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MINISTRY OF DEFENCE LAND RANGES - NOISE AND VIBRATION STUDY

MOD SHOEBURYNESS RANGE

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VOLUME 1: FINAL REPORT

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MOD SHOEBURYNESS RANGE

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Authored By Ian Arthurs BSc (Hons), MSc, MIOA	**Position** Senior Consultant	**Signature**	**Date** 21/06/2016
Reviewed By Rick Methold BEng (Hons), CEng, FIOA	**Position** Director	**Signature**	**Date** 21/06/2016
Checked By Matthew Tomes BSc (Hons), MSc, MIOA	**Position** Senior Consultant	**Signature**	**Date** 21/06/2016
Approved By Rick Methold BEng (Hons), CEng, FIOA	**Position** Director	**Signature**	**Date** 21/06/2016

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This is Volume 1 of 3 of the MOD Shoeburyness Range Final Report. This volume should be read in conjunction with Volumes 2 and 3.

HEAD OFFICE: 16 Station Street, Lewes, East Sussex, BN7 2DB, UK Tel: +44 (0)1273 488186
LONDON OFFICE: 10 Greycoat Place, London, SW1P 1SB, UK Tel: +44 (0)207 9606255
enquiries@southdowns.eu.com www.southdowns.eu.com

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CONTENTS **PAGE NO.**

1. INTRODUCTION

1.1 Background

1.1.1 There is a public perception that Test, Evaluation, Demilitarisation, and Training support activities (the Range Activities) at the Ministry of Defence (MOD) Land Ranges operated by QinetiQ can produce noise and vibration that may be damaging to property through airborne or seismic shock waves.

1.1.2 Southdowns Environmental Consultants Ltd (Southdowns) has been appointed by QinetiQ, on behalf of the MOD, to undertake an independent investigation into whether, and to what extent, Range Activities result in potentially damaging effects to building structures at locations surrounding the Land Ranges.

1.1.3 QinetiQ provides Test and Evaluation (T&E) and Training Support services to MOD under a 25-year contract – the Long Term Partnering Agreement (LTPA).

1.1.4 The initial requirements for the monitoring study were presented in 'Shoeburyness Noise and Vibration Monitoring Study (NVMS) - System Requirements Document (SRD) [1] produced on behalf of the MOD by QinetiQ.

1.1.5 The Single Statement of User Need, set out in the SRD states:

'The User requires a competent independent study to ascertain whether Test, Evaluation, Demilitarisation, and Training support activities (the Range Activities) cause excessive noise or vibration that could possibly cause damage or exceed legal limits and their effect on local communities and at specific locations through airborne or seismic shock waves'

1.1.6 Further consideration was given to the main study aims, the associated risks and study limitations and, following further communication with QinetiQ, the final study scope and key objectives were agreed. These are set out in Section 1.2 below.

1.2 Scope

1.2.1 The study comprised the long-term continuous measurement of airborne sound pressure levels, air overpressure and ground-borne vibration caused by Range Activities at a series of locations within and around the LTPA Land Ranges. The resulting measurement dataset has been analysed and where possible, a causal link between on-Range Activities and measured magnitudes of sound and vibration at surrounding off-Range locations determined.

1.2.2 Where a causal link has been determined from the analysis, then the magnitudes of measured sound / air overpressure and ground-borne vibration have been assessed against appropriate criteria to establish the likely risk of potential building damage.

1.2.3 The following key objectives have been identified to achieve the overarching aims of the study:

- Establishment of relevant metrics, criteria and thresholds for building damage, through the review of contemporary research and published literature;
- Selection of appropriate monitoring equipment and systems;
- Development of a detailed methodology for the undertaking of a large scale monitoring programme;

- Selection of suitable monitoring locations;
- Design and implementation of data management procedures to maintain data quality;
- Collation and analysis of large quantities of data;
- Determination of the magnitude of sound pressure and vibration exposures from Range Activities;
- Development of a robust technique for defining causal link; and
- Reporting of suitable information to the client and other external parties.

1.2.4 The monitoring commenced in the vicinity of the Shoeburyness Range on 28th June 2015 for a period of six months at 10 off-Range monitoring locations. In addition, three monitoring systems were installed within the confines of the MOD Shoeburyness Land Range. The monitoring equipment was set-up with a synchronous trigger system which allowed for simultaneous triggering between the on-Range and off-Range monitoring locations, allowing data capture at the off-Range monitoring locations at the precise time of an activity on the Range.

1.2.5 The assessment criteria and thresholds adopted for this study are summarised in Section 2 of this report. The monitoring methodology is presented in Section 3. Details of the Range firing activities and the data captured are presented in Section 4. The results of the monitoring study are presented and discussed in Section 5 and finally, the study conclusions are presented in Section 6.

2. ASSESSMENT CRITERIA

2.1 Introduction

2.1.1 An independent review of published available contemporary research and guidance has been undertaken to ensure that appropriate assessment indicators and effect thresholds were identified and adopted for the interpretation and assessment of the collated dataset.

2.1.2 The following series of review objectives were established to achieve the overall aim:

- develop an understanding of the acoustic effects of activities which are undertaken on MOD Land Ranges;
- identify the acoustic characteristics which may cause adverse effects leading to structural damage;
- provide best practice guidance for the measurement of acoustic effects from military Land Range Activities at receptor locations distant from Range operations; and
- develop an understanding of the magnitudes at which such acoustic related effects are likely to cause structural damage to property and potential damage to hearing.

2.1.3 The review drew on previous similar studies undertaken in the UK and overseas, as well as relevant British Standards and academic literature, to provide context and technical commentary on the key considerations for the monitoring study.

2.1.4 The primary focus of the review was associated with potential building damage associated with sound pressure, air overpressure and ground-borne vibration generated by Range Activities. Human responses associated with the non-auditory adverse effects of noise and vibration including disturbance, annoyance and sleep disturbance fall outside the scope of the review.

2.1.5 The findings of the research are presented in full in Southdowns report 'Criteria for the Assessment of Potential Building Damage Effects from Military Test Activities' - reference [2].

2.2 Building Damage Thresholds

2.2.1 The findings of the independent review have been used to establish relevant thresholds for the onset of building damage for ground-borne vibration and air overpressure. The thresholds, presented in Table 2.1 and Table 2.2 for ground-borne vibration and air overpressure respectively, have been adopted for the main study, to assess the potential effects from Range Activities, on properties and their occupants in the vicinity of Shoeburyness Range.

TRANSIENT VIBRATION THRESHOLDS FOR THE ON-SET OF COSMETIC DAMAGE					
TYPE OF BUILDING		**MAXIMUM DISPLACEMENT**	**PEAK COMPONENT PARTICLE VELOCITY IN FREQUENCY RANGE OF PREDOMINANT PULSE**		
		Less than 4 Hz	Less than 4Hz	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings		-	-	50 mms^{-1} at 4 Hz and above	
Unreinforced or light framed structures. Residential or light commercial type		0.6 mm zero to peak	-	15 mms^{-1} at 4 Hz increasing to 20 mms^{-1} at 15 Hz	20 mms^{-1} at 15 Hz increasing to 50 mms^{-1} at 40 Hz and above
Precautionary Thresholds Adopted	**Any building**	**0.6 mm zero to peak**	**12.5 mms^{-1}**		
	Vulnerable Structures		**6 mms^{-1}**		

TABLE 2.1: GROUND-BORNE VIBRATION THRESHOLDS FOR ON-SET OF COSMETIC DAMAGE TO BUILDINGS

Notes:
[1] – further information on the derivation of these values is provided in Reference [2].

Air Overpressure Threshold Scale	
dB L_{pZpeak}	**Categorisation**
180	Onset of structural damage
171	General window breakage
151	Some window breakage
140	Reasonable threshold to prevent glass and plaster damage
134	USBM 'Safe' maximum
120	Secondary vibration effects including rattling windows and objects

TABLE 2.2: AIR OVERPRESSURE THRESHOLDS FOR DAMAGE AND OTHER EFFECTS ON BUILDING STRUCTURES

[1] – further information on the derivation of these values is provided in Reference [2].

2.3 The Control of Noise at Work Regulations 2005

2.3.1 In addition to the consideration of potential damage to building structures, the study has also considered the potential for Range Activities to exceed statutory limits, which include the thresholds set out in the Control of Noise at Work Regulations 2005, as referenced in the Shoeburyness SRD [1].

2.3.2 The Control of Noise at Work Regulations 2005 (CNWR) [3] came into effect on the 6th April 2006 and describe the various obligations on employers and employees to ensure that the risk of hearing damage in the workplace is minimised. The Regulations are based around two action levels and an exposure limit value, which are reproduced in Table 2.3.

Lower exposure action values	daily or weekly personal exposure of 80 dB(A)[1]
	peak sound pressure of 135 dB(C)[2]
Upper exposure action values	daily or weekly personal exposure of 85 dB(A) [1]
	peak sound pressure of 137 dB(C) [2]
Exposure limit values	daily or weekly personal exposure of 87 dB(A) [1]
	peak sound pressure of 140 dB(C) [2]

TABLE 2.3: SUMMARY OF ACTION AND EXPOSURE LIMIT VALUES FROM THE CNWR 2005

Notes:
[1] - The daily or weekly personal exposure is the level of exposure to noise of a person, averaged over a working day or week; and
[2] - The peak sound pressure is the maximum value of the C-weighted sound pressure, to which a person is exposed during the working day.

2.3.3 The above action values and exposure limits are used to determine the risk to hearing and when action should be taken to reduce an employee's exposure to noise.

3. MONITORING METHODOLOGY

3.1 Study Location

3.1.1 Shoeburyness Range is in Essex on the southeast coast of England.

3.1.2 The Range covers 9,300 acres, with an additional 35,000 acres at low water. It is home to 200 residents living in approximately 100 dwellings. There are seven working farms managing 700 acres between them.

3.1.3 The Shoeburyness Range includes 21 firing areas and has facilities for dynamic, static, demilitarisation and environmental testing. It is the largest Testing and Evaluation static Range in the UK.

3.1.4 The Range is surrounded by a large number of coastal towns and villages on both sides of the Thames Estuary, with Essex to the north and Kent to the south. The nearest mainland village is Great Wakering and the nearest large town is Southend-on-Sea, approximately eight miles away.

3.1.5 It is understood that the Shoeburyness Range uses acoustic forecasting to operate within a contractual noise limit of 125 dB L_{pZpeak} at existing off-site noise monitoring stations. It is understood that if noise forecasting indicates that Range Activities are expected to exceed 125 dB L_{pZpeak}, then the activities will be postponed until more favourable meteorological conditions occur. QinetiQ monitors noise at seven locations (including one on the Range), around the Thames Estuary.

3.2 Site Selection Process

3.2.1 Locations for the monitoring study were selected on the basis of both acoustic and non-acoustic considerations, having regard to appropriate published guidance documents. The practicalities of installing, securing and maintaining the monitoring equipment were also key considerations.

3.2.2 Following the completion of the site selection process, 10 ‘off-Range’ locations and 3 ‘on-Range’ locations were selected. One of the off-Range locations was within the Range boundary, but was considered a representative location for the local population of Great Wakering. The monitoring locations are presented in Table 3.1 overleaf and Figure A1 of Appendix A.

3.2.3 Full details of the site selection process for the monitoring locations are provided in Volume 2 – Technical Appendices: Detailed Methodology [4].

Monitoring Location ID	Area / Region	Approximate Distance to Range (SHB_R2_RUG) (km)
SHB_R1_DAT	On-Range (DAT Control Building)	n/a
SHB_R2_RUG	On-Range (Rugwood Control Building)	n/a
SHB_R3_BAT	On-Range (Q Battery Control Building)	n/a
SHB_OS1	Holland-On-Sea	32
SHB_OS2	Jaywick	26
SHB_OS3	Southminster	10
SHB_OS4	Lee-over-Sands	23
SHB_OS5	Mersea Island	24
SHB_OS6	Great Wakering	7
SHB_OS7	Isle of Sheppey	19
SHB_OS8	Seasalter	27
SHB_OS9	Herne Bay	29
SHB_OS10	Birchington- on-Sea	35

TABLE 3.1: MONITORING LOCATIONS

3.3 Selected Monitoring Equipment

3.3.1 The selected monitoring equipment deployed for the main study was based on the SINUS Samurai monitoring system. The system comprises an industrial PC running Windows 7 and features a synchronous triggering function which has allowed for simultaneous triggering between separate monitoring locations. Data collected during the monitoring study was stored locally on Solid State Drives (SSD) installed within each of the monitoring stations, and then uploaded to a dedicated secure central data server on a daily basis via a File Transfer Protocol (FTP).

3.3.2 Each monitoring station comprised of:

- SINUS Swing 4-channel noise and vibration monitoring station; and
- Uninterruptible Power Supply (UPS) system (up to 48 hours of power backup).

3.3.3 Connected accessories to each of the SINUS noise and vibration monitoring stations included:

- G.R.A.S. 41CN Outdoor Microphone System;
- SINUS tri-axial geophone;
- Garmin Global Positioning System (GPS) receiver; and
- Thies Clima Sensor (at selected monitoring locations).

3.4 Synchronous Detection Technique

3.4.1 A feature of the monitoring system deployed was the use of a GPS clock to synchronise the time base across all monitoring systems at both on-Range and off-Range monitoring locations. Combined with this was the use of a networked synchronous triggering system which allowed for simultaneous triggering between on-Range, and all off-Range monitoring locations. To ensure data capture, the trigger threshold for all three on-Range monitors was set at 75 dB L_{pAF}. When this trigger level, at one of the on-Range monitors was exceeded, a trigger command was transmitted to the off-Range monitoring systems via the internet, which allowed for data to be captured at the monitoring locations at the precise time of an on-Range Activity occurrence. In addition to the main triggering system, each off-Range monitor was also configured to trigger following a localised (non Range related) noise event.

3.4.2 A 5 second pre-trigger audio capture, followed by a post trigger audio capture of 30 seconds was set up for the on-Range systems. The off-Range monitors were set with a 5 second pre-trigger capture, followed by a post-trigger capture of audio for up to 120 seconds, which allowed for small delays implicit in the triggering system and also delays expected due to the propagation of air overpressure and/or ground-borne vibration over the longer distances involved.

3.4.3 The hardware was programmed to ensure that any trigger activity was captured from both the microphone and geophone sensors simultaneously, to allow side by side comparison of sound pressure and ground-borne vibration in the time domain.

3.4.4 The introduction of a synchronised time base and networked triggering system allowed for a clear link to be established between on-Range Activities and magnitudes of sound / air overpressure and vibration at off-Range locations, which is a principle aim of the monitoring study. An overview of the synchronous trigger system process is displayed graphically in Figure A2 of Appendix A.

3.4.5 Full details of the monitoring equipment and data management systems are provided in Volume 2 – Technical Appendices: Detailed Methodology [4].

4. MONITORING SUMMARY

4.1 Summary of Range Activities and Data Capture

4.1.1 The full Shoeburyness Range firing records, as provided by QinetiQ Ltd between 28th June 2015 and 24th December 2015 are presented in Volume 3: Technical Appendices – Results [5].

4.1.2 During the monitoring study, there were a total of 8,727 events which triggered the on-Range monitors (3,927 captured by SHB_R1_DAT, 1,331 captured by SHB_R2_RUG and 3,469 captured by SHB_R3_BAT).

4.1.3 Of the 8,727 triggered events, 8,237 were attributable to non-firing activities on the Range including local vehicle movements, wind noise on the microphone, local maintenance works, Range alarms and vehicle sirens.

4.1.4 Of the 490 (8,727 – 8,237) Range triggered events, 178 triggered more than one of the on-Range monitors, capturing a total of 312 individual Range Activities.

4.1.5 During the monitoring study, the Range logs recorded a total of 338 Range Activities, of these, 26 (338 – 312) were not captured by Range monitors.

4.1.6 Of the 26 Range Activities not captured by the on-Range monitors. 13 were not captured because they did not exceed the trigger threshold level, whilst 13 were not captured due to equipment outages.

4.1.7 Of the 312 individual triggered Range Activities, the number of activities captured at an individual off-Range monitor ranged between 309 and 198. The number of activities not captured at an off-Range location was influenced by a variety of reasons including: unforeseen delays in installing the ADSL services at off-Range locations, Range network outages and ADSL outages.

4.1.8 For cases where the on-Range monitors were not triggered, it was found that the off-Range monitors were also not triggered by sound / air overpressure from the Range Activity.

4.1.9 A summary of the quantities of captured on-Range and off-Range Activities during the monitoring study is presented in Table B1 of Appendix B.

4.2 Summary of Data Capture

4.2.1 Full details of scheduled equipment maintenance works (including telecommunications and data management system maintenance) and known system outages experienced during the monitoring study are presented in Volume 2- Technical Appendices – Detailed Methodology [4], whilst Tables B2 to B7 of Appendix B provide summarised schedules of Range Activities captured at each of the individual off-Range monitoring locations respectively.

5. RESULTS AND DISCUSSION

5.1 Introduction

5.1.1 The dataset collected during the monitoring study has been processed, using appropriate methodologies and statistical techniques, to determine causal links and to assess the magnitude of the measured values. These methodologies and techniques are described in full in Volume 2 – Technical Appendices – Detailed Methodology [4], which includes worked examples of a selection of confirmed Range Activities captured during the monitoring study. In addition examples of non-Range (or 'extraneous') activities are presented to enable a direct comparison with those known to be associated with Range Activities.

5.1.2 Section 5.2 below presents a summary of the testing undertaken to test for any causal link between on-Range and off-Range triggered activities, while Section 5.3 presents a summary of the results for the on-Range and off-Range triggered activities and a summary of activities concluded not to be associated with the Range.

5.1.3 The full study results for sound pressure / air overpressure and vibration including time histories, sound spectrograms and calculated statistical results are presented in Volume 3 –Technical Appendices – Results [5].

5.2 Test for Causal Link

5.2.1 The classification of the test for a causal link used herein provides a measure of the probability that a Range Activity at an on-Range monitoring location has given rise to a measured response at an off-Range monitoring location.

5.2.2 Automated signal processing techniques were used to determine an initial indication of causality at all monitoring locations for all captured Range Activities. The magnitude of causality presented in the results has been categorised accordingly:

- positive causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);
- uncertain causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);
- no causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality).

5.2.3 Activities which fall into positive causality (PC) have been included in the data set for assessing magnitudes of sound / air overpressure at off-Range locations, as it is accepted that the measured effect is most likely to be due to Range Activities.

5.2.4 Activities which fall into the uncertain causality (UC) category have also been included in the assessment nevertheless, as it is accepted that the measured effect could be due to Range Activities.

5.2.5 For activities which identified no causality (NC) following the initial application of the signal processing techniques, further manual analytical interrogation of the data set was applied in each case to determine whether a causal link could be established.

5.2.6 Where causality was subsequently established, the individual Range Activities were included in the assessment of sound / air overpressure magnitudes from Range Activities.

5.2.7 A summary of the distribution of confirmed Range Activities detected at the off-Range monitoring locations is presented graphically in Figure A3 in Appendix A, which identifies the proportion of the activities that have been assessed to have: positive, uncertain or no causality. These results are also tabulated in Table 5.1.

Off-Range Monitoring Location ID	Total On-Range Activities[1] Captured	Total Off-Range Activities[1] Captured	No. of Activities Captured			% Activities Captured		
			No Causality	Uncertain Causality	Positive Causality	No Causality	Uncertain Causality	Positive Causality
SHB_OS1	312	279	25	73	181	9%	26%	65%
SHB_OS2	312	269	21	50	198	8%	19%	73%
SHB_OS3	312	275	19	65	191	7%	24%	69%
SHB_OS4	312	273	14	69	190	5%	25%	70%
SHB_OS5	312	300	25	70	205	8%	23%	69%
SHB_OS6	312	305	32	113	160	10%	37%	53%
SHB_OS7	312	305	31	120	154	10%	39%	51%
SHB_OS8	312	298	24	101	173	8%	34%	58%
SHB_OS9	312	303	31	106	166	10%	35%	55%
SHB_OS10	312	244	24	63	157	10%	26%	64%

TABLE 5.1: DISTRIBUTION OF ACTIVITIES INTO CAUSAL CATEGORIES

Notes:
[1] number of individual firing activities captured

5.2.8 The results indicate that Range Activities which showed 'No-Causality' varied between 5% (SHB_OS4) and 10 % (SHB_OS6, SHB_OS7, SHB_OS9 and SHB_OS10) across the individual off-Range monitoring locations, when using a combination of signal processing techniques and manual interrogation of the data set.

5.2.9 Between 74% (SHB_OS2) and 50% (SHB_OS7) of the confirmed on-Range Activities have been classified as 'Positive Causality' across all of the off-Range monitoring locations.

5.2.10 The off-Range monitoring location where the highest number of activities were categorised as 'Uncertain Causality' was at SHB_OS7 whilst the lowest proportion of 'Uncertain Causality' was at SHB_OS2.

5.2.11 SHB_OS3 and SHB_OS4 are shown to exhibit the lowest proportion of 'No Causality' activities whilst the highest proportion of 'No Causality' activities was at SHB_OS6.

5.2.12 The study has therefore identified a confirmed causal link between Range Activities and measured effects at off-Range monitoring locations, for up to 74% of the triggered activities. If those activities falling into the 'Uncertain Causality' category are included for a cautious assessment then up to 95% (SHB_OS4) of the on-Range Activities show a causal link at off-Range monitoring locations. Activities falling into the 'No Causality' category have not been included in the assessment.

5.3 Sound / Air Overpressure and Vibration Magnitudes

5.3.1 The dataset (Positive and Uncertain Causality) has been processed to calculate absolute sound / air overpressure and vibration values at both the on-Range and off-Range monitoring locations.

5.3.2 The sound / air overpressure and vibration levels measured at SHB_OS1 to SHB_OS10 that correspond to on-Range Activities are presented fully in Volume 3: Technical Appendices – Results [5].

5.3.3 Sound / air overpressure and vibration levels are presented graphically in Figures A4 to A33 of Appendix A and summarised in Tables B2 to B7 of Appendix B.

Summary of Range Activity Results

5.3.4 The results indicate that the highest Z-weighted (or linear) sound pressure level resulting from Range Activity, measured at an off-Range location during the monitoring study was 124 dB L_{Zpeak}, which was measured at SHB_OS6. This falls below the adopted study threshold to prevent glass and plaster damage of 140 dB L_{Zpeak}, by approximately 16 dB.

5.3.5 The highest C-weighted sound pressure level from Range Activity, measured at an off-Range location was 118 dB L_{Cpeak}, which falls below the CNWR lower exposure action value of 135 dB $L_{Cpeak.}$

5.3.6 Detailed analysis of the results has shown that the vibration signals captured at off-Range locations arrived at a similar time to the sound pressure waves, indicating that the vibration generated by Range Activities at off-Range locations was a result of a coupling effect between the sound / air overpressure wave and the ground at the point of measurement, rather than from direct ground-borne propagation of vibration from the source of Range Activity. An example of this is shown graphically in Figure A36 of Appendix A for SHB_OS4 with the signal arriving around 55 seconds after the on-Range event was triggered. If the measured vibration was associated with ground-borne propagation then a pronounced difference in arrival times would be observed with the vibration signal arriving in advance of the sound pressure signal.

5.3.7 Notwithstanding that the vibration measured is considered to be attributable to the air overpressure coupling (as opposed to ground-borne vibration), the highest component vibration velocity level measured at an off-Range location arising from the Range Activities was 0.75 mms^{-1}, which was measured on the z axis at SHB_OS4. This falls considerably below the ground-borne vibration thresholds for the on-set of cosmetic damage adopted for this study as set out in Table 2.1.

5.3.8 Table B11 of Appendix B presents the distribution of maximum component velocities per each orthogonal axis. A total of 65% of events across all monitoring stations (Range and Off-Range) observed a maximum velocity level on the z-axis (vertical) compared to 23%

on the y-axis and 12% on the x-axis. Of all the off-Range locations, only SHB_OS6 showed a most frequent maximum velocity on a horizontal axis (x or y).

5.3.9 The maximum displacement levels for both static and dynamic activities fell below the threshold of 0.6 mm zero to peak at frequencies below 4 Hz. The highest measured level of displacement was 0.01 mm, measured at SHB_OS4.

Summary of Off-Range Locally Triggered (extraneous) Activities

5.3.10 A summary of locally triggered measurements (triggered activities not associated with Range Activities e.g. birdsong, aircraft, road traffic) is presented in Volume 3: Technical Appendices – Results [5]. The table presents the highest $L_{Cpeak,}$ L_{Zpeak} and PPV values measured at each off-Range monitoring location between 28th June 2015 and 24th December 2015.

5.3.11 The results indicate that the highest number of off-Range triggered activity caused by local activities was 785, at SHB_OS2. These were mainly attributable to dog barks.

5.3.12 The lowest number of off-Range triggered activities which were caused by local activity was 37, which occurred at SHB_OS9.

5.3.13 The highest level measured at any off-Range location, which occurred as a result of local activity was 140 dB $L_{Zpeak,}$ which was measured at SHB_OS8 and was confirmed to be attributable to local fireworks.

5.3.14 The highest vibration levels measured as a result of off-Range local activity ranged from 0.09 mms^{-1} at SHB_OS6 to 7.64 mms^{-1}, at SHB_OS7.

