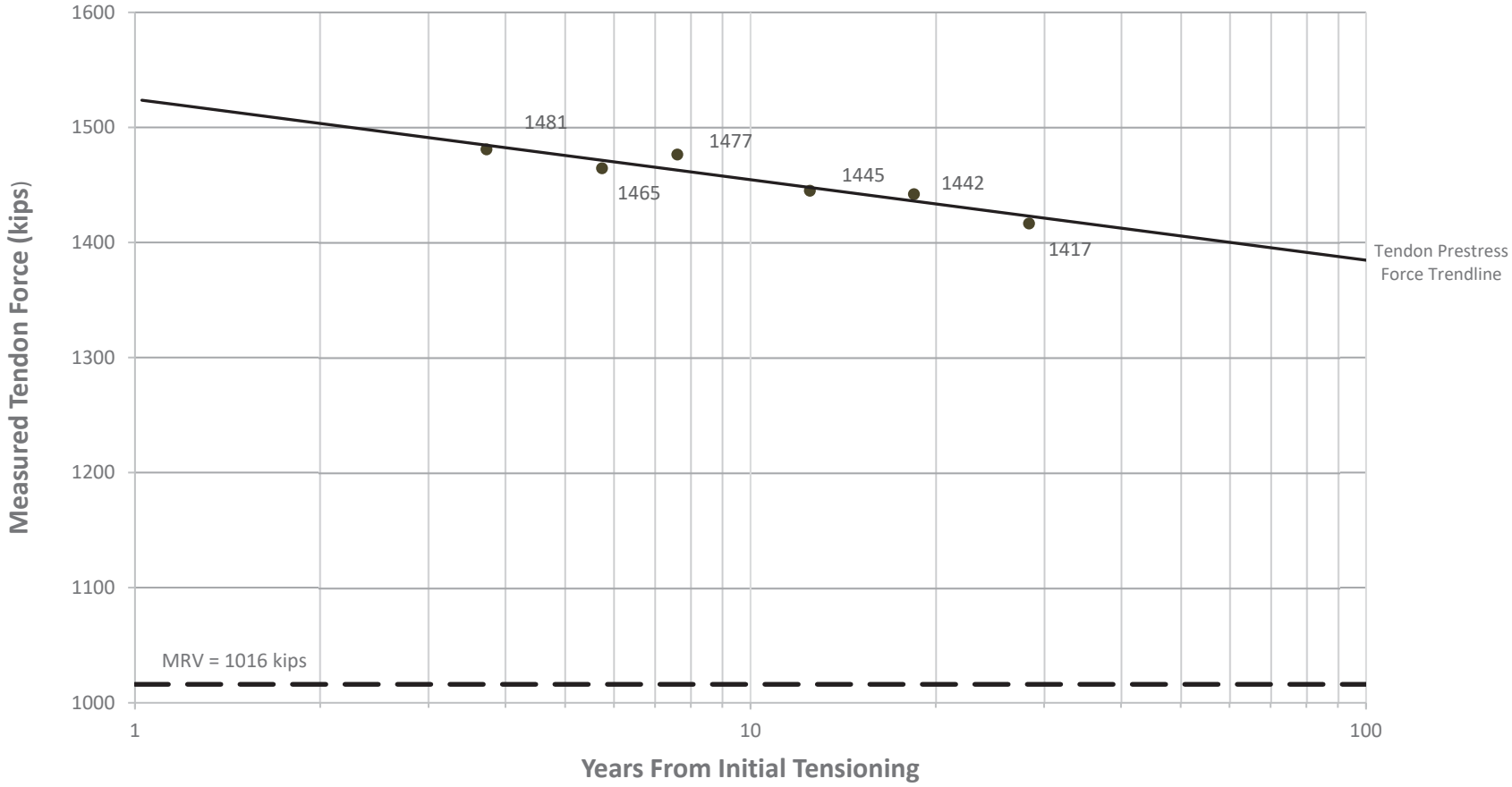

Figure 11
Palo Verde Units 1 and 3
Dome Hoop Tendons (Combined)