5.4 Meteorological Data

5.4.1 Meteorological data was collected at the following four monitoring locations during the monitoring study:

- SHB_R2_RUG, On-Range (Rugwood Control Building);
- SHB_OS3, Southminster;
- SHB_OS5, Mersea Island; and
- SHB_OS9, Herne Bay.

5.4.2 The results of the meteorological monitoring including wind speed (ms^{-1}), wind direction, air temperature (°C), relative humidity (%), atmospheric pressure (mBar) and rain rate (mm/h) for each of the four locations gathered during the monitoring study are presented fully in Volume 3 -Technical Appendices – Results [5].

5.4.3 The results of the meteorological monitoring collated at the on-Range location (SHB_R2_RUG) during the monitoring study are summarised in Table B8 of Appendix B and discussed in the following sub-sections.

5.4.4 Wind speeds measured on-Range during the Range Activities presented in this report were found to average 6.2 ms^{-1} with maximum and minimum levels of 15.2 ms^{-1} and 0.8 ms^{-1} respectively.

5.4.5 The average air temperature measured on-Range during the Range Activities presented in this report was 15.4°C with maximum and minimum levels of 24.3 °C and 2.0°C respectively.

5.4.6 The average relative humidity measured on-Range during the Range Activities presented in this report was 79.0% with maximum and minimum levels of 100 % and 46.3 % respectively.

5.4.7 Maximum and minimum rain rate levels of 1.7 mm/h and 0.0 mm/h respectively were measured on Range during the Range Activities presented in this report.

5.4.8 A review of the meteorological data presented in Volume 3 -Technical Appendices – Results [5] indicates Range firing Activity data capture has occurred under a range of meteorological conditions over a six month period, including conditions which are likely to have enhanced sound pressure propagation over large distances.

6. CONCLUSIONS

6.1.1 The sound pressure level and vibration monitoring commenced in the vicinity of the Shoeburyness Range on 28th June 2015 for a period of 6 months at 10 no. off-Range monitoring locations. In addition, 3 no. on-Range monitoring systems were installed within the confines of the MOD Shoeburyness Land Range. The monitoring equipment was set-up with a synchronised triggering system which enabled simultaneous triggering between the on-Range and off-Range monitoring locations, allowing data capture at the off-Range monitoring locations at the precise time of an activity at the Range.

6.1.2 Activity data capture has occurred under a range of meteorological conditions over a six month period, including conditions which are likely to have enhanced sound pressure propagation over large distances.

6.1.3 In total, 312 individual Range Activities were captured by the on-Range monitors. Of these, the maximum number of activities captured at a single off-Range location was 309, whilst the minimum was 198 at another.

6.1.4 Analytical and statistical functions were developed to analyse the recorded signals captured to determine whether a causal link exists between activities occurring on-Range and the signals captured at off-Range locations.

6.1.5 The study has tested and confirmed a 'probable' causal link between Range Activities and measured effects at off-Range monitoring locations, for up to 73% of the triggered activities. If those activities also falling into the 'possible' causal link category are included, then up to 95% (SHB_OS4) of the Range Activities would confirm a causal link at off-Range monitoring locations.

6.1.6 The results of the study indicate, 99 % (N = 2,853) of the Range Activity data points captured at off-Range monitoring locations remained below the adopted study threshold for secondary vibration effects including ratting of objects of 120 dB L_{Zpeak}.

6.1.7 Of the remaining 1% (N = 33), the highest measured sound pressure level at an off-Range location which was attributable to a Range Activity was 124 dB L_{Zpeak}. This falls below the adopted study threshold to prevent glass and plaster damage of 140 dB L_{Zpeak}, by 16 dB.

6.1.8 There is no evidence of appreciable ground-borne vibration (propagation of vibration through the ground) being received at any of the off-Range monitoring locations.

6.1.9 Vibration measured as a result of the coupling between the air overpressure and the ground did not exceeded the ground-borne vibration thresholds adopted for this study for the on-set of cosmetic damage at any off-Range locations.

6.1.10 Whilst not considered to be directly relevant in cases where vibration propagated through the ground is minimal or absent, nor when building damage risk is the sole consideration, the maximum level at any location also falls below the threshold of 134 dB L_{Zpeak} recommended by the USBM for blasting regime design purposes as a 'safe' maximum by 10 dB.

6.1.11 None of the measurements that relate to confirmed Range Activity at off-Range locations, exceeded the lower action value of 135 dB L_{Cpeak}, set out in The Control of Noise at Work Regulations 2005.

6.1.12 The magnitudes of sound / air overpressure and vibration resulting from the on-Range Activities that have been catalogued during the monitoring period are unlikely to have resulted in damage to building structures at locations surrounding the Range when compared to the thresholds derived and adopted for this study.

6.1.13 The Range Activities observed during the study period have been described by QinetiQ as being representative of typical activities undertaken on the Shoeburyness Range, relating to scheduling, type, size and frequency of firing.

6.1.14 As such, based upon consideration of the data gathered and assessment thresholds derived, the continuation of Range Activities under the same conditions of operation and management by QinetiQ would lead to the conclusion that any building damage as a result of activities at the Shoeburyness Range is improbable.

7. REFERENCES

1. A.K. Waters. 2012 Shoeburyness Noise & Vibration Monitoring Study (NVMS), System Requirements Document. QINETIQ/12/02300/1.0/ 2012.

2. Southdowns Environmental Consultants Ltd. 2016. *Criteria for the Assessment of Potential Building Damage Effects from Range Activities*. 1897m-SEC-00151-04.

3. Controlling Noise at Work (2005). The Control of Noise at Work Regulations 2005. Guidance on Regulations

4. Southdowns Environmental Consultants Ltd. 2016. *Volume 2 – Technical Appendices: Detailed Methodology.* 1897m-SEC-00178-03.

5. Southdowns Environmental Consultants Ltd. 2016. *Volume 3: Technical Appendices – Results.* 1897m-SEC-00178-03.

APPENDIX A: FIGURES

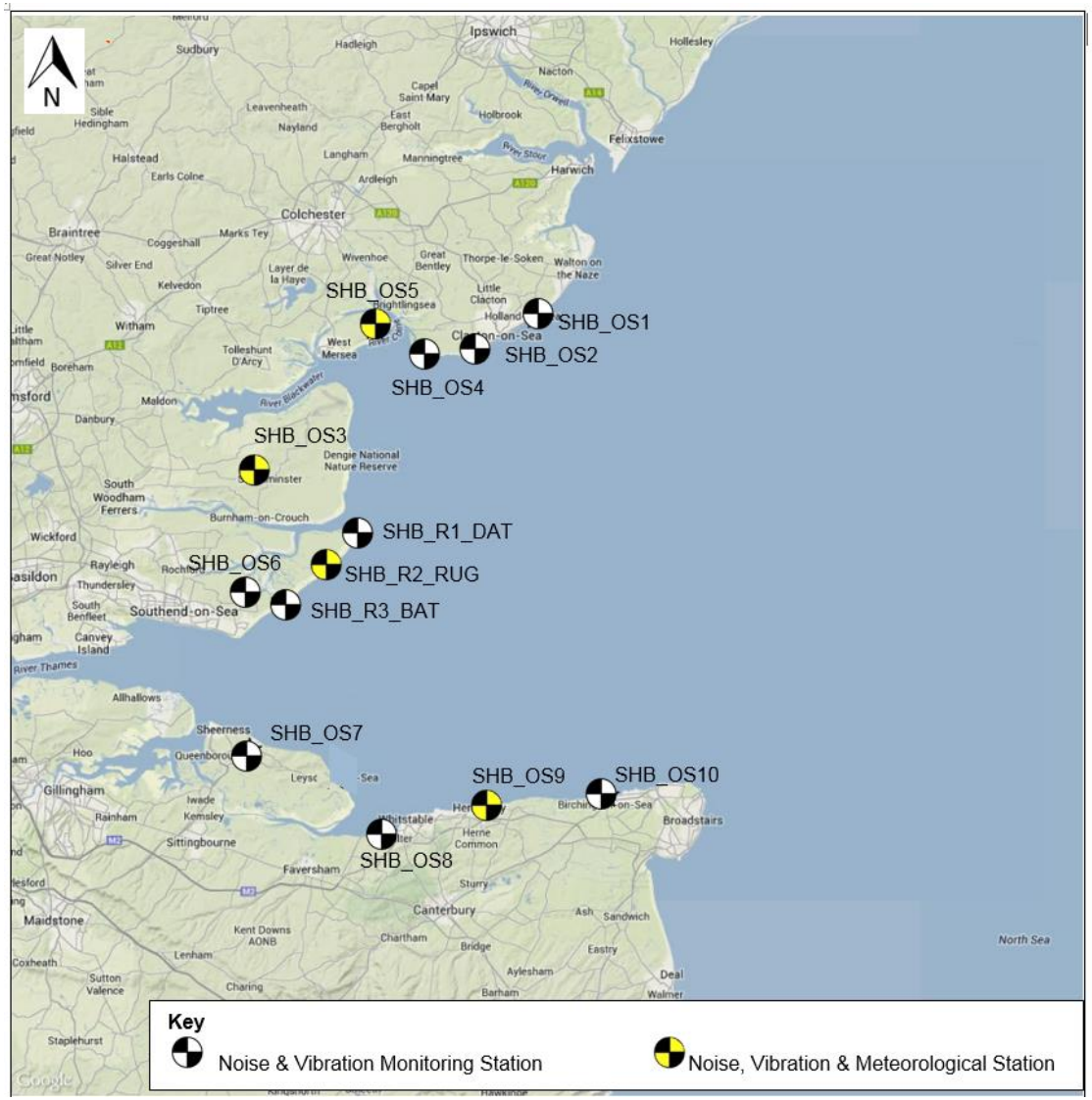

FIGURE A1: MONITORING LOCATIONS

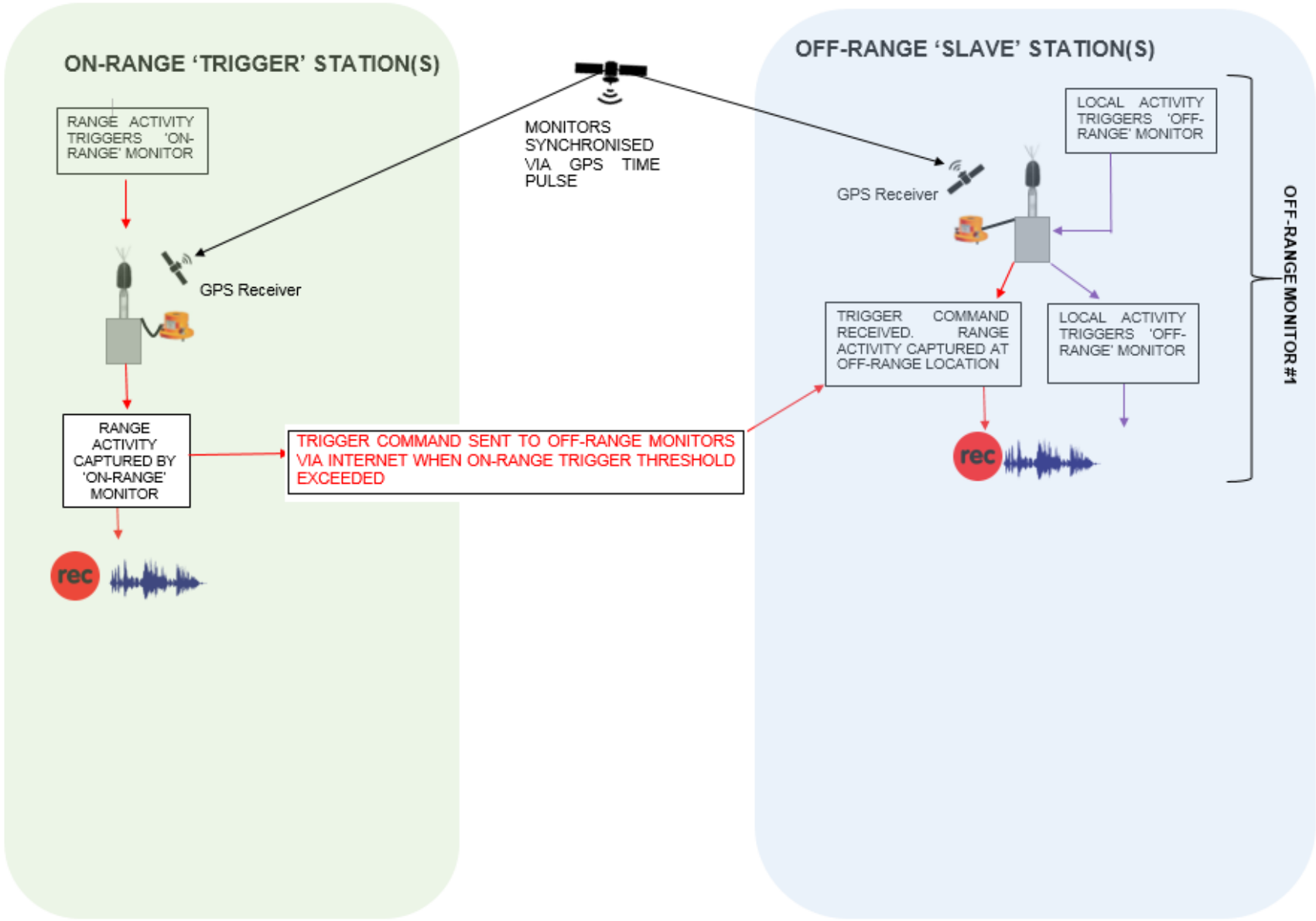

FIGURE A2: SYNCHRONOUS TRIGGER SYSTEM PROCESS

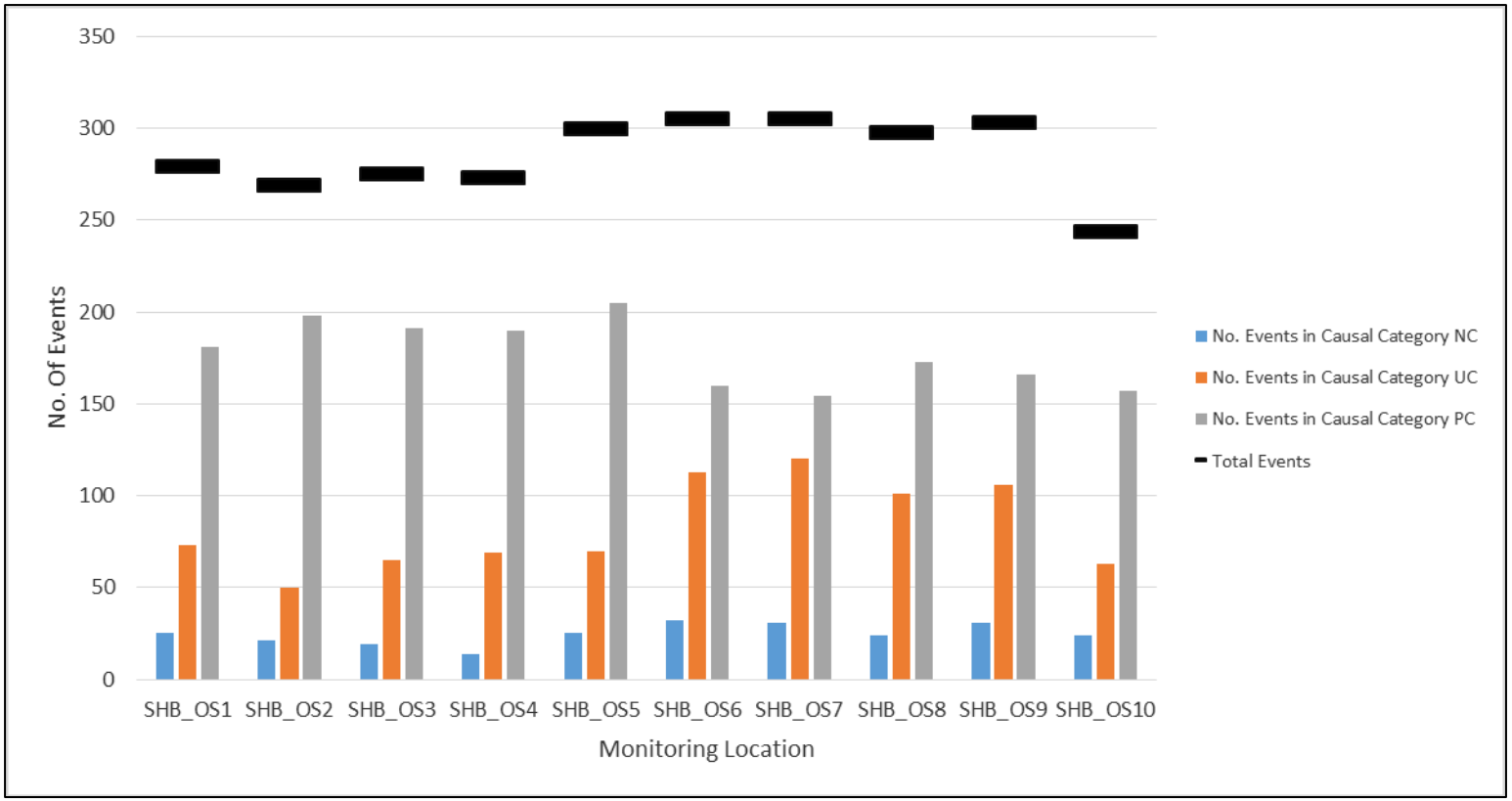

FIGURE A3: **DISTRIBUTION OF ACTIVITIES INTO CAUSAL LINK CATEGORIES**

Notes:
[1] total number of Range Activities captured at each off-Range monitoring location represented by black markers;
[2] 'No Causality' or NC represented by blue bars
[3] 'Uncertain Causality' or UC represented by orange bars;
[4] 'Positive Causality' or PC represented by grey bars.

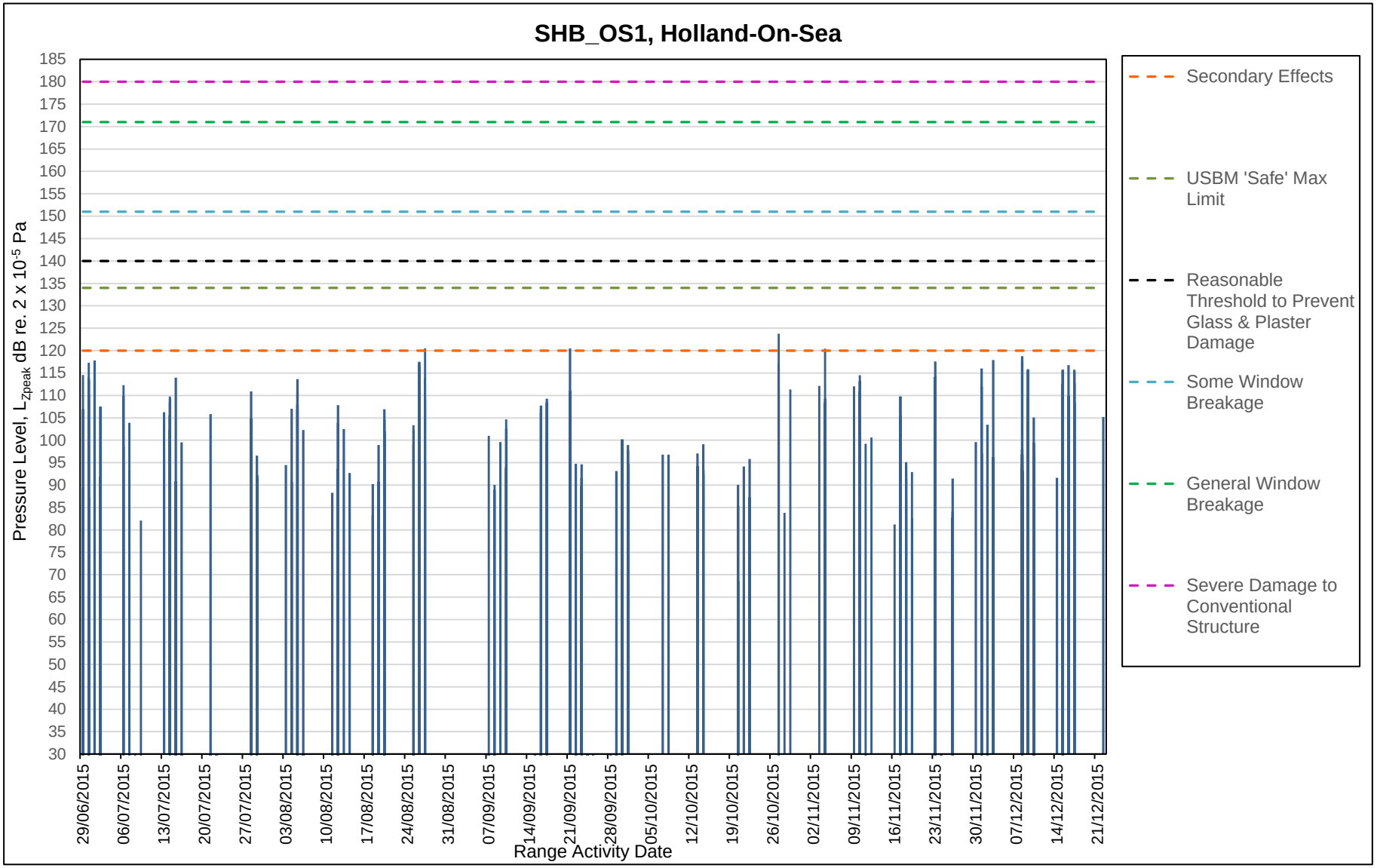

FIGURE A4: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS1, HOLLAND-ON-SEA, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

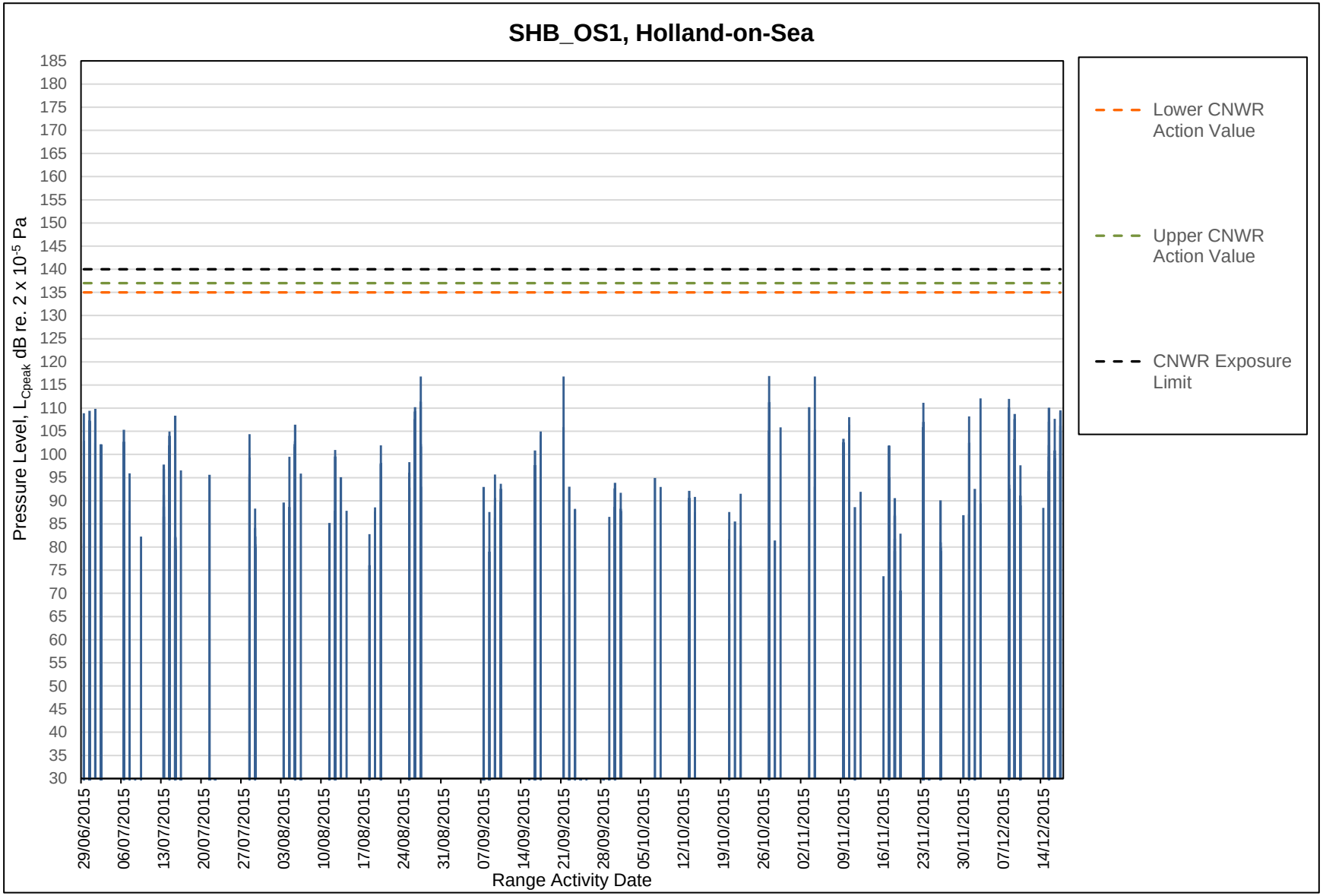

FIGURE A5: SUMMARY OF L_{CPEAK} VALUES, SHB_OS1, HOLLAND-ON-SEA, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

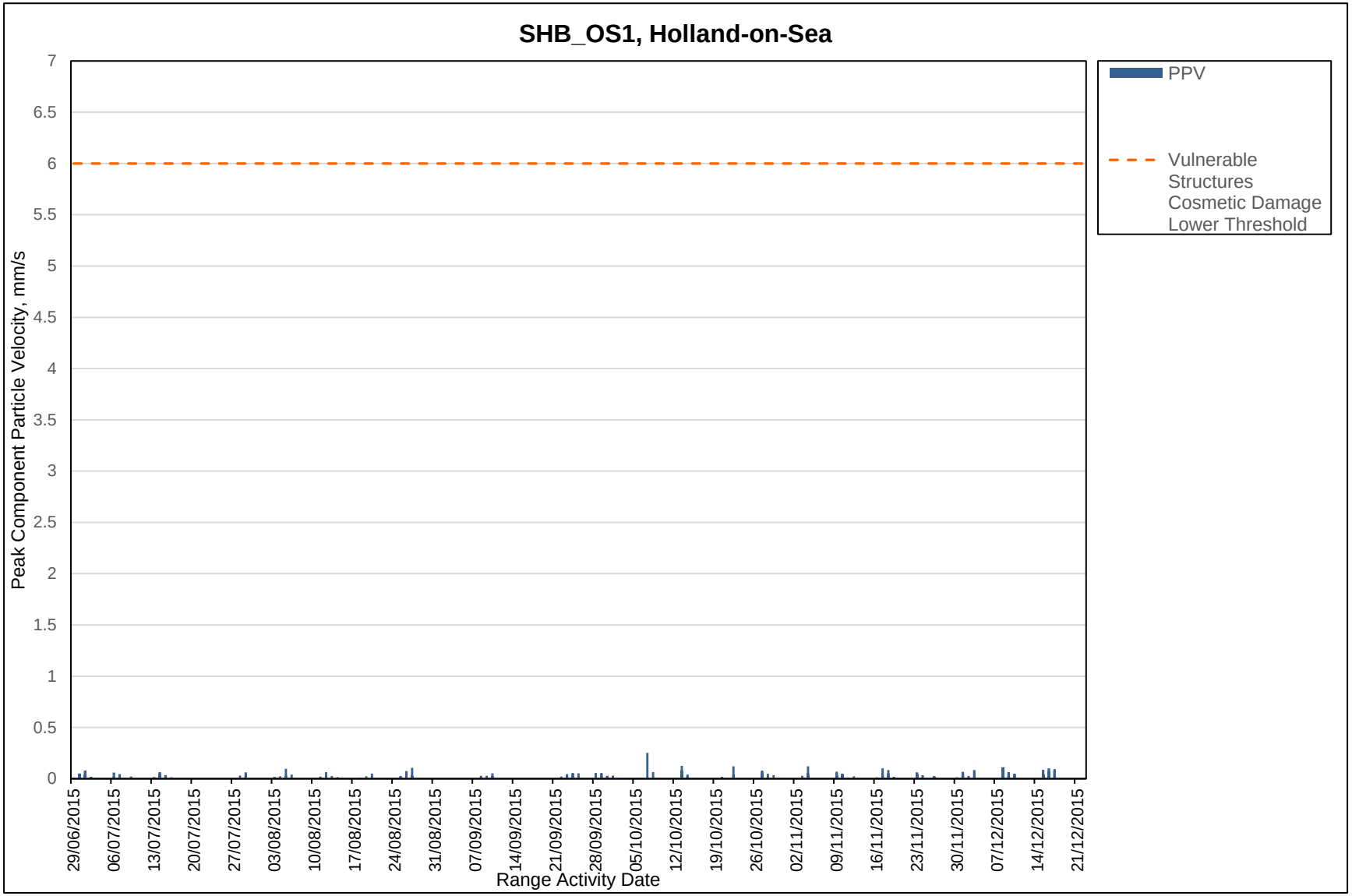

FIGURE A6: SUMMARY OF PPV VALUES, SHB_OS1, HOLLAND-ON-SEA, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

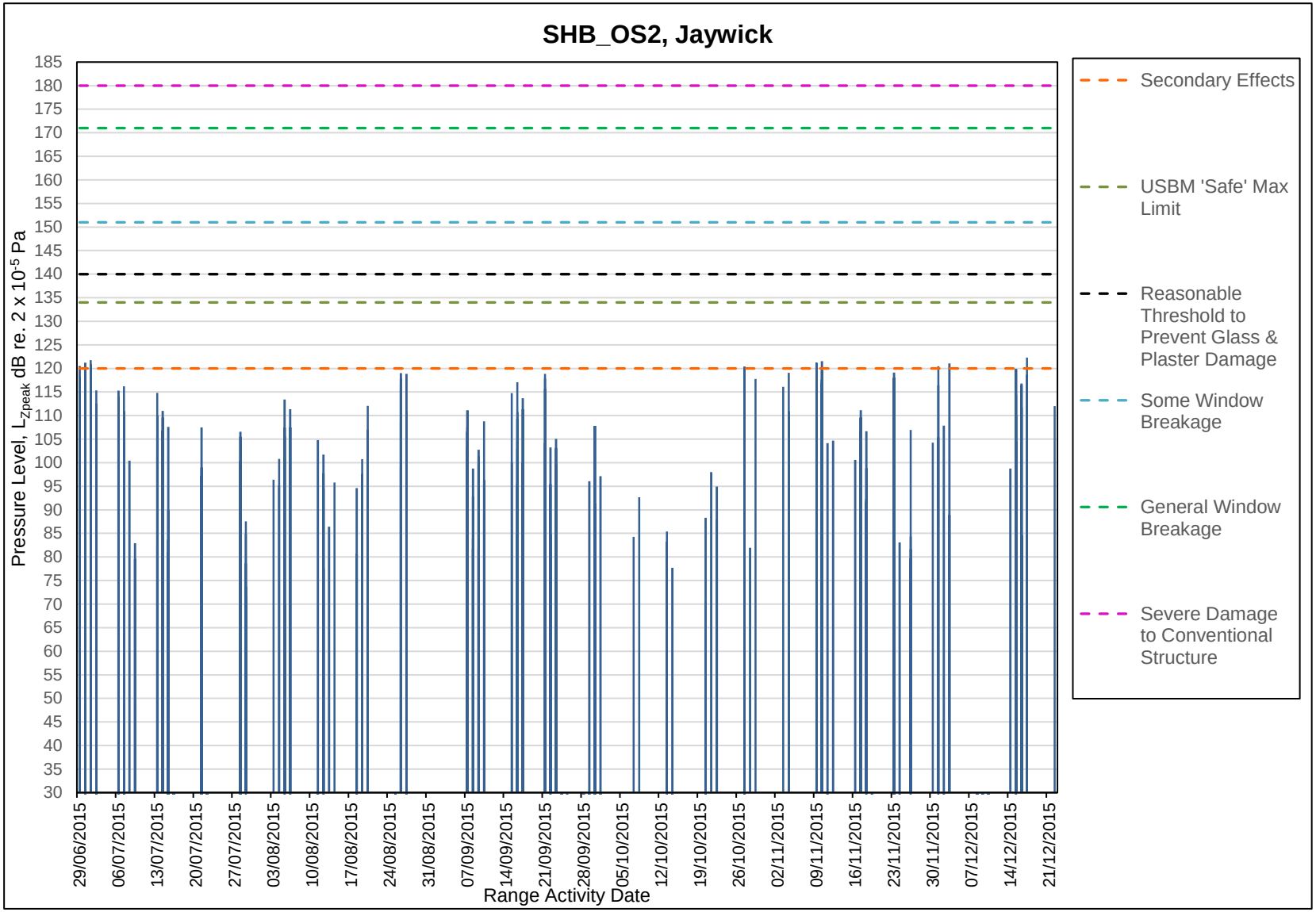

FIGURE A7: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS2, JAYWICK, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

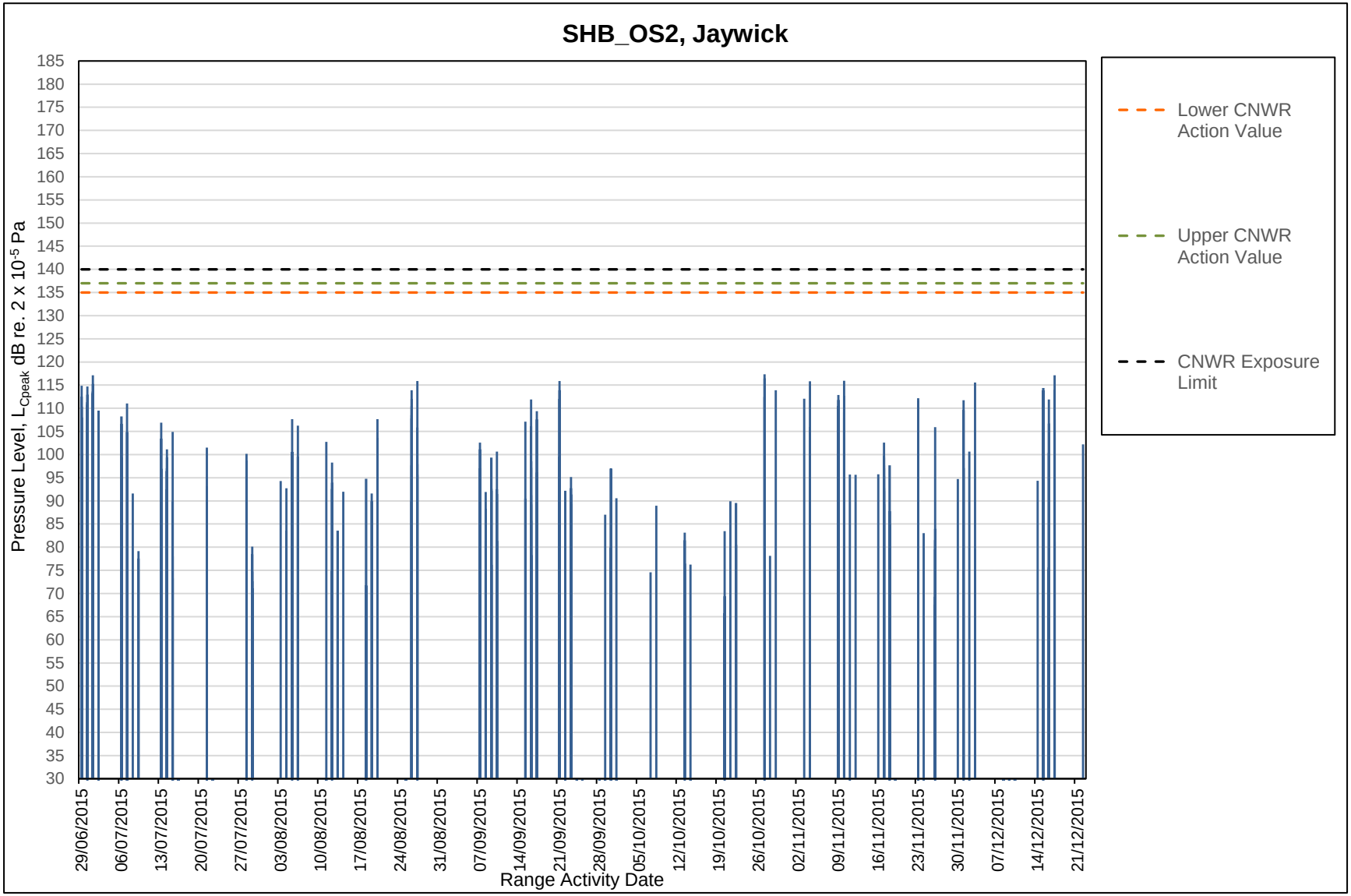

FIGURE A8: SUMMARY OF L_{CPEAK} VALUES, SHB_OS2, JAYWICK, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

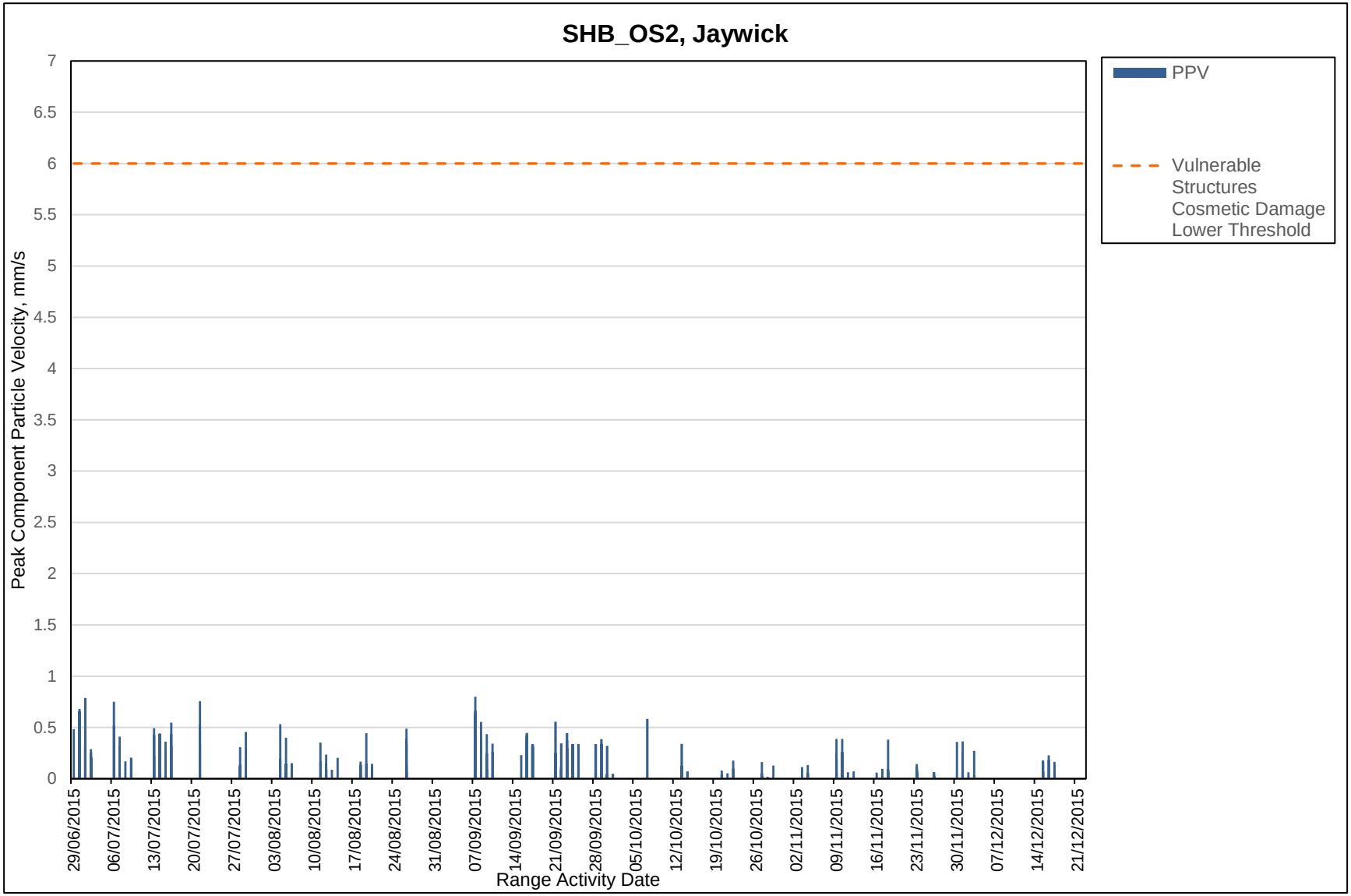

FIGURE A9: SUMMARY OF PPV VALUES, SHB_OS2, JAYWICK, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

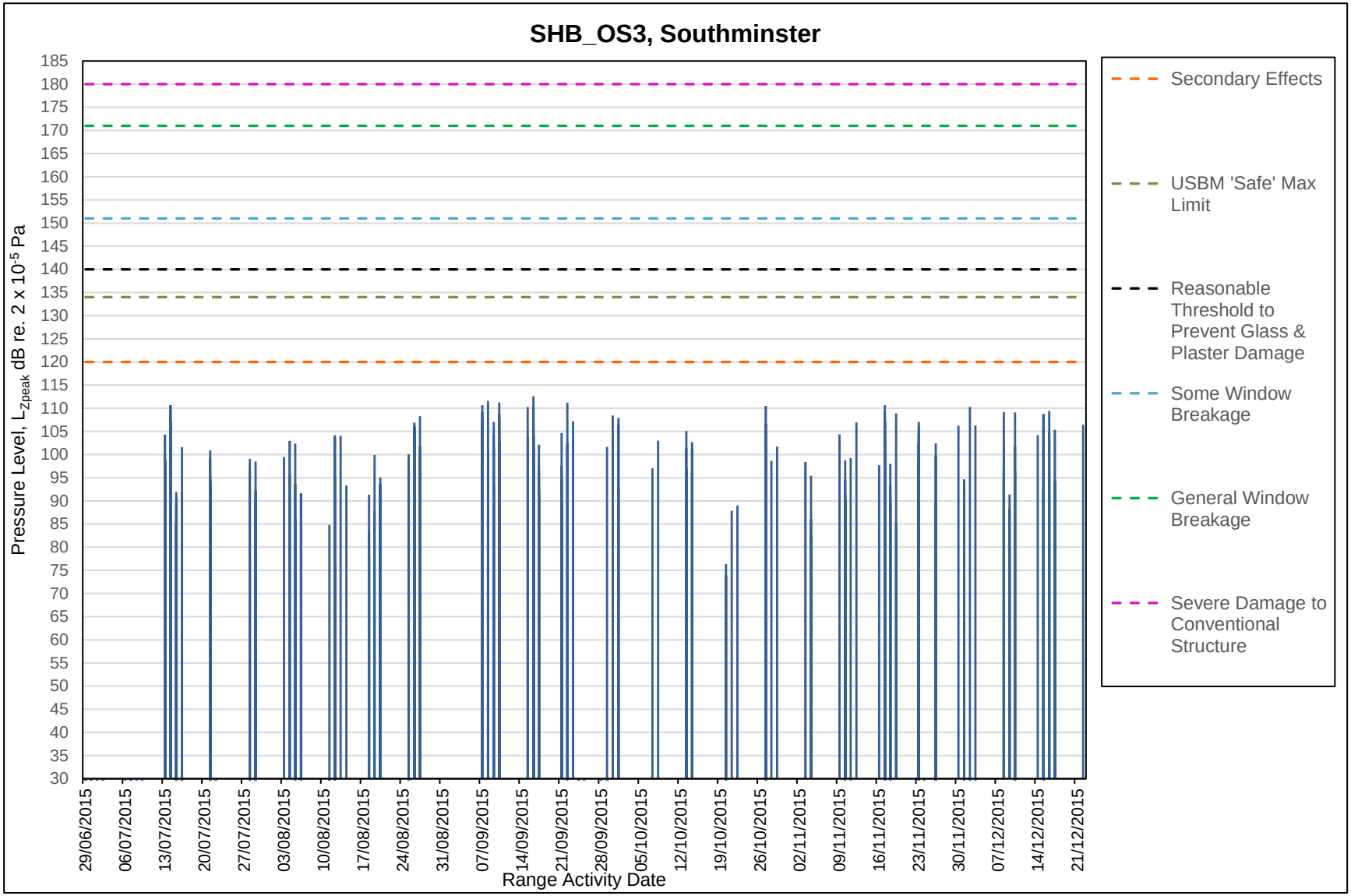

FIGURE A10: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS3, SOUTHMINSTER, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