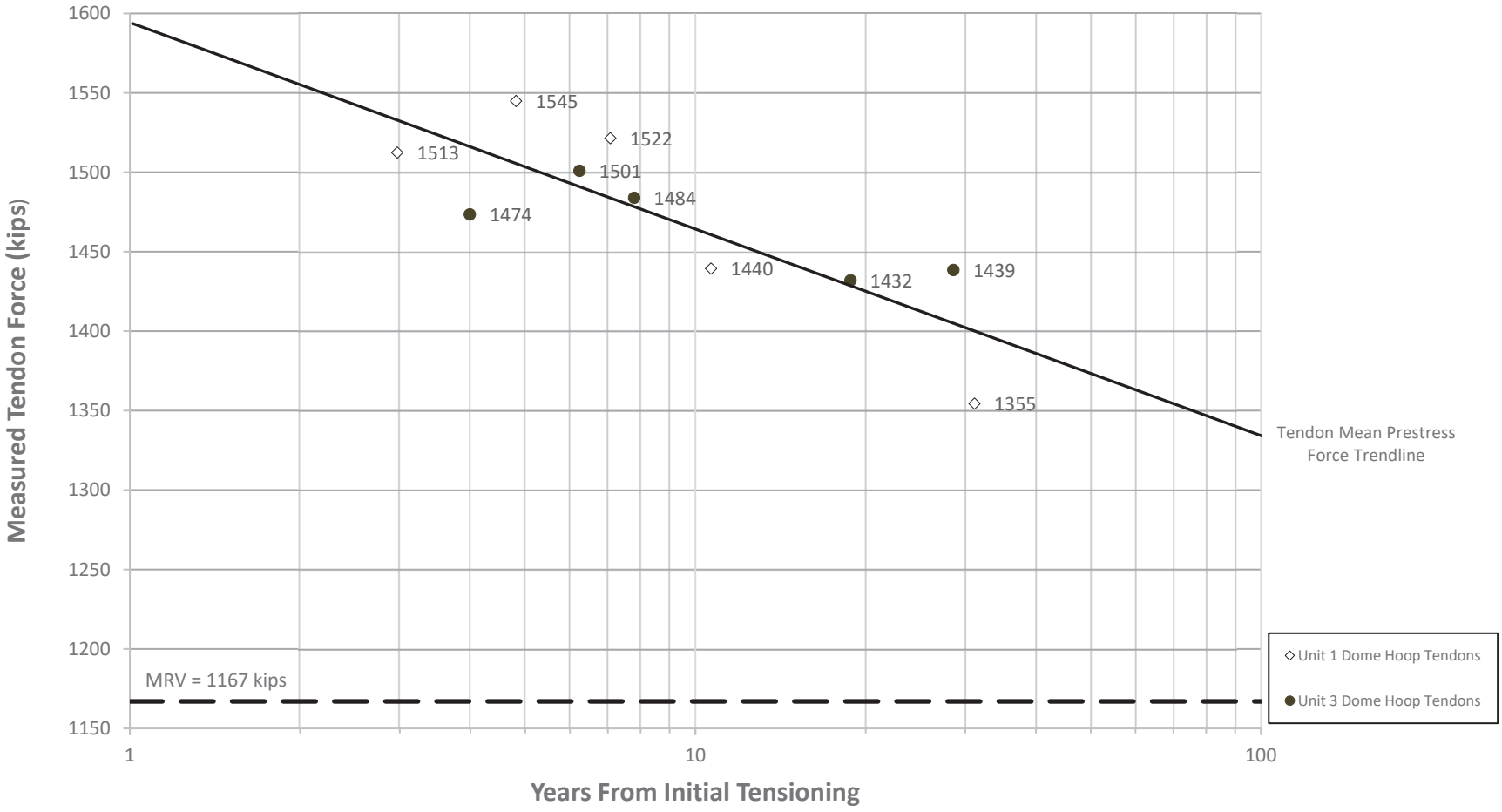

Figure 12
Palo Verde Units 1, 2, and 3
Wall Hoop Tendons (Combined)