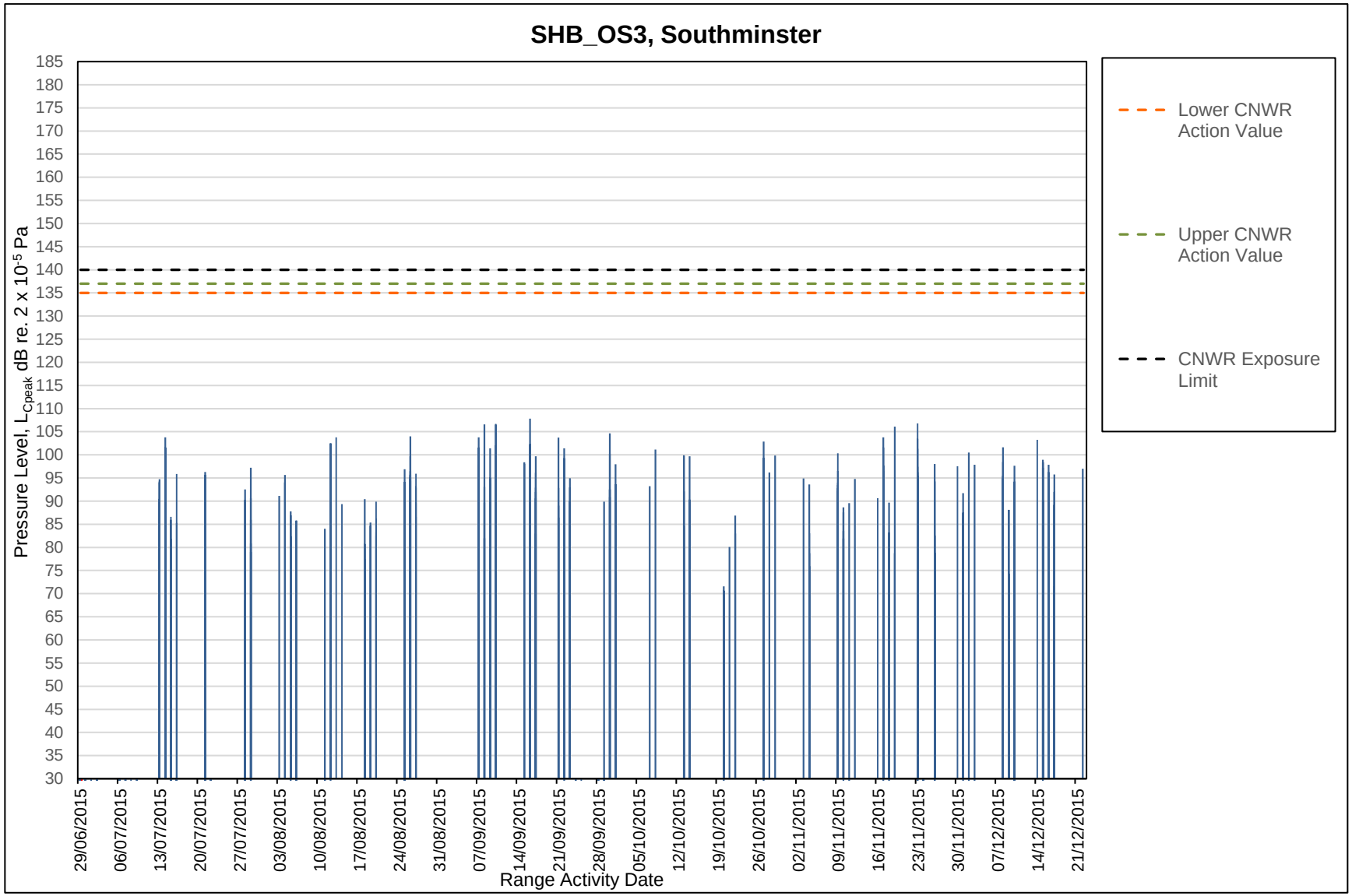

FIGURE A11: SUMMARY OF L_{CPEAK} VALUES, SHB_OS3, SOUTHMINSTER, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

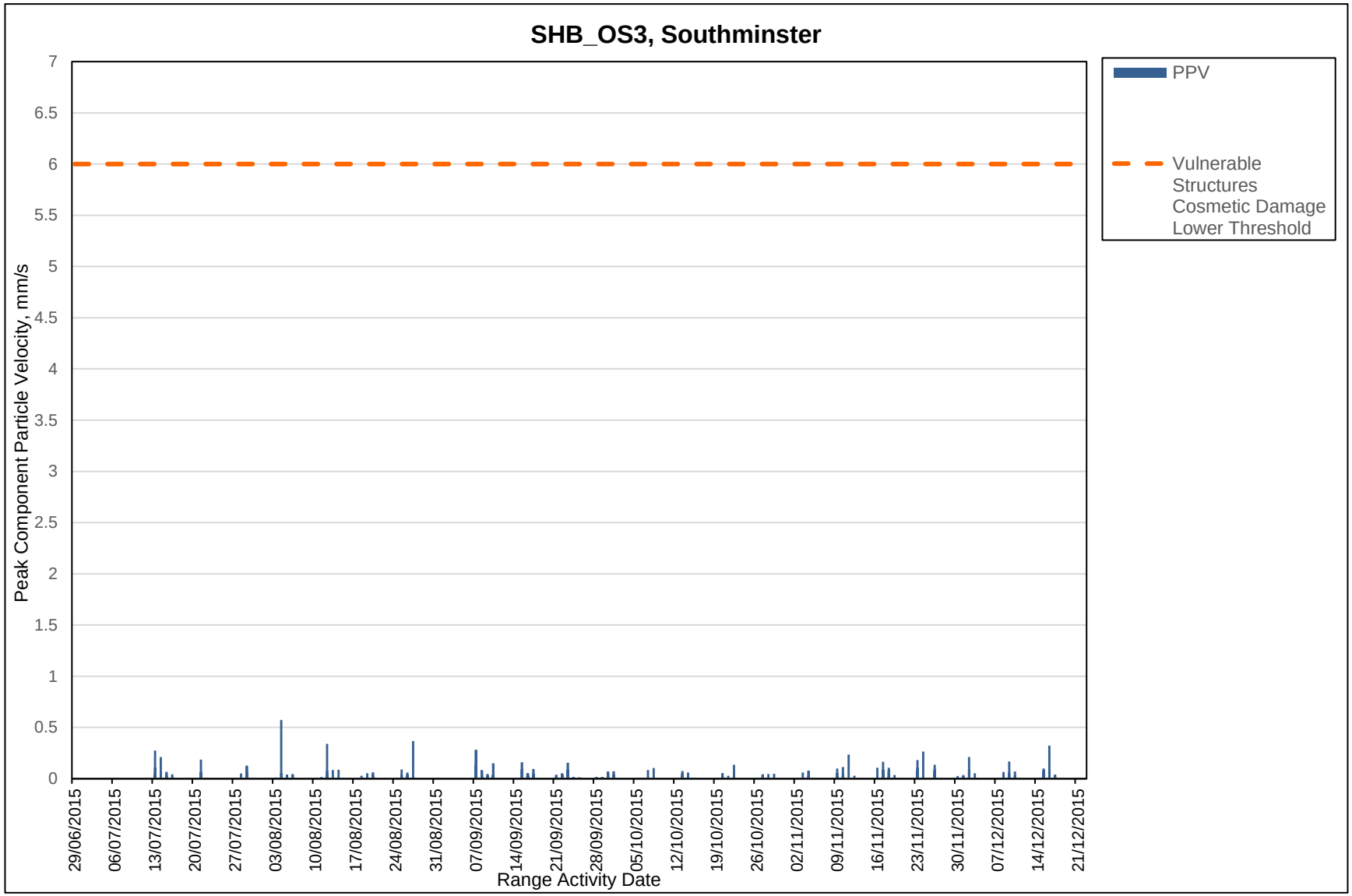

FIGURE A12: SUMMARY OF PPV VALUES, SHB_OS3, SOUTHMINSTER, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

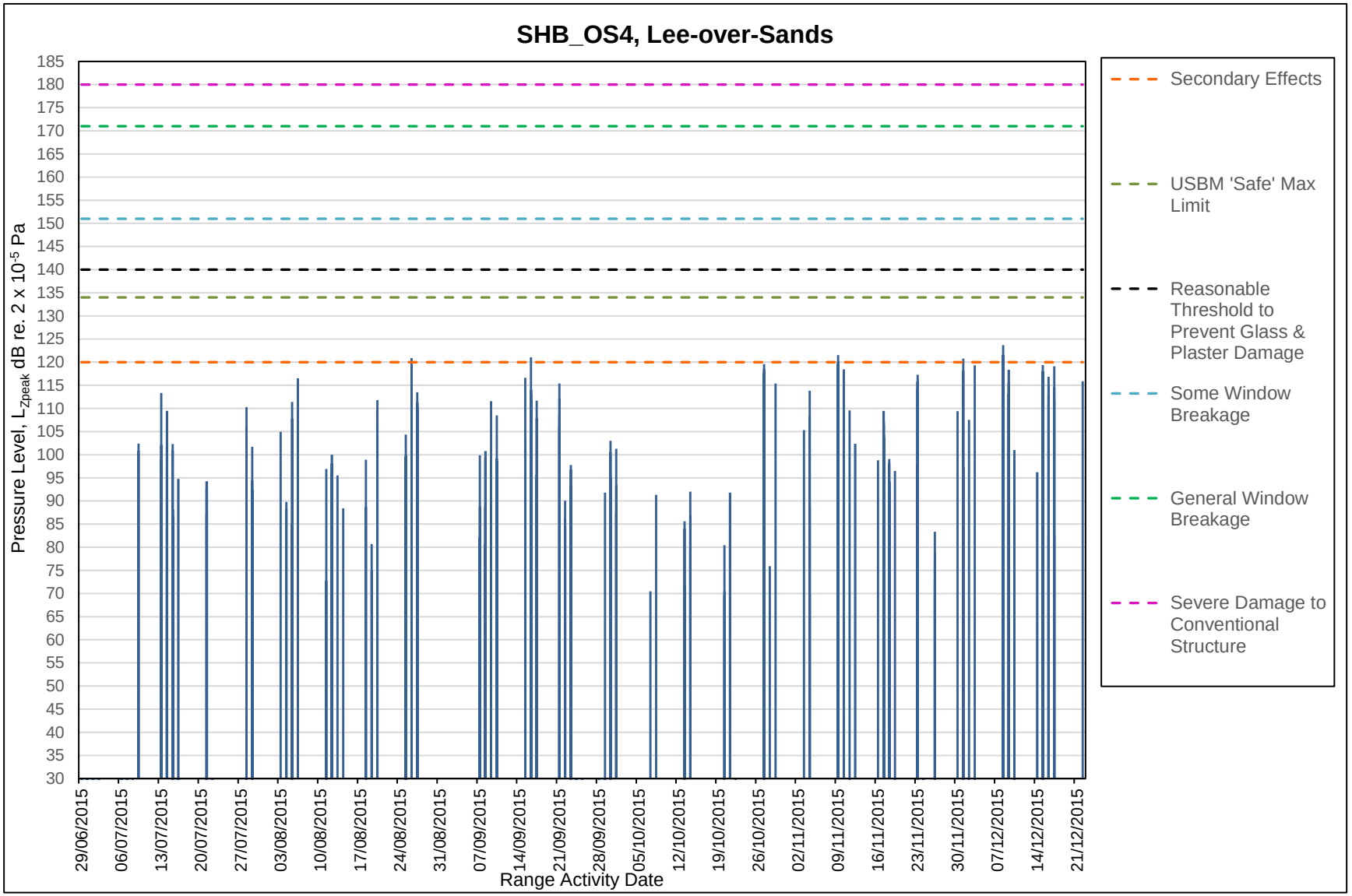

FIGURE A13: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS4, LEE-OVER-SANDS, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

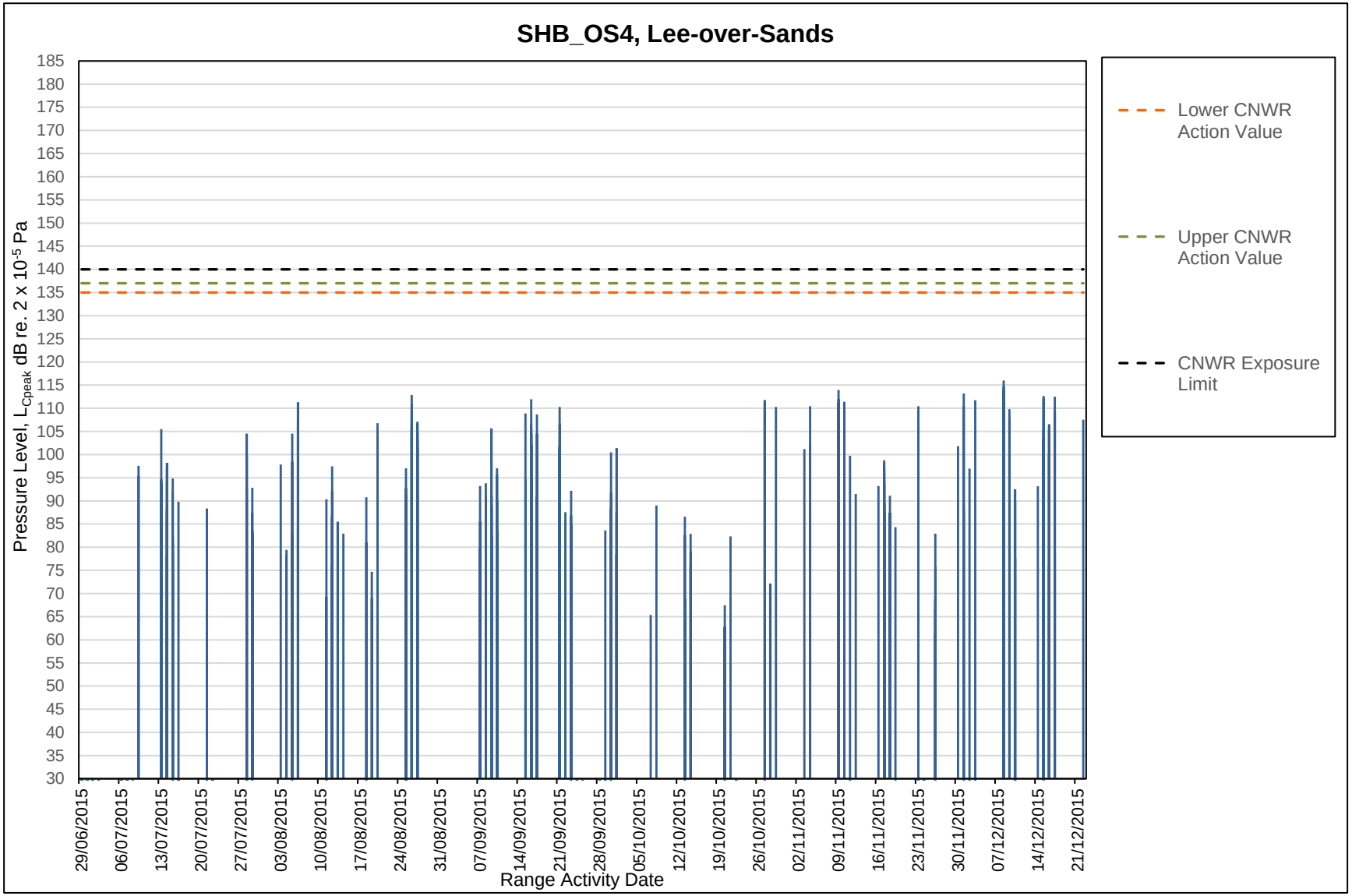

FIGURE A14: SUMMARY OF L_{CPEAK} VALUES, SHB_OS4, LEE-OVER-SANDS, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

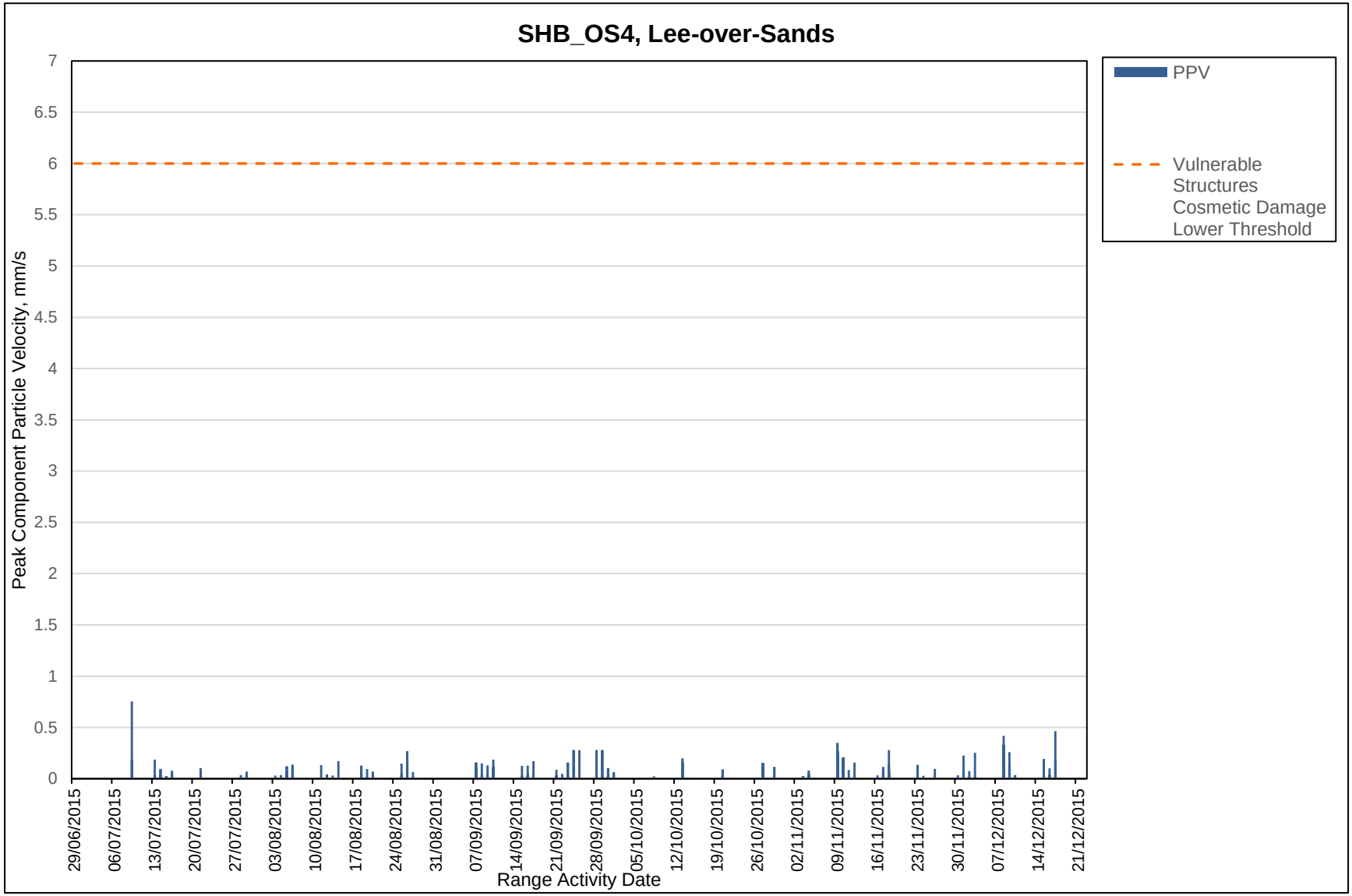

FIGURE A15: SUMMARY OF PPV VALUES, SHB_OS4, LEE-OVER-SANDS, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

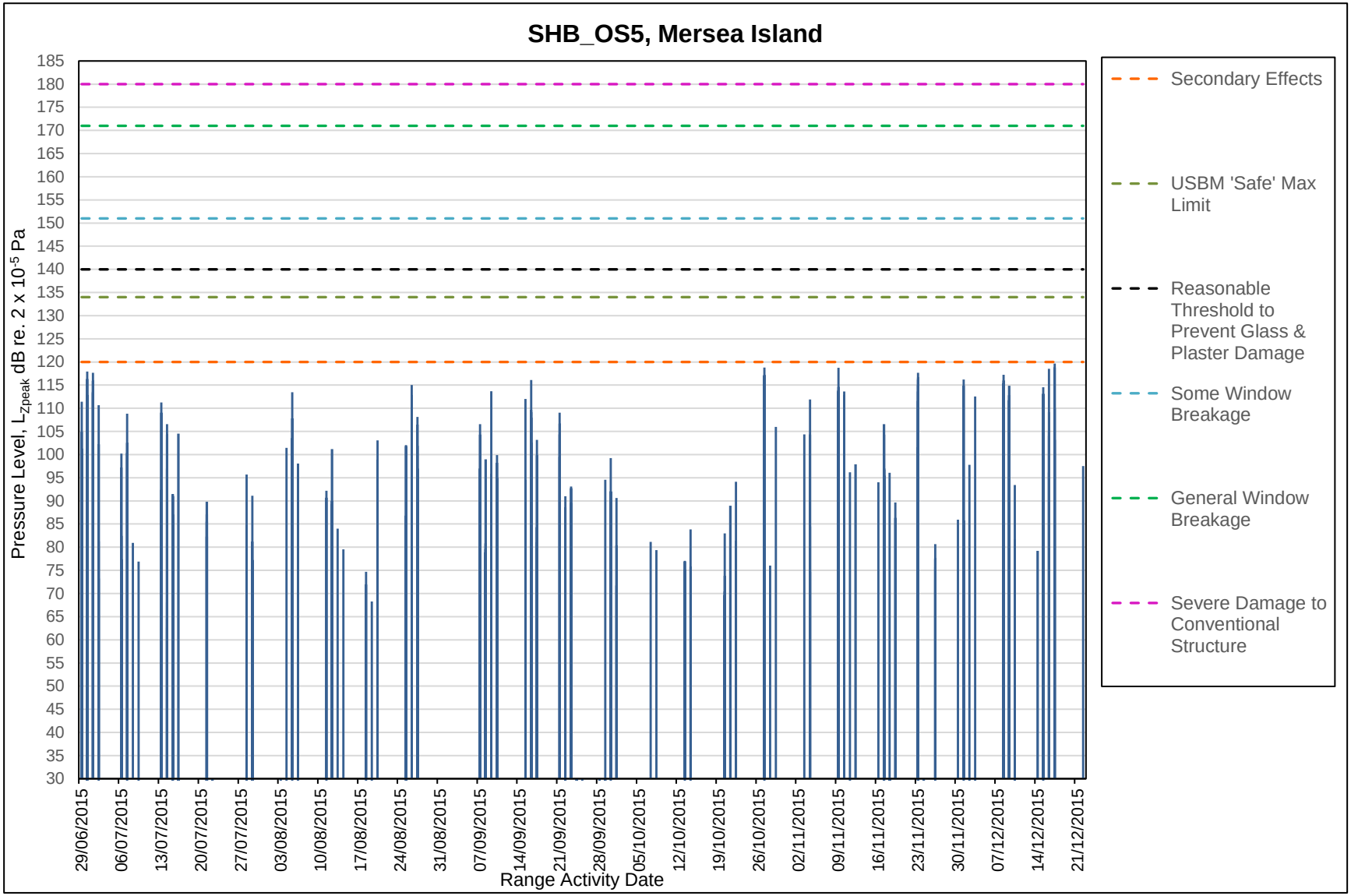

FIGURE A16: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS5, MERSEA ISLAND, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