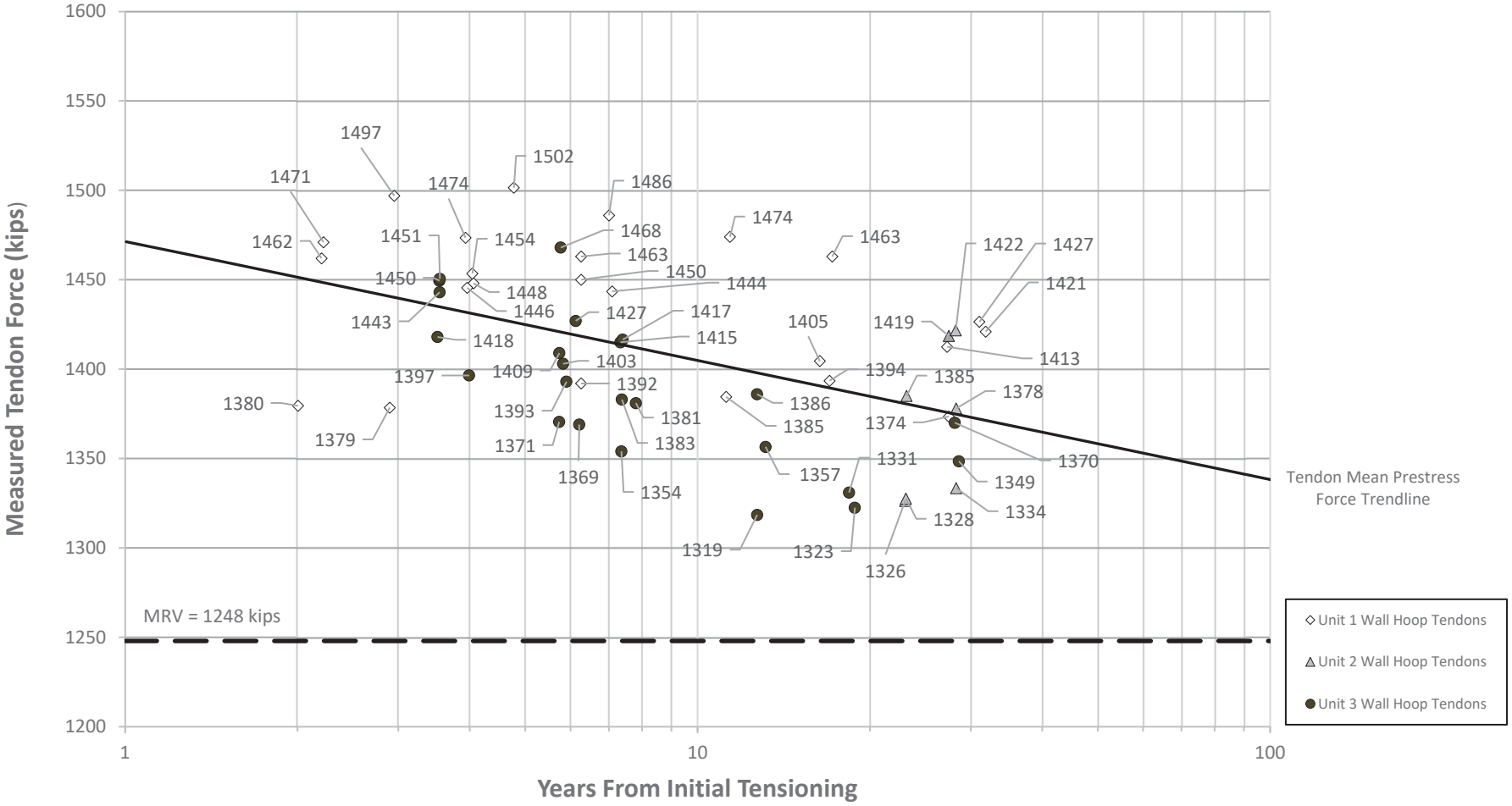

Figure 13
Palo Verde Units 1, 2, and 3
Vertical Tendons (Combined)