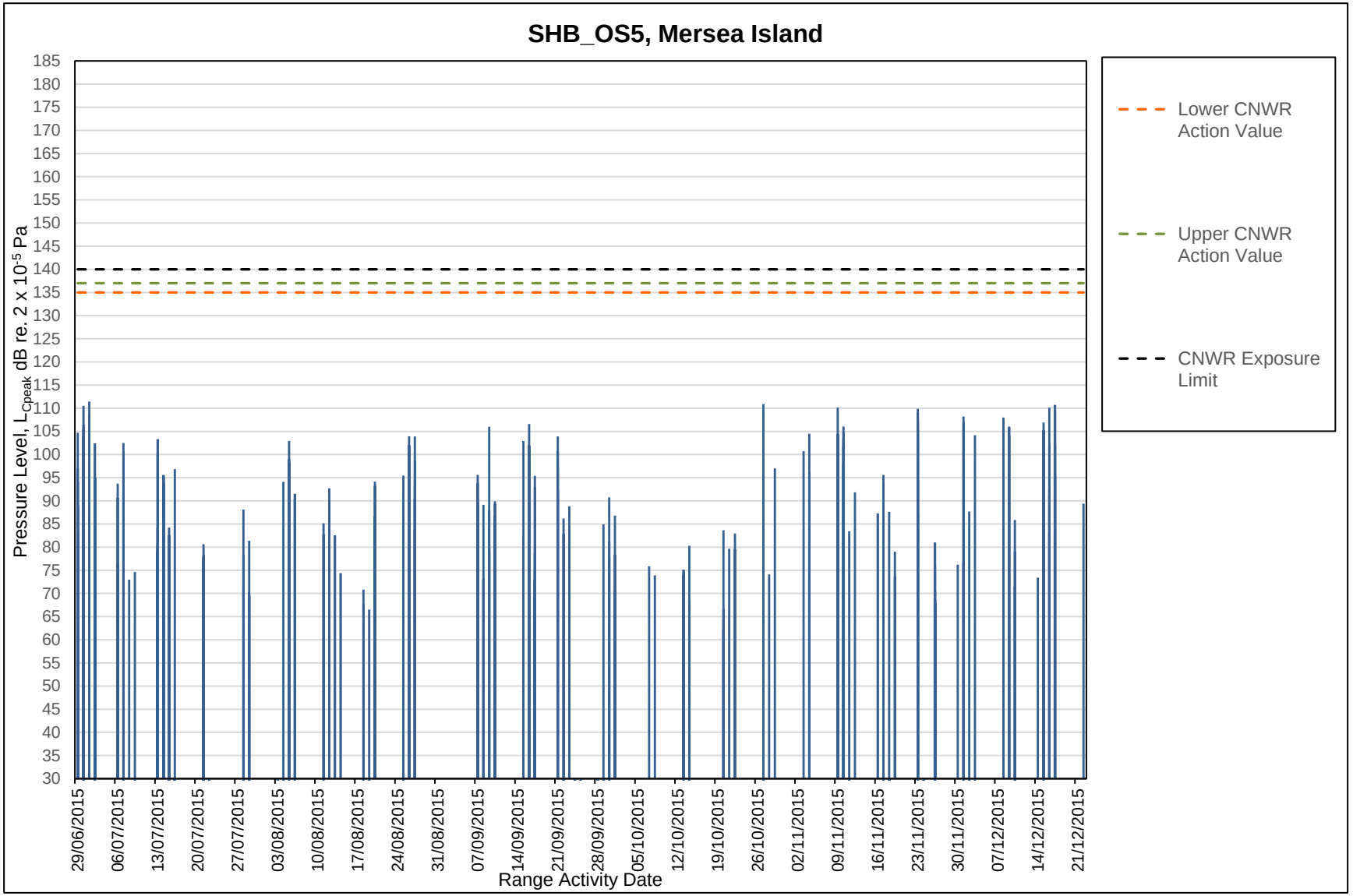

FIGURE A17: SUMMARY OF L_{CPEAK} VALUES, SHB_OS5, MERSEA ISLAND, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

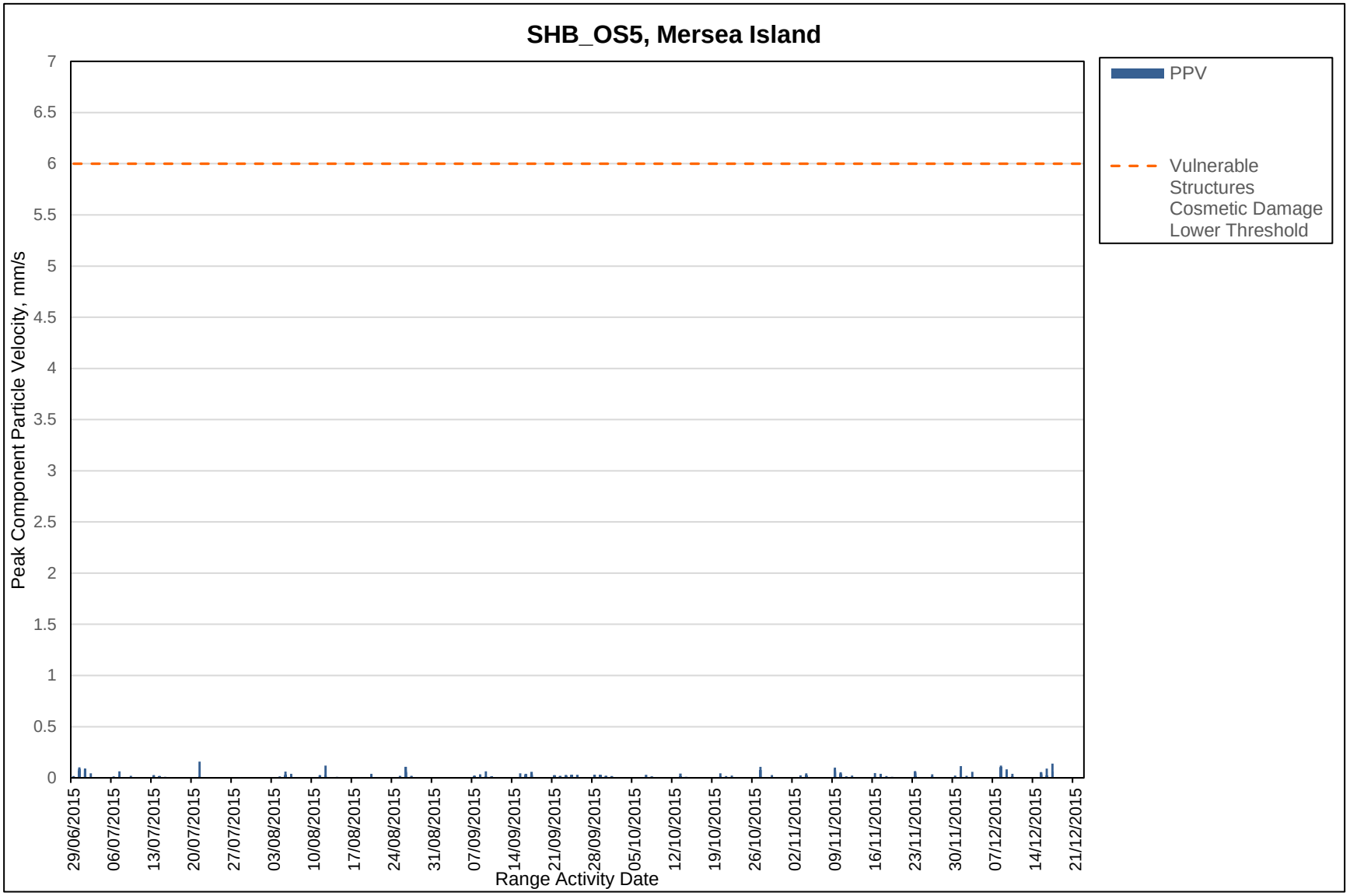

FIGURE A18: SUMMARY OF PPV VALUES, SHB_OS5, MERSEA ISLAND, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

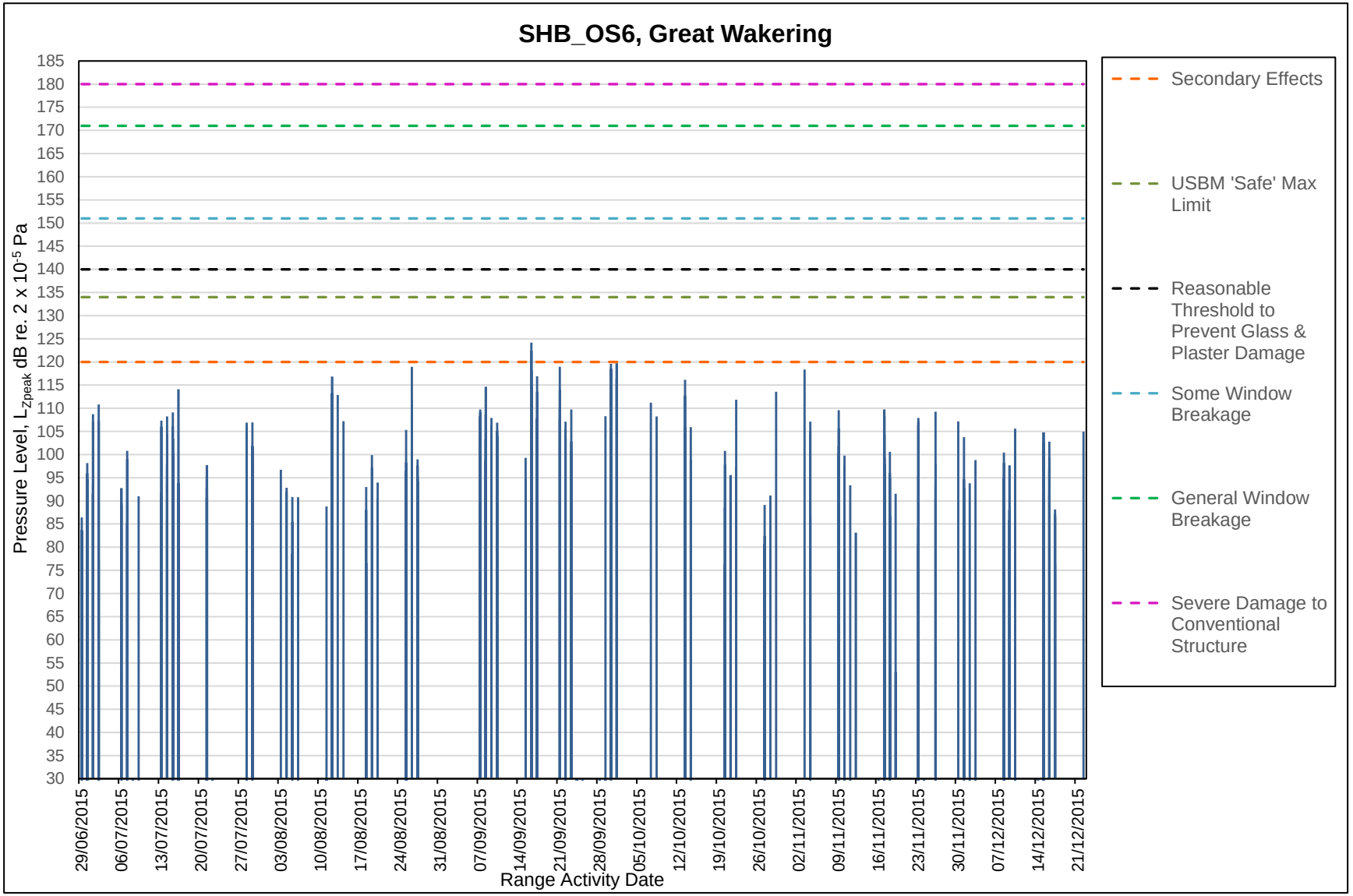

FIGURE A19: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS6, GREAT WAKERING, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

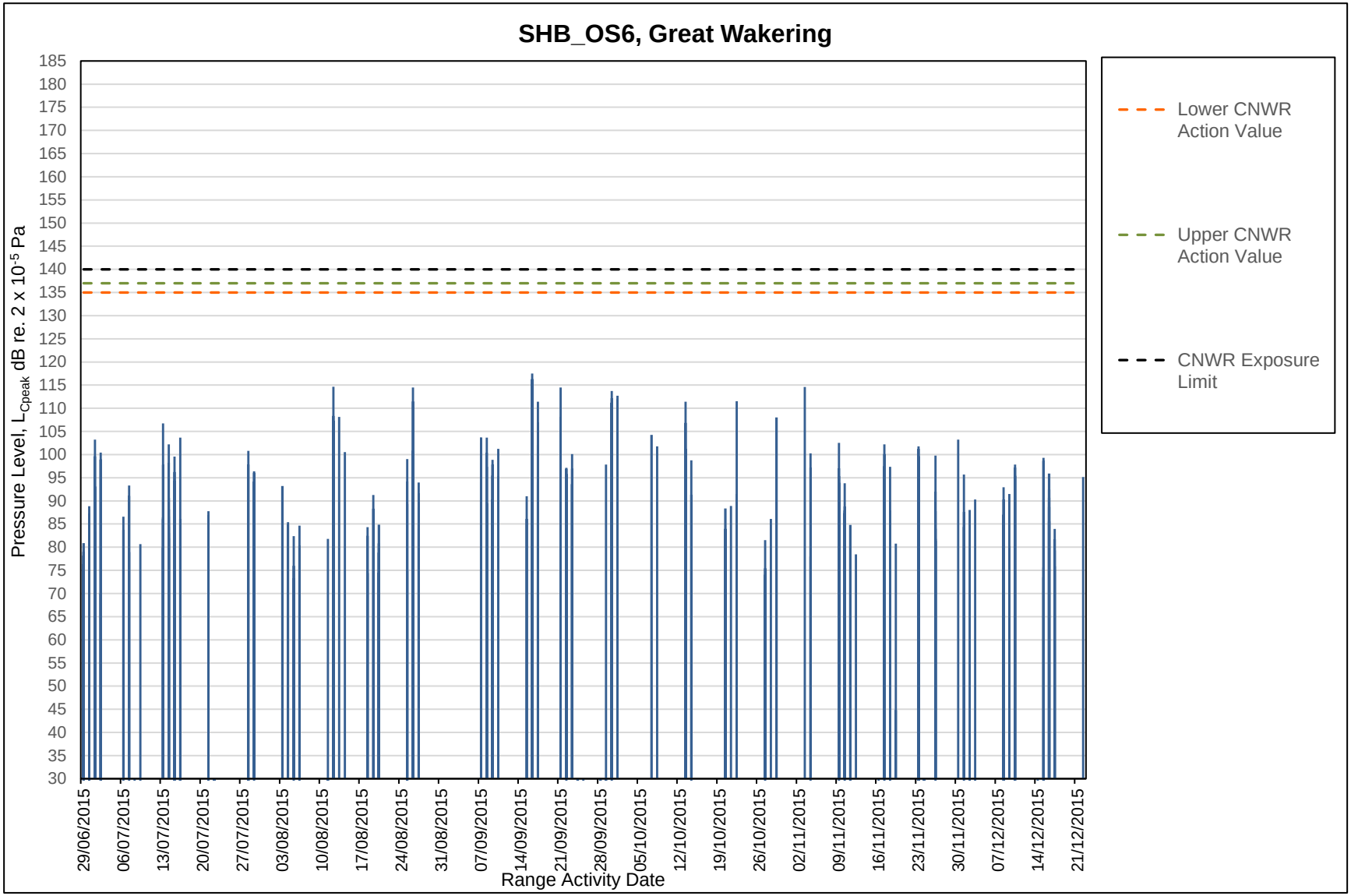

FIGURE A20: SUMMARY OF L_{CPEAK} VALUES, SHB_OS6, GREAT WAKERING, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

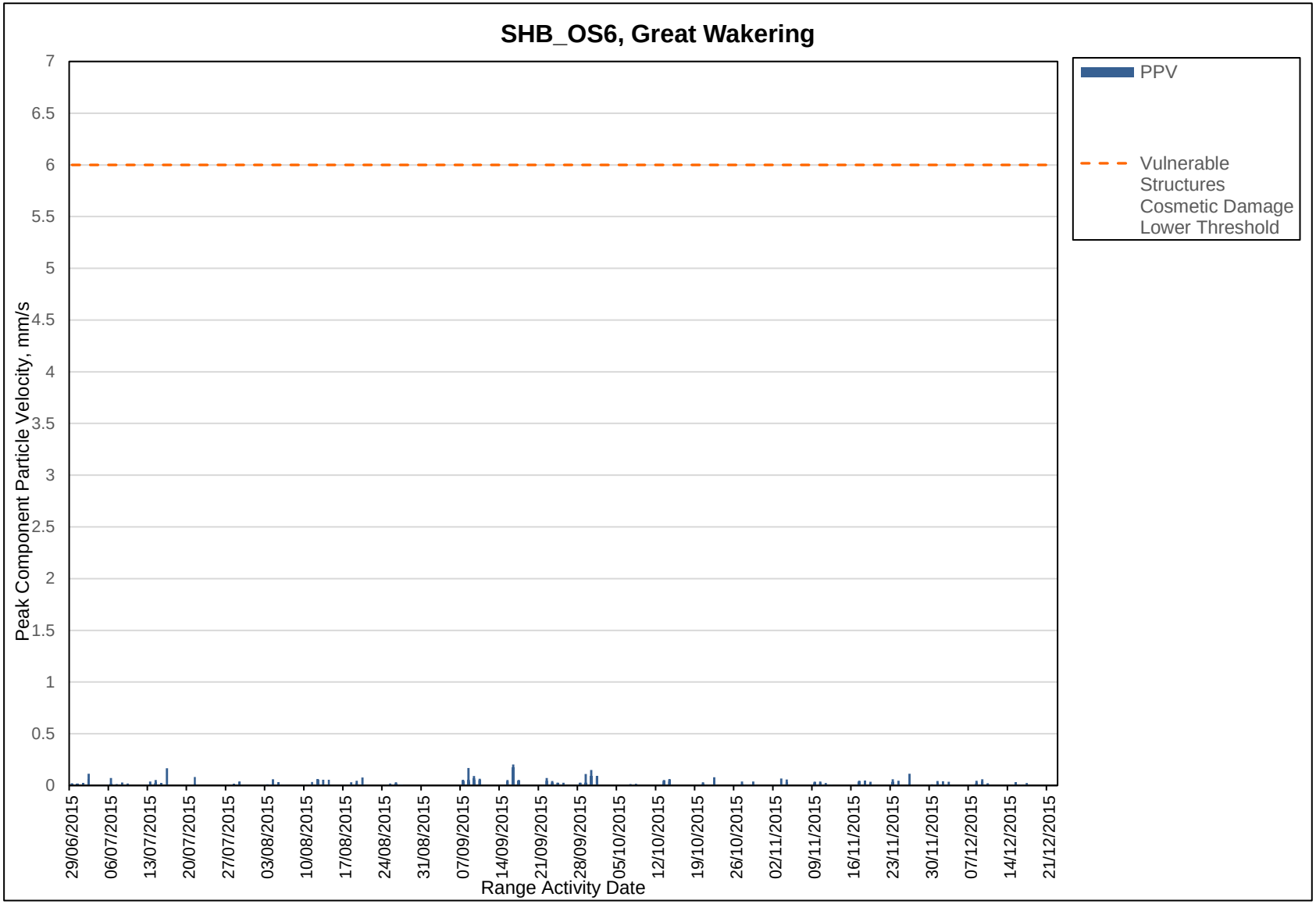

FIGURE A21: SUMMARY OF PPV VALUES, SHB_OS6, GREAT WAKERING, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

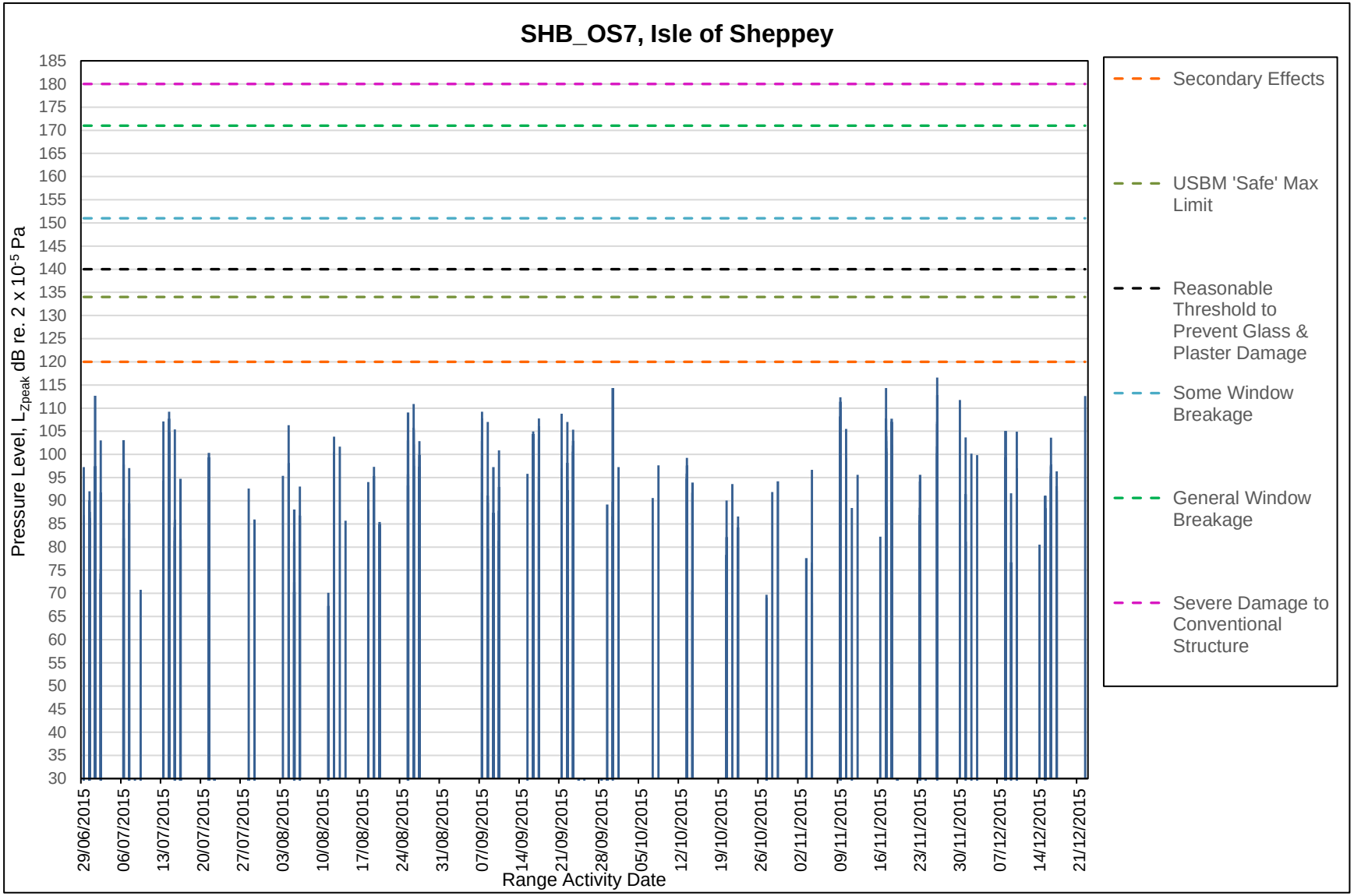

FIGURE A22: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS7, ISLE OF SHEPPEY, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

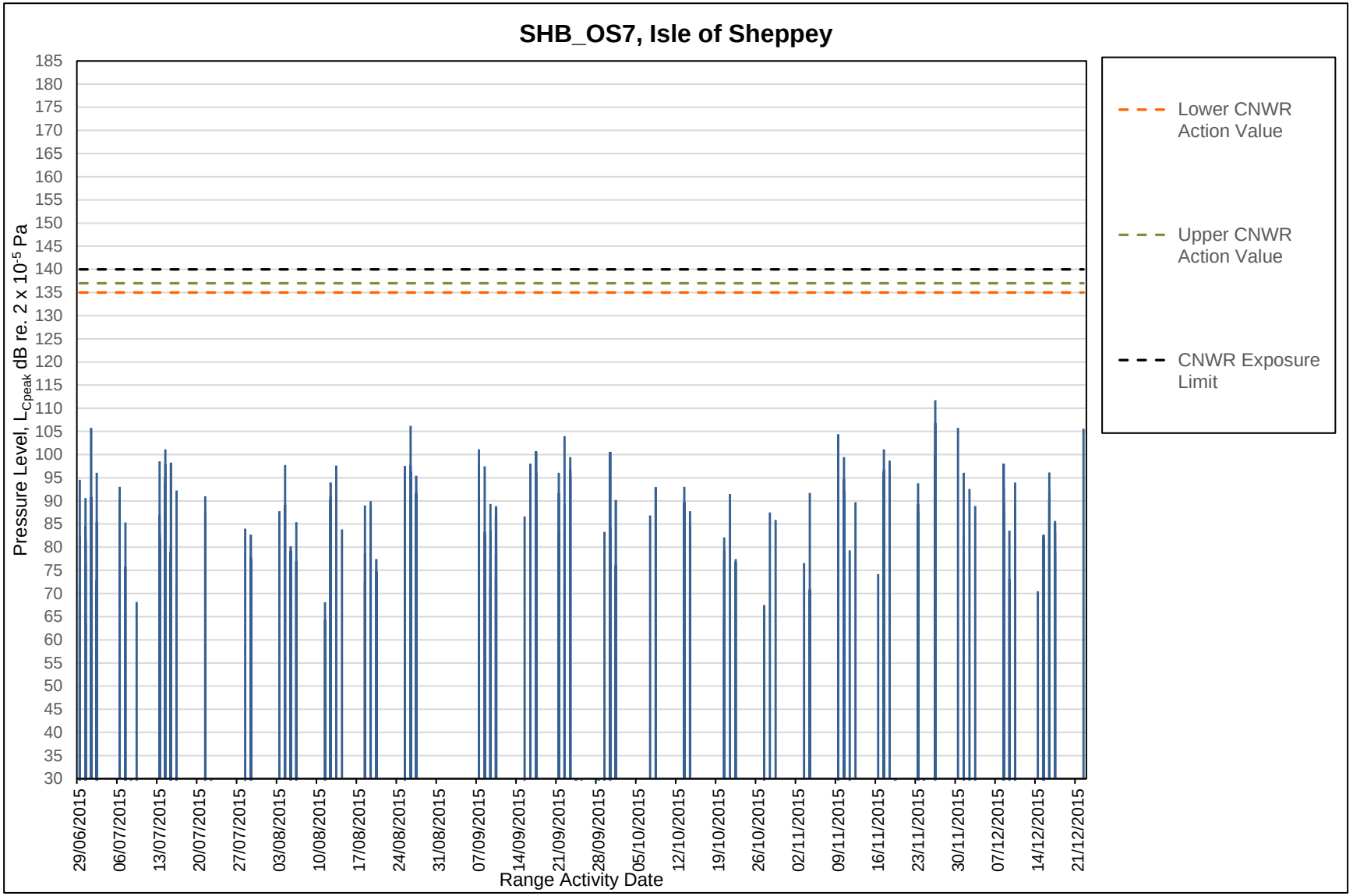

FIGURE A23: SUMMARY OF L_{CPEAK} VALUES, SHB_OS7, ISLE OF SHEPPEY, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

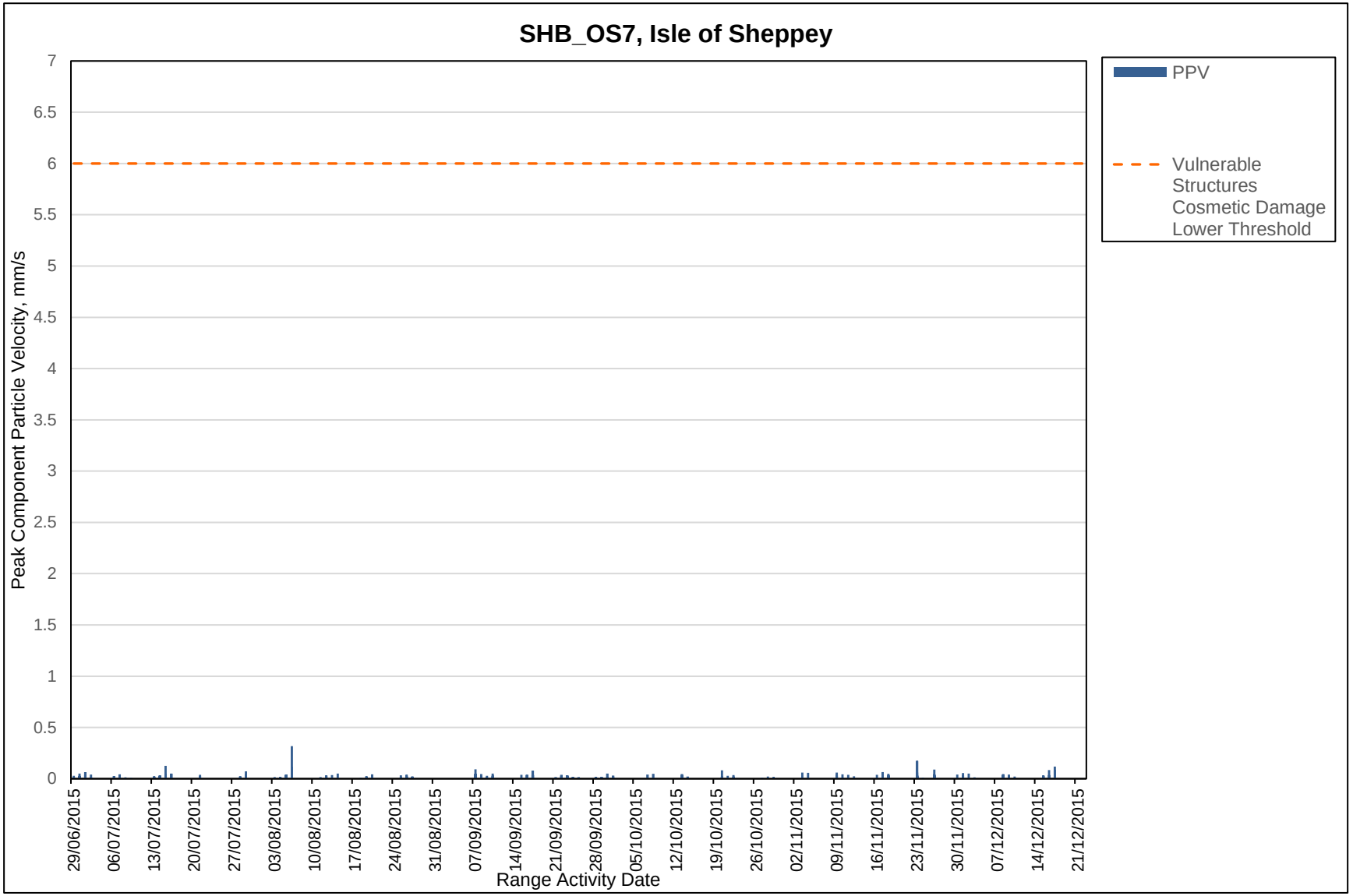

FIGURE A24: SUMMARY OF PPV VALUES, SHB_OS7, ISLE OF SHEPPEY, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

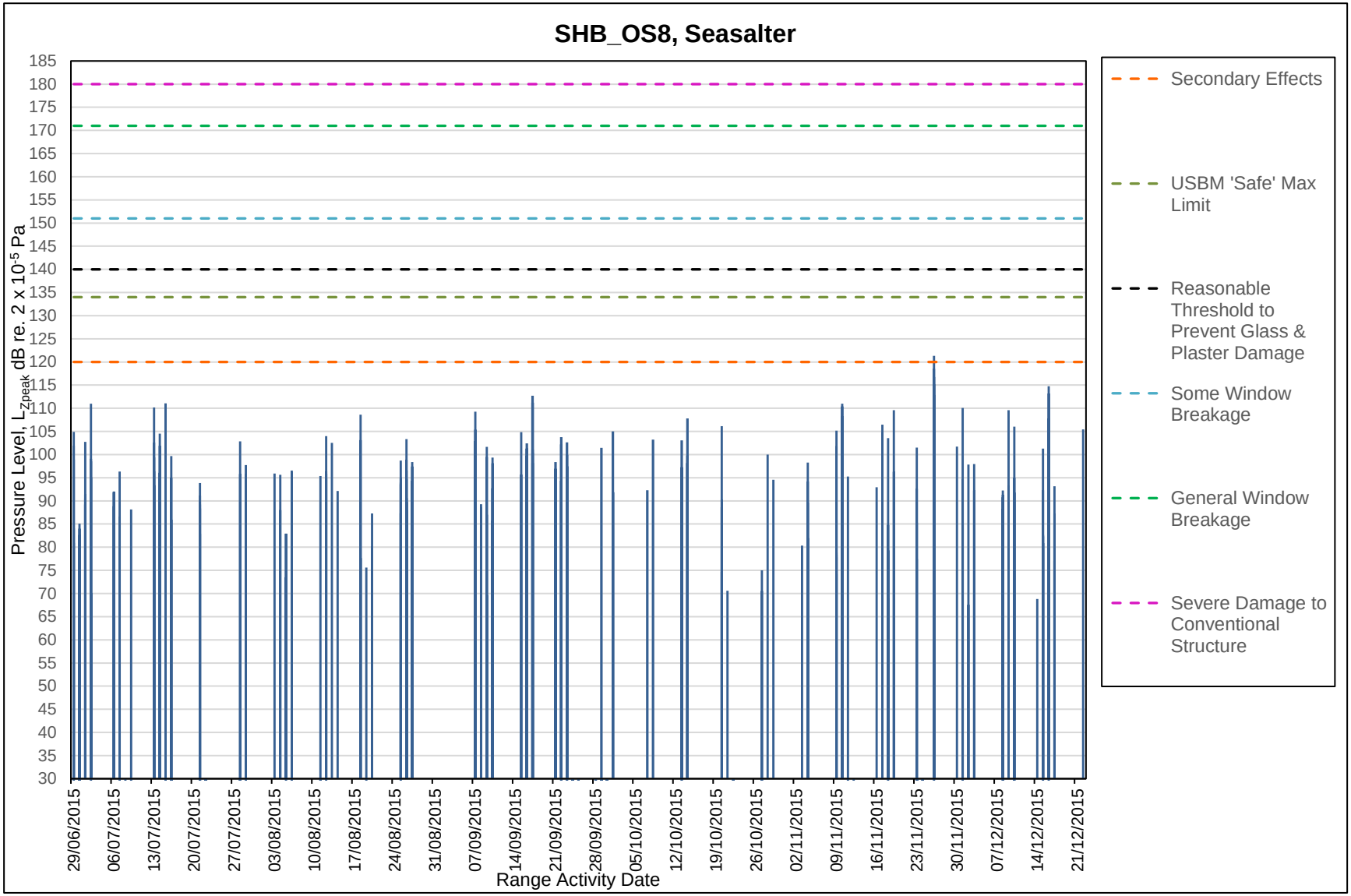

FIGURE A25: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS8, SEASALTER, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

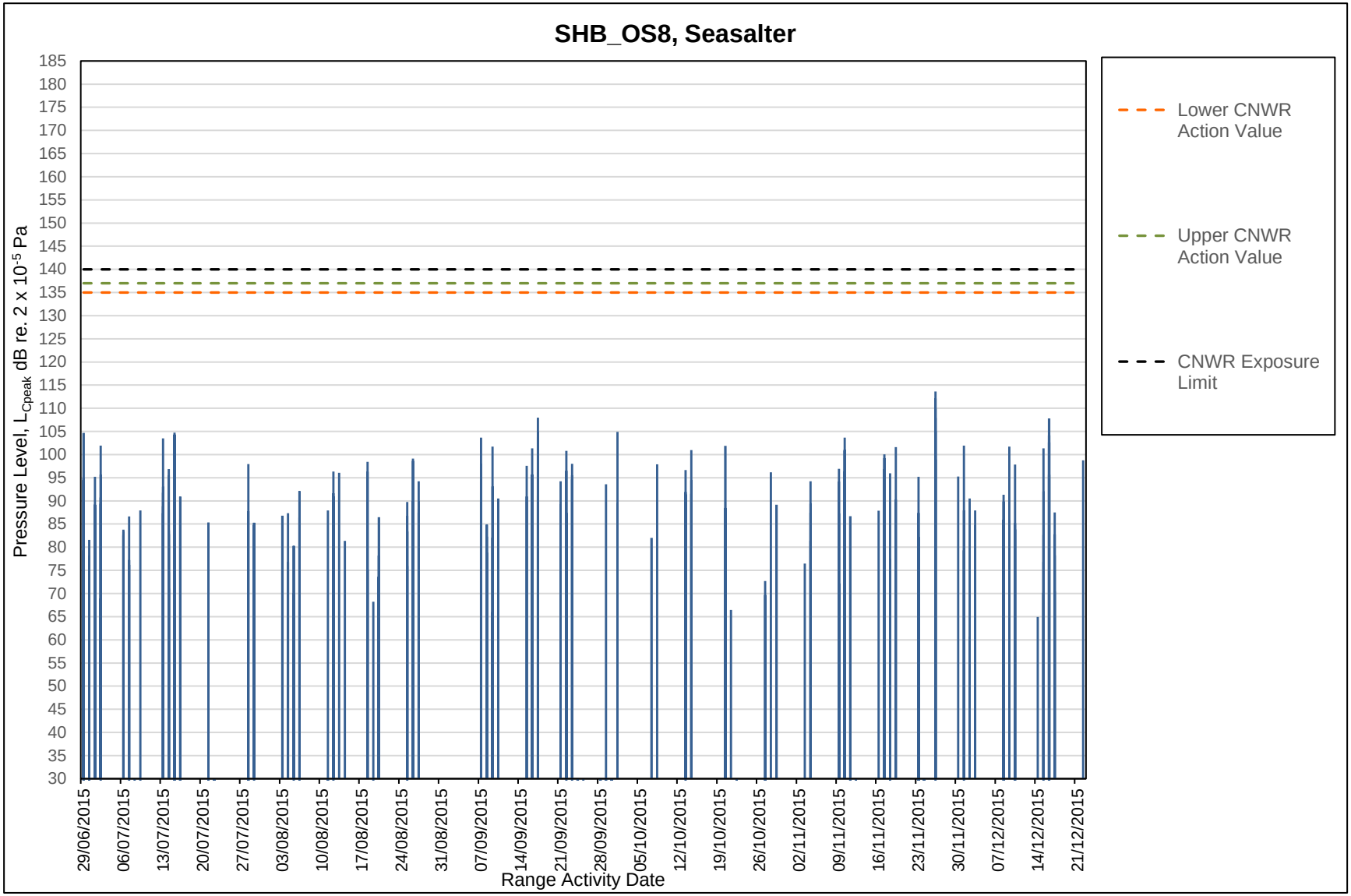

FIGURE A26: SUMMARY OF L_{CPEAK} VALUES, SHB_OS7, SEASALTER, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

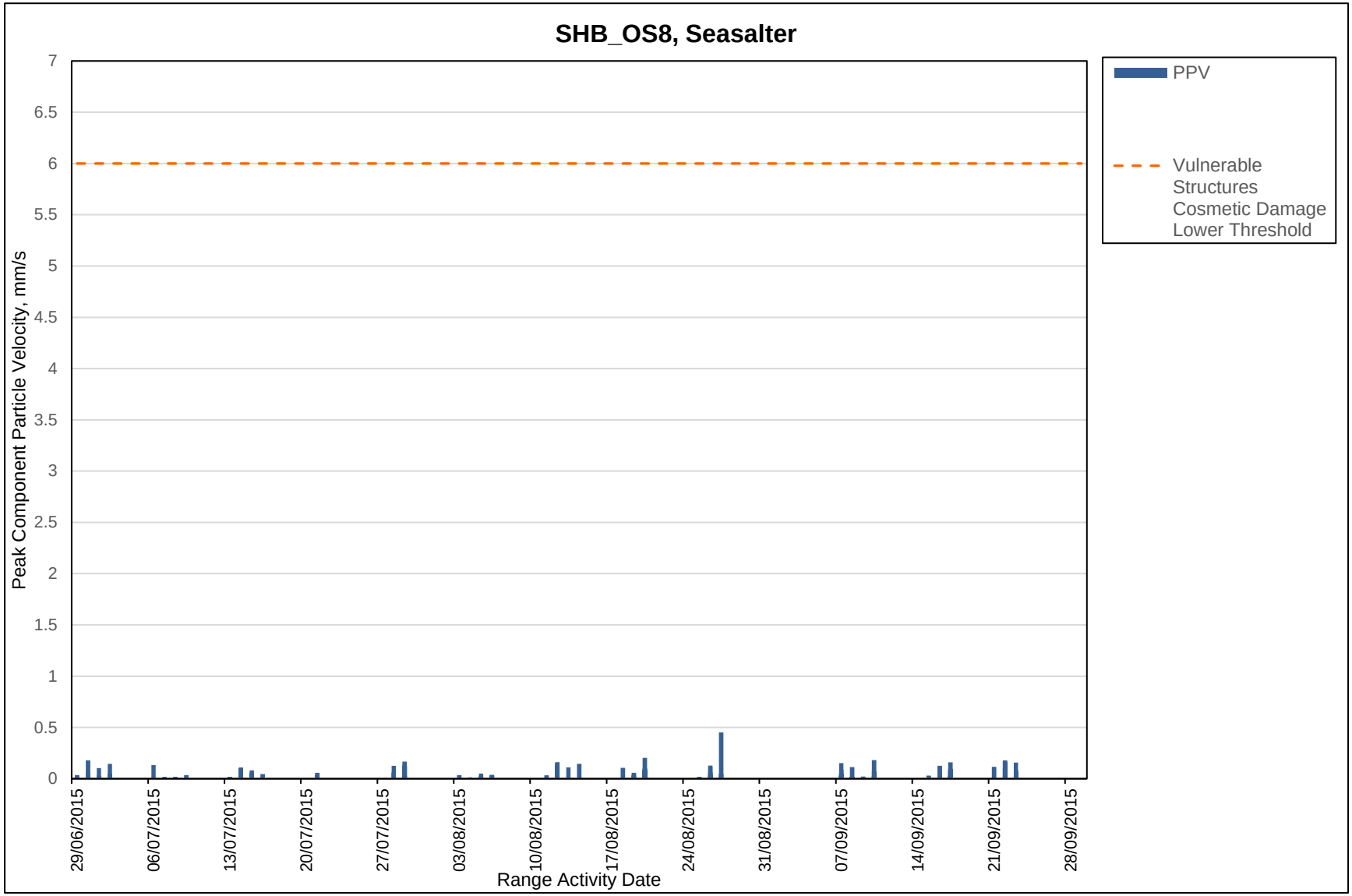

FIGURE A27: SUMMARY OF PPV VALUES, SHB_OS8, SEASALTER, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

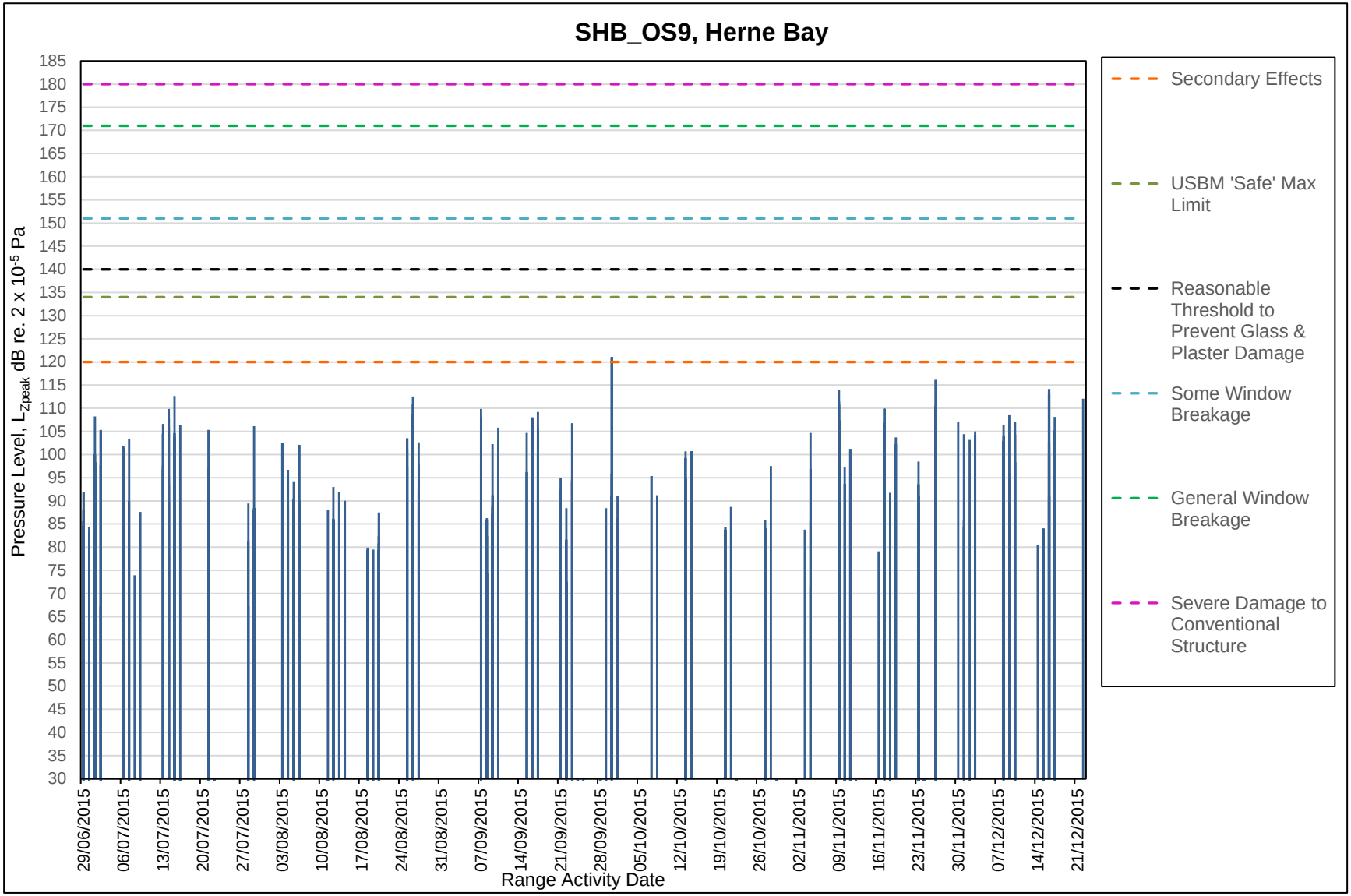

FIGURE A28: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS9, HERNE BAY, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

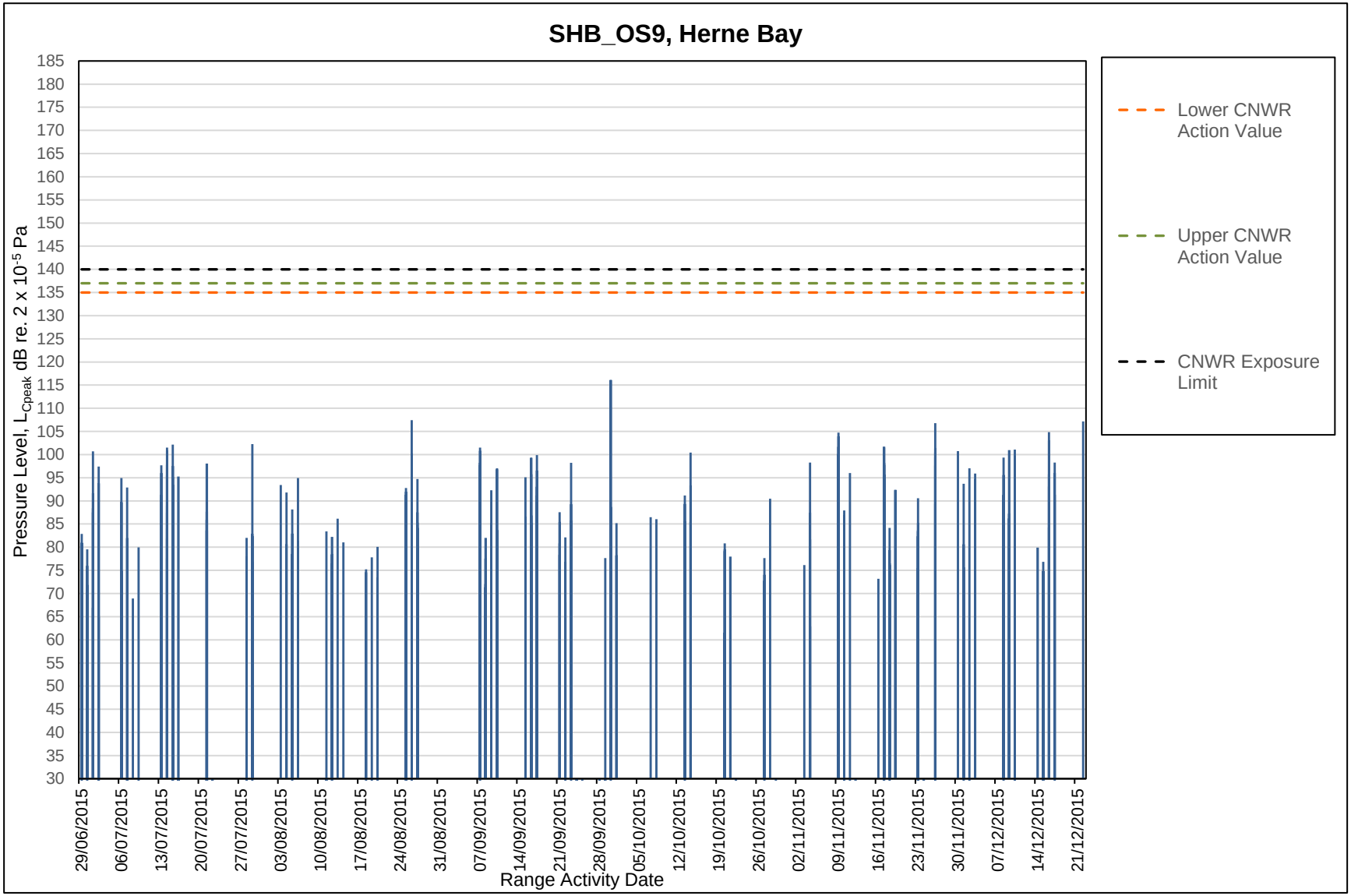

FIGURE A29: SUMMARY OF L_{CPEAK} VALUES, SHB_OS9, HERNE BAY, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

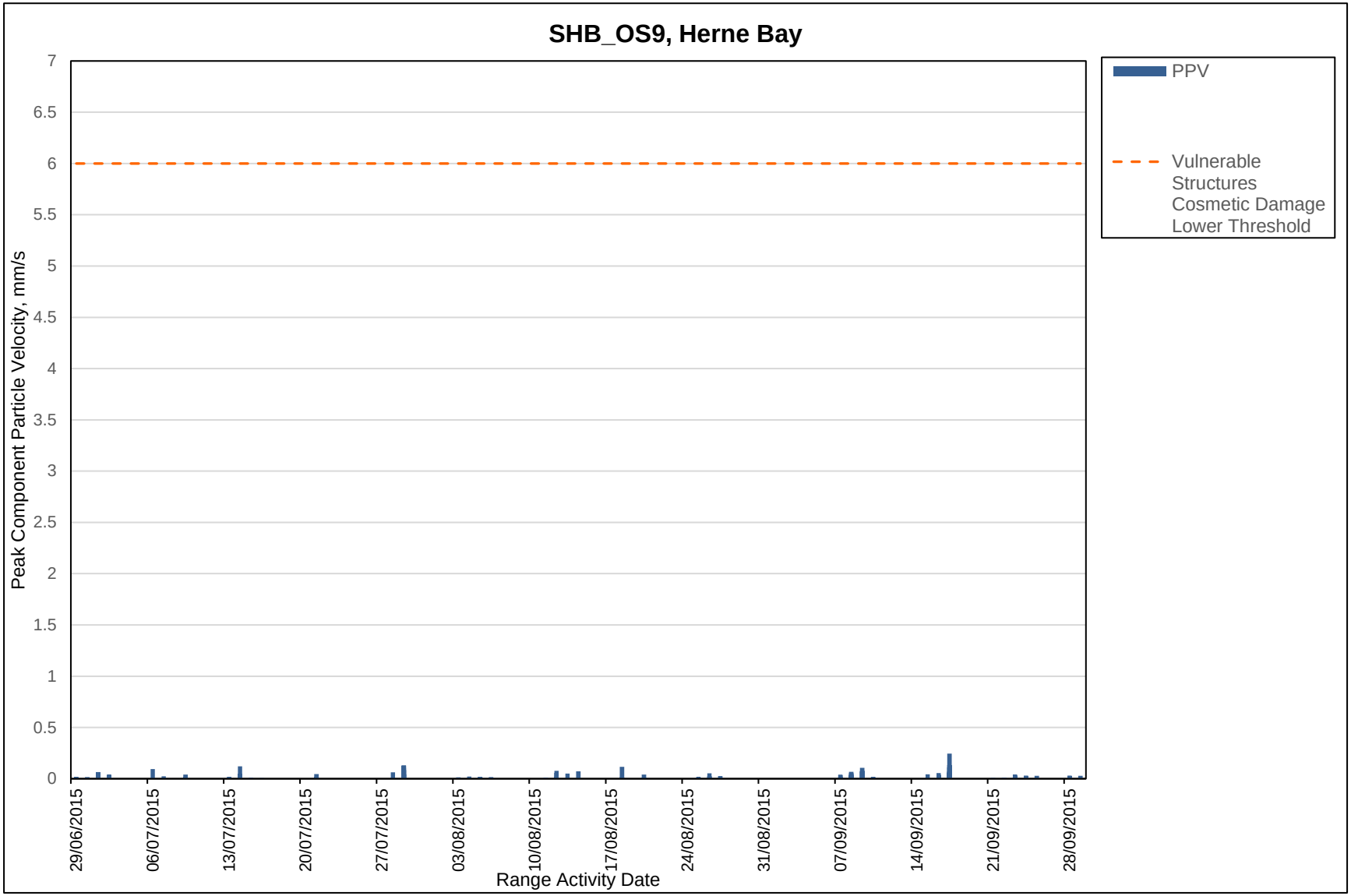

FIGURE A30: SUMMARY OF PPV VALUES, SHB_OS9, HERNE BAY, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

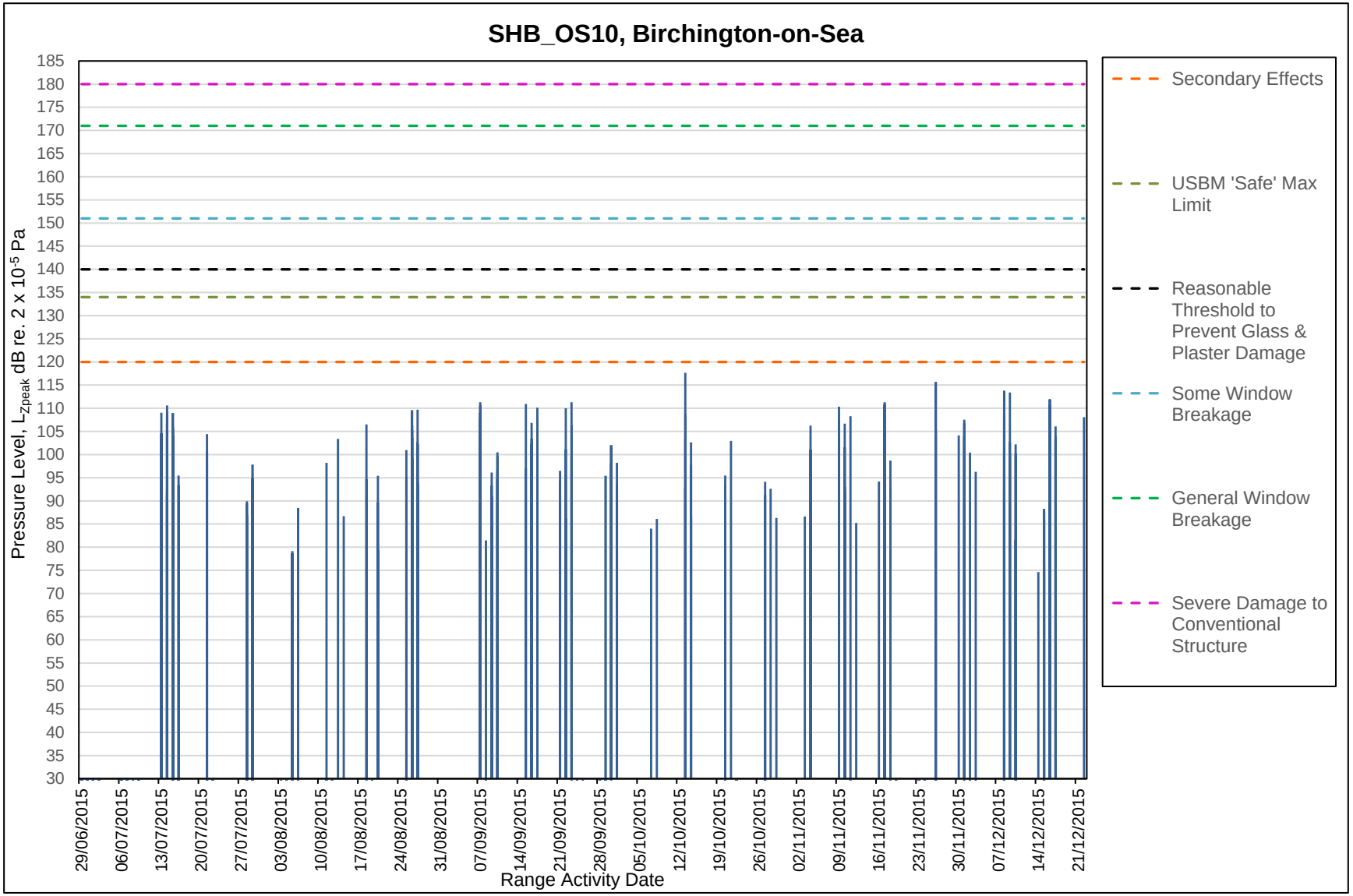

FIGURE A31: SUMMARY OF L_{ZPEAK} VALUES, SHB_OS10, BIRCHINGTON-ON-SEA, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

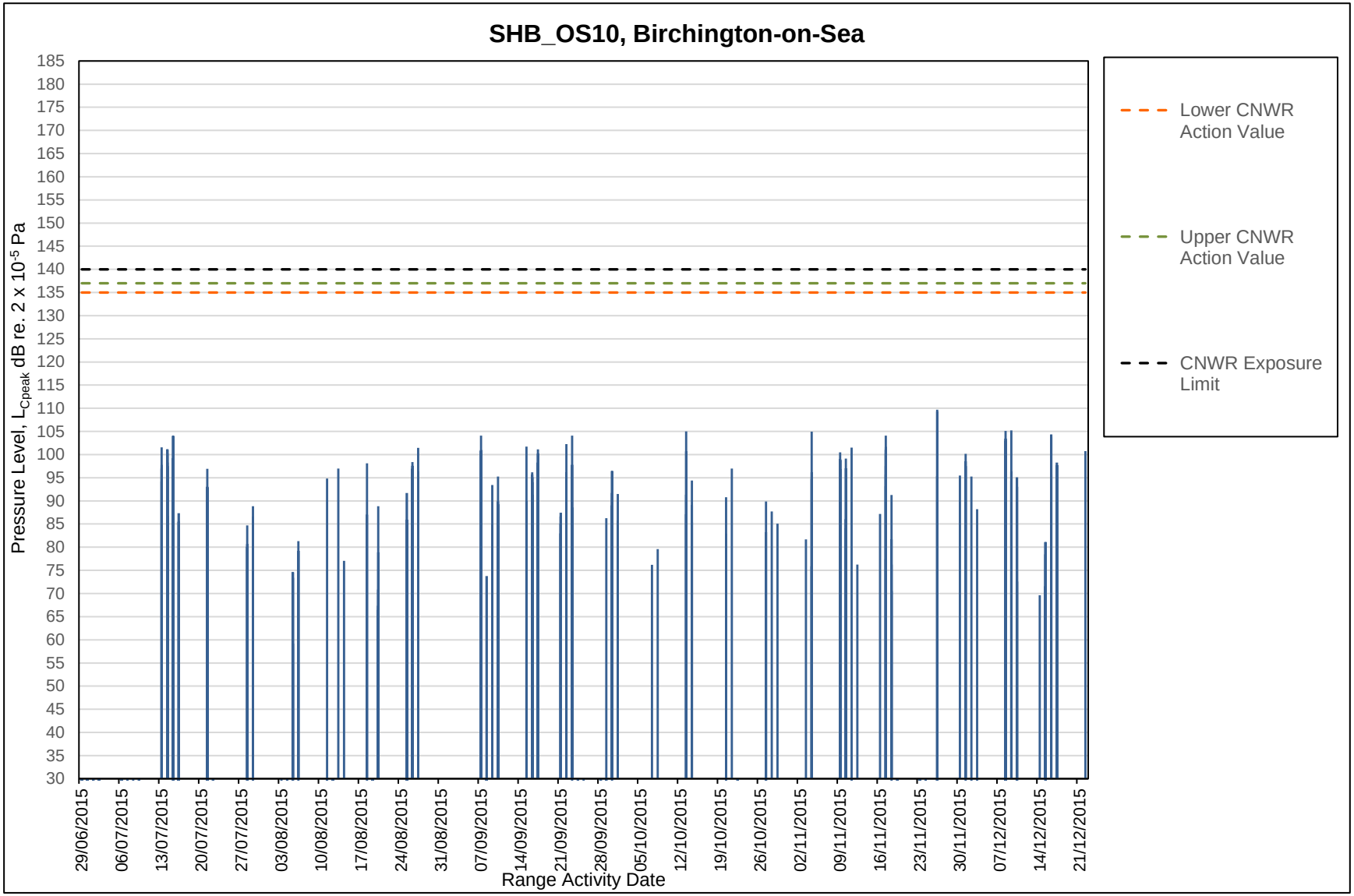

FIGURE A32: SUMMARY OF L_{CPEAK} VALUES, SHB_OS10, BIRCHINGTON-ON-SEA, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

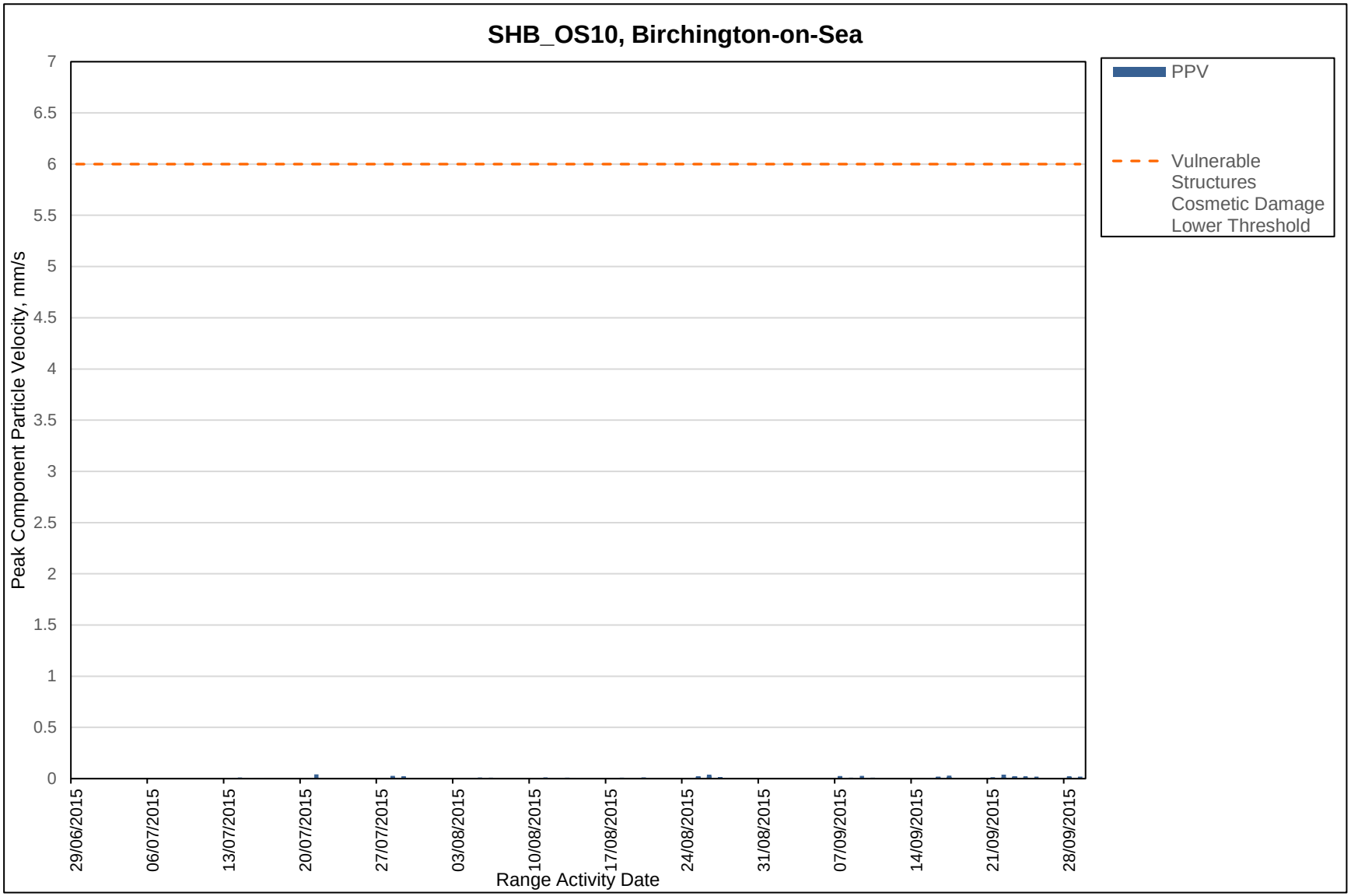

FIGURE A33: SUMMARY OF PPV VALUES, SHB_OS10, BIRCHINGTON-ON-SEA, 28TH JUNE 2015 – 31ST DECEMBER 2015

Note: Highest daily levels presented

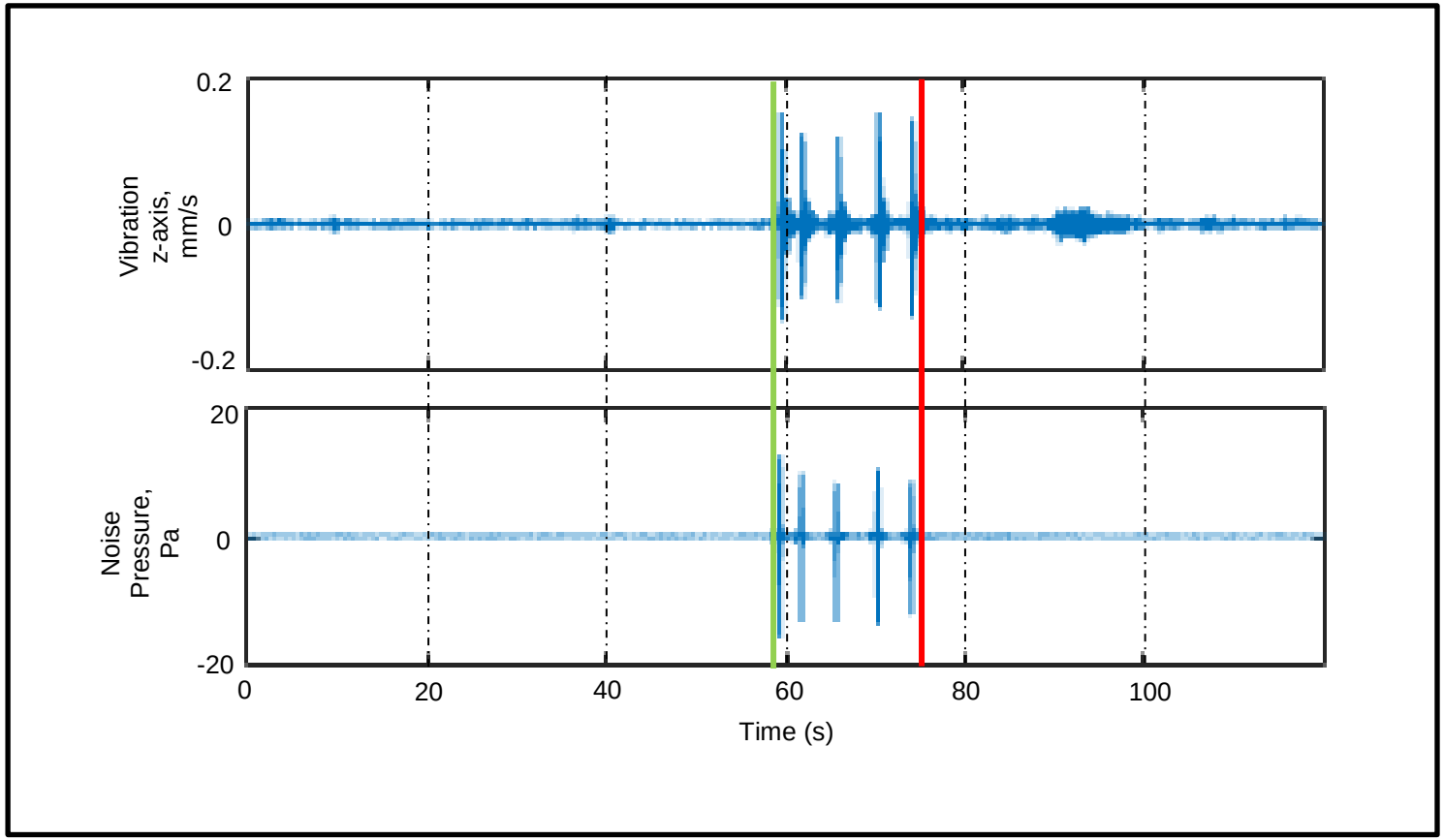

FIGURE A34: ANALYSIS OF MEASURED VIBRATION AND AIR OVERPRESSURE SIGNAL ARRIVAL TIMES AT AN OFF-RANGE LOCATION

Notes: [1] Green line indicates start of the measured events and red line indicates end of measured event

APPENDIX B: TABLES

Monitor ID	No. of On-Range Triggered Activities	No of Range Firing Activities Expected to Trigger Range Monitors	No of On-Site Triggered Activities Caused by Range Firing Activities	No of On-Site Triggered Activities Caused by 'Spurious' Activities	No of Triggered Range Firing Activities Captured by Off-Site Activities	No of Off-Site Triggered Activities Caused by Local Activity	Trigger Threshold for Monitoring Period dB(A)
SHB_R1-DAT	3,927	338[3]	255	3,672	n/a	n/a	75
SHB_R2_RUG	1,331		135	1,196	n/a	n/a	75
SHB_R3_BAT	3,469		100	3,369	n/a	n/a	75
TOTAL	8,727		490(312)[1]	8,237[2]	n/a	n/a	-
SHB_OS1	n/a	n/a	n/a	n/a	198	99	85
SHB _OS2	n/a	n/a	n/a	n/a	259	785	85
SHB _OS3	n/a	n/a	n/a	n/a	273	237	85
SHB _OS4	n/a	n/a	n/a	n/a	273	83	85
SHB _OS5	n/a	n/a	n/a	n/a	308	79	85
SHB _OS6	n/a	n/a	n/a	n/a	303	107	85
SHB _OS7	n/a	n/a	n/a	n/a	309	116	85
SHB _OS8	n/a	n/a	n/a	n/a	301	403	85
SHB _OS9	n/a	n/a	n/a	n/a	308	37	85
SHB _OS10	n/a	n/a	n/a	n/a	263	74	85

TABLE B1: SUMMARY QUANTITIES OF TRIGGERED ACTIVITIES DURING MONITORING STUDY

Notes:
[1] – Sum of the Range Activities captured by on-Range monitors presented in brackets;
[2] - Extraneous activities include those attributable to non-Range Activities (i.e. local vehicle movements, wind noise on the microphone, local maintenance works, aircraft activity, alarm / sirens); and
[3] - Number of individual Range Activities expected to cause a Range trigger are those associated with the quantities of reported firing activities in the Range logs.

Jun/Jul-15		Measured L_{pZpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Trigger Identification Code	Measured L_{pZpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Date	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
29	09:49	147	TNE	TNE	15-6-R1-6	86	84	Not Installed	Not Installed	75	84	72	81	86	Not Installed
29	11:37	147	TNE	TNE	15-6-R1-12	89	102			88	79	87	77	85	
29	12:14	147	TNE	TNE	15-6-R1-17	107	114			94	83	77	105	85	
29	14:02	151	TNE	TNE	15-6-R1-23	115	118			101	78	97	102	85	
29	15:00	151	TNE	TNE	15-6-R1-28	X	112			105	84	83	99	92	
29	15:05	149	TNE	TNE	15-6-R1-29	X	121			111	86	78	84	88	
30	09:33	145	TNE	TNE	15-6-R1-42	110	111			108	85	67	84	78	
30	12:15	141	TNE	TNE	15-6-R1-46	84	78			83	94	86	80	83	
30	12:48	149	TNE	TNE	15-6-R1-49	114	116			113	98	86	85	71	
30	13:11	153	TNE	TNE	15-6-R1-55	113	117			118	96	86	72	65	
30	13:37	153	TNE	TNE	15-6-R1-60	117	108			113	93	88	83	83	
30	13:38	128	TNE	TNE	15-6-R1-61	117	121			113	96	83	88	84	
30	14:26	153	TNE	TNE	15-6-R1-69	87	119			116	95	92	78	80	
30	14:37	150	TNE	TNE	15-6-R1-70	114	117			112	93	90	79	79	
01	10:10	152	TNE	TNE	15-7-R1-75	114	121			113	92	76	91	100	
01	12:11	150	TNE	141	15-7-R1-85 & R3-56	118	120			116	94	96	89	97	
01	12:17	150	109	156	15-7-R1-85 & R2-11 & R3-57	118	119			116	107	96	89	98	
01	14:57	151	TNE	TNE	15-7-R1-98	116	122			118	92	97	91	73	

TABLE B2: SUMMARY OF DATA CAPTURE – JUNE/JULY 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Jul-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
01	15:08	149	114	TNE	15-7-R1-100 & R2-25	109	115	Not Installed	Not Installed	114	109	113	103	108	Not Installed
02	09:10	150	TNE	TNE	15-7-R1-107	75	77			73	70	76	73	77	
02	10:20	153	TNE	TNE	15-7-R1-116	84	89			66	77	78	95	73	
02	10:41	151	93	TNE	15-7-R1-118 & R2-27	108	113			102	107	103	111	105	
02	10:45	151	TNE	TNE	15-7-R1-118	108	113			102	107	92	99	67	
02	11:53	152	TNE	TNE	15-7-R1-123	92	94			81	81	74	70	98	
02	12:13	154	TNE	102	15-7-R1-127 & R3-120	88	115			111	111	73	99	105	
06	13:49	149	TNE	94	15-7-R1-234 & R3-140	99	105			83	93	103	92	85	
06	12:31	151	TNE	102	15-7-R1-227 & R3-134	94	95			77	94	98	89	101	
06	14:40	152	TNE	TNE	15-7-R1-240	110	115			97	93	82	92	100	
06	15:08	153	TNE	TNE	15-7-R1-242	112	114			100	89	86	92	102	
07	09:45	148	TNE	TNE	15-7-R1-265	89	116			109	85	89	81	103	
07	11:29	149	TNE	TNE	15-7-R1-275	99	98			103	90	92	96	97	
07	12:02	154	TNE	TNE	15-7-R1-279	93	111			100	101	97	87	90	
07	13:47	113	TNE	TNE	15-7-R1-284	104	105			80	99	98	99	99	
08	14:39	149	TNE	TNE	15-7-R1-351	101	100			81	100	99	90	74	
09	10:17	122	TNE	90	15-7-R1-358 & R3-156	90	80			77	89	76	78	78	
09	11:02	145	TNE	92	15-7-R1-361 & R3-158	82	83			75	91	71	88	88	

TABLE B2 (CTD): SUMMARY OF DATA CAPTURE – JULY 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Jul-15		Measured L_{zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5}Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
13	10:21	TNE	120	TNE	15-7-R2-41	96	82	99	113	111	92	90	110	104	105
13	11:37	TNE	125	TNE	15-7-R2-42	97	101	97	99	89	90	90	103	98	105
13	12:00	TNE	127	96	15-7-R2-44 & R3-180	96	110	99	99	92	92	89	96	97	103
13	12:46	111	125	154	15-7-R1-402 & R2-45	106	115	99	102	109	107	107	93	105	109
13	14:43	TNE	130	155	15-7-R2-46 & R3-190	106	106	104	98	83	106	94	99	107	102
14	08:11	149	TNE	TNE	15-7-R1-407	87	97	88	95	81	90	80	86	95	92
14	10:28	102	126	151	15-7-R1-428 & R2-50	108	93	103	84	103	98	105	88	90	105
14	10:34	143	133	153	15-7-R1-429 & R2-50	109	110	105	107	107	98	99	105	105	107
14	11:29	144	TNE	TNE	15-7-R1-435	106	107	111	110	104	98	103	92	108	108
14	11:30	144	TNE	TNE	15-7-R1-435	106	107	111	110	104	98	103	92	108	108
14	11:54	103	136	TNE	15-7-R1-439 & R2-51	102	106	107	102	97	104	108	96	110	111
14	12:58	TNE	125	TNE	15-7-R2-52	91	90	99	77	68	97	74	81	94	91
14	13:11	150	TNE	TNE	15-7-R1-444	110	111	107	97	97	108	109	102	106	109
14	14:13	148	TNE	TNE	15-7-R1-453	89	89	91	65	63	85	73	81	78	92
14	15:11	TNE	132	TNE	15-7-R2-53	101	81	103	75	65	94	69	83	93	93
15	08:10	147	TNE	TNE	15-7-R1-467	114	108	81	102	87	76	81	94	97	95
15	09:16	150	TNE	TNE	15-7-R1-470	87	84	83	78	68	83	81	86	82	77
15	10:00	TNE	129	TNE	15-7-R2-54	91	81	90	88	81	100	86	109	113	106

TABLE B2 (CTD): SUMMARY OF DATA CAPTURE – JULY 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Jul-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
15	10:43	154	TNE	TNE	15-7-R1-485	X	X	X	X	X	X	X	X	X	X
15	11:19	TNE	134	TNE	15-7-R2-55	86	90	90	81	72	98	105	110	102	103
15	12:33	TNE	125	TNE	15-7-R2-57	86	84	92	101	91	109	92	96	105	104
15	14:17	TNE	123	TNE	15-7-R2-60	86	96	89	88	91	106	85	108	104	106
15	14:55	TNE	127	TNE	15-7-R2-61	89	82	85	87	91	104	84	111	104	109
16	11:34	TNE	TNE	TNE	15-7-R3-222	100	104	102	109	105	114	95	95	106	96
16	12:19	TNE	TNE	121	15-7-R2-65	95	94	97	95	79	100	82	86	86	95
16	14:53	TNE	TNE	TNE	15-7-R1-506 & R3-228	X	91	92	95	76	94	86	100	86	93
16	15:04	149	TNE	104	15-7-R1-507	X	X	X	X	X	X	X	X	X	X
21	10:38	TNE	TNE	TNE	15-7-R2-81	106	108	95	87	90	93	100	89	97	101
21	12:18	TNE	TNE	TNE	15-7-R2-83	X	97	94	93	87	95	99	91	91	95
21	13:34	TNE	127	TNE	15-7-R2-84	X	97	92	86	76	94	95	83	96	91
21	13:59	TNE	96	TNE	15-7-R2-85	X	97	95	94	82	91	98	83	93	100
21	15:02	TNE	122	TNE	15-7-R2-90	X	97	99	70	70	94	101	94	95	99

TABLE B2 (CTD): SUMMARY OF DATA CAPTURE – JULY 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Jul-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2×10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
21	15:04	TNE	98	TNE	15-7-R2-91	X	99	101	94	86	98	95	88	105	104
28	09:29	TNE	TNE	TNE	15-7-R1-568	93	101	98	97	90	105	92	109	81	94
28	10:29	150	TNE	TNE	15-7-R1-575	105	100	78	98	76	106	93	103	67	87
28	12:01	149	TNE	TNE	15-7-R1-581	102	107	97	106	96	104	99	95	89	90
28	12:52	149	TNE	TNE	15-7-R1-584	102	105	100	95	77	105	89	102	86	89
28	14:33	148	TNE	TNE	15-7-R1-590 & R3-315	111	106	99	110	85	107	98	96	81	90
29	09:51	151	TNE	104	15-7-R1-616 & R2-120	92	85	92	94	81	99	86	96	88	99
29	10:26	136	98	TNE	15-7-R1-618	92	90	86	90	77	94	86	98	106	98
29	11:46	155	TNE	TNE	15-7-R1-630 & R2-122	88	74	99	92	77	102	86	98	86	91
29	12:29	154	107	TNE	15-7-R1-643	89	79	83	91	76	107	78	87	85	93
29	14:38	153	TNE	TNE	15-7-R1-664	98	67	87	92	81	66	84	91	67	80
29	14:38	148	TNE	TNE	15-7-R1-666	92	72	86	91	91	73	87	96	89	95
29	15:09	151	TNE	TNE	15-7-R1-679 & R2-133	97	88	90	102	X	102	82	92	75	94

TABLE B2 (CTD): SUMMARY OF DATA CAPTURE – JULY 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);
Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);
Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and
X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Aug-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
03	11:40	TNE	TNE	154	15-8-R3-70	95	96	100	105	99	97	95	96	103	X
04	08:19	101	TNE	145	15-8-R1-40 & R3-156	91	95	96	90	74	92	98	88	89	X
04	14:43	151	TNE	149	15-8-R1-89 & R3-262	107	101	103	88	101	93	106	96	97	X
05	10:21	149	TNE	TNE	15-8-R1-105	111	70	94	108	108	75	72	68	78	65
05	11:08	147	TNE	TNE	15-8-R1-111	108	108	74	76	104	79	70	83	90	79
05	11:20	151	TNE	TNE	15-8-R1-112	107	113	86	85	113	86	88	73	85	79
05	13:03	149	TNE	TNE	15-8-R1-117	114	106	102	111	73	91	81	74	94	69
06	09:26	154	TNE	95	15-8-R1-137 & R3-360	89	96	92	92	79	88	97	81	90	87
06	12:21	153	TNE	TNE	15-8-R1-147	102	111	94	114	97	91	93	97	102	88
06	13:07	151	TNE	TNE	15-8-R1-153	X	108	92	117	98	90	87	96	90	89
06	13:15	151	TNE	TNE	15-8-R1-153	X	108	92	117	98	90	87	96	90	89
11	09:10	152	125	156	15-8-R1-204 & R2-40	88	105	85	97	92	89	67	95	88	98
11	12:56	102	TNE	TNE	15-8-R1-229	76	74	89	73	91	79	70	87	73	72

TABLE B3: SUMMARY OF DATA CAPTURE – AUGUST 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Aug-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
12	09:47	150	129	156	15-8-R1-248 & R2-73 & R3-382	94	102	95	100	89	113	97	104	93	✕
12	09:26	TNE	96	156	15-8-R2-66 & R3-377	84	78	77	88	90	95	98	96	86	✕
12	11:05	151	125	156	15-8-R1-251 & R2-79 & R3-411	104	95	104	95	84	113	104	95	85	✕
12	11:27	149	121	156	15-8-R1-258 & R2-81 & R3-423	108	98	104	98	101	117	101	96	86	✕
12	11:54	142	TNE	100	15-8-R1-262 & R3-427	95	96	96	96	88	100	90	95	91	✕
13	09:25	TNE	119	156	15-8-R2-89 & R3-469	103	86	104	96	84	113	102	103	92	103
14	09:52	147	120	156	15-8-R1-316 & R2-106 & R3-899	93	96	93	88	80	107	86	92	90	87
18	10:07	TNE	115	147	15-8-R2-119 & R3-556	90	95	78	89	72	93	94	103	80	107
18	13:10	TNE	117	149	15-8-R2-135 & R3-629	83	81	83	99	75	88	88	109	79	95
18	14:50	138	TNE	TNE	15-8-R1-402	77	85	91	88	66	77	76	78	84	86
19	09:45	TNE	147	150	15-8-R2-141 & R3-651	91	98	88	75	68	100	95	76	80	✕
19	13:12	TNE	158	143	15-8- R2-151 & R3-721	99	101	100	81	✕	97	97	84	✕	✕
20	09:44	150	TNE	TNE	15-8-R1-440	102	105	93	96	89	76	79	73	81	79
20	11:19	151	TNE	TNE	15-8-R1-444	107	104	94	106	103	94	85	87	88	74
20	12:35	153	TNE	TNE	15-8-R1-451	✕	101	95	112	93	90	84	80	79	95

TABLE B3 (CTD): SUMMARY OF DATA CAPTURE – AUGUST 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Aug-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
20	14:15	151	TNE	TNE	15-8-R1-456	105	112	94	109	99	84	85	80	87	90
20	14:36	148	TNE	TNE	15-8-R1-461	X	107	85	110	93	87	79	80	82	79
25	09:16	TNE	149	TNE	15-8-R2-187	102	X	93	99	87	83	96	94	98	101
25	10:42	148	97	TNE	15-8-R1-494 & R2-191	99	X	97	100	102	97	109	87	101	95
25	11:38	142	113	TNE	15-8-R1-498 & R2-192	104	X	100	103	84	105	103	99	105	105
25	12:00	154	TNE	TNE	15-8-R1-501	103	X	99	104	102	98	103	94	103	95
25	12:49	148	103	TNE	15-8-R1-505 & R2-199	106	X	94	97	74	101	93	95	104	87
25	13:04	152	TNE	TNE	15-8-R1-508	X	X	X	X	X	X	X	X	X	X
26	09:37	151	TNE	110	15-8-R1-520 & R3-793	112	109	106	114	106	104	111	90	113	104
26	10:16	156	TNE	TNE	15-8-R1-524	112	117	106	119	110	103	105	97	103	98
26	11:10	153	147	TNE	15-8-R1-529	115	99	107	117	115	105	98	103	109	106
26	11:43	152	146	TNE	15-8-R1-535	117	119	103	121	111	102	99	88	105	110

TABLE B3 (CTD): SUMMARY OF DATA CAPTURE – AUGUST 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Aug-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
26	12:14	154	TNE	TNE	15-8-R1-540	118	118	106	116	112	112	105	99	105	99
26	13:53	153	TNE	149	15-8-R1-543	117	118	105	119	107	108	102	95	115	97
26	14:13	154	TNE	TNE	15-8-R1-547	113	116	100	117	113	119	106	91	111	105
27	12:51	143	TNE	TNE	15-8-R1-558	121	119	95	111	108	99	97	89	89	94
27	13:25	155	TNE	TNE	15-8-R1-561	114	111	90	114	106	91	97	98	92	102
27	14:00	154	TNE	TNE	15-8-R1-565	95	100	102	109	102	98	97	94	98	103
27	14:36	156	TNE	TNE	15-8-R1-569	110	105	100	110	97	94	100	97	103	110
27	14:56	150	TNE	TNE	15-8-R1-572	109	80	108	111	90	95	103	92	93	93

TABLE B3 (CTD): SUMMARY OF DATA CAPTURE – AUGUST 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Sep-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
07	10:01	147	115	156	15-9-R1-72 & R2-28 & R3-43	X	101	98	100	96	109	97	109	105	108
07	10:33	103	144	155	15-9-R1-75 & R2-32 & R3-51	X	100	100	89	88	110	100	105	106	103
07	11:10	150	136	156	15-9-R1-82 & R2-36 & R3-59	X	103	103	76	93	108	103	103	107	111
07	11:23	150	136	155	15-9-R1-83 & R2-37 & R3-63	X	108	105	82	107	106	105	101	99	104
07	12:08	151	135	155	15-9-R1-90 & R2-41 & R3-79	X	107	111	82	104	106	103	100	108	96
07	13:56	152	131	TNE	15-9-R1-96	X	111	109	81	96	100	104	89	98	104
07	14:53	147	136	96	15-9-R1-102 & R2-59 & R3-125	X	106	107	81	97	105	108	97	110	111
07	15:07	148	139	155	15-9-R1-106 & R2-62 & R3-131	X	111	107	81	97	108	109	97	106	109
07	15:13	148	119	TNE	15-9-R1-106	X	72	98	73	68	104	92	97	76	94
08	11:05	91	148	TNE	15-9-R1-114 & R2-67	70	93	101	81	79	109	91	85	86	80
08	11:20	147	113	TNE	15-9-R1-117	89	84	98	101	80	99	80	84	74	82
08	11:53	154	119	TNE	15-9-R1-121 & R2-69 & R3-143	95	82	112	99	99	103	107	89	86	99
08	12:49	TNE	158	117	15-9- & R2-71R3-154	90	99	88	89	81	115	90	89	82	X
09	09:20	149	119	TNE	15-9-R1-140	100	82	102	112	114	100	72	70	102	91
09	10:36	153	124	156	15-9-R1-148 & R2-78	94	101	107	99	96	108	97	102	87	85

TABLE B4: SUMMARY OF DATA CAPTURE – SEPTEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Sep-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
09	11:54	153	125	156	15-9-R1-153	99	100	93	92	90	106	87	87	89	93
09	13:44	151	122	156	15-9-R1-158 & R3-181	100	103	104	93	89	105	81	100	91	96
10	10:13	147	124	156	15-9-R1-165 & R3-224	94	96	108	99	95	102	81	86	92	95
10	10:49	154	TNE	TNE	15-9-R1-171 & R2-80	94	89	109	92	100	104	88	93	95	97
10	11:40	150	131	TNE	15-9-R1-175 & R2-84	105	109	111	109	98	105	93	98	103	101
10	15:10	104	132	150	15-9-R1-180 & R2-96	103	96	103	99	85	107	101	99	106	100
15	09:44	152	136	97	15-9-R1-243 & R2-123 & R3-269	X	115	110	117	112	95	96	105	105	111
15	15:43	109	129	TNE	15-9-R1-275 & R2-137	X	100	104	104	94	99	95	96	96	97
16	08:55	143	125	TNE	15-9-R1-282	X	96	102	121	116	99	89	99	94	102
16	09:50	153	127	100	15-9-R1-287 & R3-359	X	111	105	112	110	99	102	99	93	107
16	10:32	153	126	TNE	15-9-R1-294 & R2-138	X	103	104	111	108	102	104	96	92	103
16	11:45	107	TNE	TNE	15-9-R1-301 & R3-365	X	95	98	97	92	118	104	90	92	100
16	11:55	152	127	156	15-9-R1-304 & R3-371	99	85	104	102	87	122	97	100	108	97

TABLE B4 (CTD): SUMMARY OF DATA CAPTURE – SEPTEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Sep-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
16	16	103	132	115	15-9-R1-306 & R3-381	106	105	107	110	97	115	100	101	83	90
16	16	150	134	156	15-9-R1-308 & R2-139 & R3-390	108	109	110	114	103	124	100	87	78	88
16	16	145	134	97	15-9-R1-313 & R3-403	108	109	110	114	103	105	92	94	76	88
16	16	104	133	116	15-9-R1-316 & R3-442	107	117	113	113	109	103	105	102	104	102
17	17	146	114	TNE	15-9-R1-326 & R2-143	96	86	97	87	81	108	108	111	102	99
17	17	149	114	TNE	15-9-R1-327 & R2-143	108	111	94	112	103	108	106	111	105	105
17	17	150	123	TNE	15-9-R1-333	109	114	92	108	100	99	103	113	109	107
17	17	153	TNE	TNE	15-9-R1-340	99	93	91	92	84	117	96	98	100	110
17	17	152	TNE	TNE	15-9-R1-351	85	100	102	95	77	114	95	101	103	100
17	17	97	131	TNE	15-9-R1-360 & R2-145	85	87	98	96	72	97	92	100	98	93
21	21	149	TNE	TNE	15-9-R1-402	111	118	98	115	107	114	109	97	90	91
21	21	103	128	TNE	15-9-R1-407 & R2-150	77	116	105	106	104	119	91	89	93	88
21	21	150	TNE	TNE	15-9-R1-410	121	119	95	112	109	108	82	82	89	97
21	21	143	TNE	TNE	15-9-R1-417	73	104	90	109	100	110	97	98	95	94
22	22	149	TNE	TNE	15-9-R1-427	95	95	103	90	91	105	74	94	82	101

TABLE B4 (CTD): SUMMARY OF DATA CAPTURE – SEPTEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Sep-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
22	11:35	150	TNE	156	15-9-R1-432 & R2-158	X	85	111	84	89	107	98	104	73	74
22	11:30	104	TNE	101	15-9-R1-430	X	103	102	86	85	98	92	98	84	86
22	14:55	TNE	123	TNE	15-9-R2-172	82	78	87	85	72	104	107	102	88	110
23	09:50	123	TNE	155	15-9-R1-464	75	99	100	89	88	110	101	92	106	82
23	11:09	132	150	143	15-9-R1-481 & R2-179	90	103	103	93	93	101	103	103	107	111
23	12:03	144	TNE	147	15-9-R1-485	92	105	107	97	93	103	105	100	94	100
23	13:02	149	TNE	143	15-9-R1-490	95	100	92	98	90	98	102	97	95	106
29	12:18	TNE	123	TNE	15-9-R2-231	93	96	102	92	95	108	89	101	88	95
30	09:51	152	128	156	15-9-R1-533 & R2-238	100	108	104	95	92	119	114	X	121	102
30	09:55	152	128	156	15-9-R1-533 & R2-238	100	108	104	95	92	119	114	X	121	102
30	11:10	154	125	156	15-9-R1-540 & R2-245	99	X	109	103	99	119	90	X	96	98
30	12:03	154	125	156	15-9-R1-543 & R2-250	98	91	104	101	79	120	87	X	91	102
30	13:30	144	TNE	TNE	15-9-R1-552	X	X	103	X	X	X	X	X	X	X

TABLE B4 (CTD): SUMMARY OF DATA CAPTURE – SEPTEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Oct-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
01	10:19	148	124	156	15-10-R1-4 & R2-3 & R3-10	95	X	108	94	72	120	80	92	86	92
01	09:42	105	125	156	15-10-R1-2 & R2-1 & R3-3	99	X	93	88	80	120	86	105	85	94
01	10:49	154	121	156	15-10-R1-7 & R2-5 & R3-17	98	97	107	101	91	116	97	92	91	98
07	11:51	105	117	156	15-10-R1-57 & R2-51 & R3-171	97	84	97	71	81	111	91	92	95	84
08	09:52	134	113	156	15-10-R1-84 & R2-53 & R3-225	97	93	103	91	79	108	98	103	91	86
13	09:27	147	TNE	157	15-10-R1-121 & R3-288	97	83	97	84	75	116	99	97	99	109
13	10:35	144	TNE	TNE	15-10-R1-124	92	X	105	83	77	98	96	105	95	103
13	11:29	146	TNE	155	15-10-R1-127 & R3-295	91	81	102	72	77	113	95	103	101	118
13	12:05	145	TNE	TNE	15-10-R1-132	94	85	87	86	71	106	98	97	94	93
14	11:40	151	TNE	TNE	15-10-R1-140	99	78	96	87	76	106	92	108	101	98
14	12:27	148	TNE	TNE	15-10-R1-143	93	X	101	92	76	99	94	98	95	87
14	12:52	144	TNE	TNE	15-10-R1-147	92	X	103	79	84	113	71	100	101	103
20	10:31	141	TNE	TNE	15-10-R1-175	69	69	74	75	83	76	67	90	84	99
20	12:33	145	TNE	TNE	15-10-R1-184	88	70	74	80	71	89	90	89	84	93
20	15:15	148	TNE	TNE	15-10-R1-194	85	78	76	70	74	98	78	75	65	69

TABLE B5: SUMMARY OF DATA CAPTURE – OCTOBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Oct-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
20	15:50	142	TNE	TNE	15-10-R1-199	90	88	80	71	70	101	82	106	80	96
21	14:30	TNE	147	TNE	15-10-R2-90	94	98	88	92	89	96	94	71	89	103
22	11:57	128	146	TNE	15-10-R1-224 & R2-92	87	88	89	102	94	97	87	109	99	99
22	13:01	120	155	TNE	15-10-R1-263 & R2-98	96	95	88	92	81	112	84	112	96	98
27	10:17	150	TNE	TNE	15-10-R1-328	117	119	111	118	117	89	70	71	84	94
27	11:05	152	TNE	TNE	15-10-R1-334	124	120	107	120	119	82	69	78	86	91
27	11:37	150	TNE	TNE	15-10-R1-338	111	120	102	118	117	81	66	75	79	78
28	10:09	TNE	TNE	144	15-10-R3-332	84	82	99	76	76	91	92	100	98	93
29	09:49	120	125	151	15-10-R1-395 & R2-101 & R3-356	111	118	102	115	106	114	94	95	X	86

TABLE B5 (CTD): SUMMARY OF DATA CAPTURE – OCTOBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Nov-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
03	09:33	TNE	122	156	15-11- R2-1 & R3-1	112	116	98	105	104	118	78	80	84	87
04	10:26	101	121	156	15-11-R1-8 & R2-11 & R3-12	120	119	95	114	112	107	73	82	86	81
04	11:32	92	122	93	15-11-R1-12 & R2-16 & R3-19	108	111	82	108	104	110	97	98	72	101
04	12:37	93	TNE	TNE	15-11-R1-17	109	111	86	70	85	87	77	90	105	106
04	13:51	119	123	156	15-11-R1-24 & R2-32 & R3-35	95	97	79	89	75	105	68	94	97	101
09	09:59	147	TNE	TNE	15-11-R1-45	110	116	98	120	113	97	112	95	103	106
09	10:33	151	TNE	TNE	15-11-R1-48	102	121	96	120	115	106	108	105	114	108
09	11:25	152	TNE	TNE	15-11-R1-52	105	113	104	119	114	100	103	86	104	110
09	12:02	152	TNE	TNE	15-11-R1-55	112	119	98	115	119	110	111	78	107	104
09	13:07	149	TNE	TNE	15-11-R1-58	111	110	103	122	111	100	101	74	111	101
09	14:30	151	TNE	TNE	15-11-R1-60	110	115	83	117	114	92	87	102	105	102
09	14:59	148	TNE	TNE	15-11-R1-63	112	117	100	115	114	102	103	79	107	100
09	15:29	149	TNE	TNE	15-11-R1-65	110	121	99	120	113	102	102	78	112	106
10	13:41	148	TNE	TNE	15-11-R1-72	113	118	91	115	112	100	99	110	97	89
10	14:12	149	TNE	TNE	15-11-R1-74	113	120	90	118	110	94	99	111	104	93

TABLE B6 SUMMARY OF DATA CAPTURE – NOVEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Nov-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
10	14:31	153	TNE	TNE	15-11-R1-77	111	117	92	118	105	94	95	98	103	92
10	14:59	149	TNE	TNE	15-11-R1-79	111	116	99	118	114	98	106	108	92	102
10	15:20	149	TNE	TNE	15-11-R1-81	115	122	95	119	113	96	97	103	94	107
11	10:40	TNE	130	TNE	15-11-R2-34	99	104	99	110	96	93	88	95	101	108
12	10:05	122	120	TNE	15-11-R1-88 & R2-36	101	105	107	102	98	83	96	91	91	85
16	09:33	113	114	156	15-11-R1-249 & R2-45 & R3-62	81	101	98	99	94	X	82	93	79	94
17	12:11	148	TNE	103	15-11-R1-305 & R3-128	93	103	102	97	78	98	89	96	83	86
17	09:33	142	114	157	15-11-R1-286 & R2-53 & R3-94	100	100	100	99	88	110	101	101	106	111
17	09:58	102	135	101	15-11-R1-295 & R2-56 & R3-107	100	103	103	102	93	97	105	105	107	111
17	11:30	113	135	103	15-11-R1-300 & R2-61 & R3-119	104	110	107	107	107	99	105	105	103	107
17	12:38	119	134	109	15-11-R1-308 & R2-63 & R3-131	106	107	111	110	104	97	103	104	104	108
17	12:48	TNE	131	TNE	15-11-R2-64	102	111	109	107	96	84	104	95	98	104
17	13:40	135	TNE	TNE	15-11-R1-312	110	107	91	101	93	98	101	107	107	105
17	14:32	116	136	105	15-11-R1-315 & R2-65 & R3-137	102	105	107	104	97	104	108	97	110	111

TABLE B6 (CTD): SUMMARY OF DATA CAPTURE – NOVEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Nov-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
17	15:27	118	137	115	15-11-R1-322 & R2-66 & R3-139	110	110	107	104	97	108	114	104	110	109
18	08:17	114	120	TNE	15-11-R1-363 & R2-75 & R3-151	91	92	91	94	91	95	94	79	86	93
18	10:04	TNE	116	TNE	15-11- R2-87 & R3-217	87	92	90	93	X	87	108	69	88	86
18	10:34	TNE	112	TNE	15-11- R2-90 & R3-234	95	99	98	94	X	96	102	104	96	79
18	10:57	TNE	TNE	110	15-11-R3-242	93	107	95	98	X	88	85	90	92	89
18	11:47	TNE	119	TNE	15-11-R2-93	95	X	93	99	96	101	107	85	86	99
19	08:40	TNE	119	TNE	15-11-R2-127	93	104	85	X	90	92	X	110	102	X
19	11:30	TNE	TNE	157	15-11-R3-334	83	95	109	97	86	53	X	96	104	X
23	10:42	142	TNE	TNE	15-11-R1-456	105	103	104	97	102	95	87	X	82	X
23	10:00	TNE	124	156	15-11-R2-152 & R3-364	91	102	97	98	91	107	96	102	88	X
23	11:21	150	TNE	TNE	15-11-R1-459	108	115	103	114	117	81	94	X	83	X
23	11:50	149	TNE	TNE	15-11-R1-464	118	117	106	116	118	84	81	X	86	X
23	12:14	149	126	94	15-11-R1-469 & R2-157 & R3-368	114	119	92	116	114	111	89	85	94	X
23	12:45	149	TNE	TNE	15-11-R1-474	112	114	98	116	116	82	81	X	99	X

TABLE B6 (CTD): SUMMARY OF DATA CAPTURE – NOVEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Nov-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
23	14:36	150	122	156	15-11-R1-480 & R2-167 & R3-379	114	118	102	117	112	108	86	93	91	X
23	15:11	149	124	157	15-11-R1-486 & R2-169 & R3-381	111	118	107	116	115	106	81	77	91	X
24	14:26	97	TNE	TNE	15-11-R1-502	86	83	94	82	81	93	82	68	80	78
26	09:48	148	TNE	TNE	15-11-R1-508	83	80	102	69	78	109	113	119	108	X
26	11:13	151	TNE	TNE	15-11-R1-510	83	107	81	77	73	98	107	117	99	X
26	11:52	153	TNE	TNE	15-11-R1-512	84	78	86	73	77	94	107	115	109	105
26	12:29	155	TNE	TNE	15-11-R1-515	82	75	90	77	81	93	117	108	110	X
26	14:21	154	124	TNE	15-11-R1-518 & R2-173	92	82	100	83	78	91	102	113	116	115
26	14:56	153	TNE	TNE	15-11-R1-520	83	84	83	79	76	90	100	121	111	116
30	11:40	TNE	TNE	156	15-11-R3-388	100	104	106	109	86	107	112	102	107	104

TABLE B6 (CTD): SUMMARY OF DATA CAPTURE – NOVEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Dec-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
01	13:00	148	TNE	TNE	15-12-R1-30	112	116	94	118	115	95	81	85	86	104
01	09:58	104	TNE	154	15-12-R1-7 & R3-1	97	105	95	97	86	104	104	110	104	108
01	14:30	155	TNE	TNE	15-12-R1-33	116	121	88	121	116	93	91	95	84	107
02	10:59	101	129	TNE	15-12-R1-43 & R2-4	104	108	110	108	98	94	100	98	103	100
02	11:19	101	TNE	TNE	15-12-R1-44	93	89	84	75	74	89	82	68	101	99
03	09:31	149	115	104	15-12-R1-64 & R2-5	118	121	106	119	113	99	100	92	104	96
03	12:08	100	TNE	TNE	15-12-R1-74	96	89	92	87	79	85	97	98	105	81
08	09:14	144	TNE	117	15-12-R1-95 & R3-75	97	X	98	113	111	83	88	92	104	92
08	09:07	120	134	TNE	15-12-R1-94 & R2-25	95	X	109	110	98	86	94	85	99	100
08	09:45	TNE	90	102	15-12- & R2-26R3-78	97	X	95	97	88	81	90	72	96	89
08	10:31	102	127	TNE	15-12-R1-97 & R2-27	90	X	103	95	88	91	92	90	102	93
08	10:45	155	124	TNE	15-12-R1-98 & R2-28	91	X	101	120	115	98	83	83	93	92
08	11:18	108	127	TNE	15-12-R1-103 & R2-29	94	X	96	94	83	88	94	86	93	97

TABLE B7: SUMMARY OF DATA CAPTURE – DECEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);
Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);
Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and
X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Dec-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
08	11:43	150	122	TNE	15-12-R1-105 & R2-30	93	X	97	122	113	90	105	84	97	109
08	11:47	150	122	TNE	15-12-R1-105 & R2-30	93	X	97	122	113	90	105	84	97	109
08	12:13	TNE	122	TNE	15-12-R2-31	93	X	97	98	87	93	92	86	84	100
08	12:37	151	TNE	TNE	15-12-R1-114	119	X	98	122	116	58	94	81	100	103
08	13:54	149	123	TNE	15-12-R1-118 & R2-34	98	X	94	122	117	95	96	88	106	114
08	14:00	151	TNE	TNE	15-12-R1-120	118	X	97	119	113	90	99	80	95	114
08	14:18	TNE	119	TNE	15-12-R2-35	91	X	97	95	83	100	93	91	95	99
08	14:44	TNE	126	TNE	15-12-R2-36	98	X	101	107	94	95	91	88	97	111
08	14:59	151	TNE	TNE	15-12-R1-123	97	X	93	124	115	86	86	91	103	106
09	08:57	146	TNE	TNE	15-12-R1-126	116	X	91	116	112	86	77	110	109	113
09	10:59	137	TNE	92	15-12-R1-134 & R3-82	110	X	80	113	113	88	83	93	96	100
09	12:00	148	TNE	TNE	15-12-R1-139	116	X	88	118	115	98	92	88	91	103
10	09:13	TNE	115	154	15-12- & R2-55R3-101	99	X	96	85	75	101	97	92	98	82
10	09:33	138	113	154	15-12-R1-160 & R2-56 & R3-103	105	X	102	99	82	106	105	95	104	100
10	11:36	TNE	123	TNE	15-12-R2-61	97	X	109	101	93	105	86	106	107	102
14	09:26	TNE	120	TNE	15-12-R2-69	92	99	104	96	79	X	81	69	81	75
15	10:06	150	TNE	TNE	15-12-R1-198	113	120	101	119	115	84	73	83	80	76

TABLE B7 (CTD): SUMMARY OF DATA CAPTURE – DECEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

Green shaded cells denote Positive Causality (PC) – statistical evidence indicates a reasonable likelihood that an on-Range Activity has caused an off-Range effect (i.e. probable causality);

Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

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X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Dec-15		Measured L_{Zpeak} Values at On-Range Locations, dB re 10^{-5} Pa			Southdowns Generated Trigger ID	Measured L_{Zpeak} Values at Off-Range Locations, dB re. 2 x 10^{-5} Pa									
Day	Time	SHB_R1	SHB_R2	SHB_R3		SHB_OS1	SHB_OS2	SHB_OS3	SHB_OS4	SHB_OS5	SHB_OS6	SHB_OS7	SHB_OS8	SHB_OS9	SHB_OS10
15	11:10	144	TNE	TNE	15-12-R1-205	105	110	92	107	100	85	77	92	80	86
15	13:24	103	132	TNE	15-12-R1-214 & R2-93	106	104	109	109	97	103	83	101	79	88
15	13:44	148	134	TNE	15-12-R1-216 & R2-94	116	120	109	118	113	105	91	81	84	88
15	13:46	148	TNE	TNE	15-12-R1-216 & R2-94	116	120	109	118	113	105	91	81	84	88
15	14:31	147	TNE	TNE	15-12-R1-219	108	114	105	113	109	83	88	82	80	86
16	13:07	142	TNE	TNE	15-12-R1-230 & R2-113	107	117	90	113	109	103	104	102	103	102
16	09:52	TNE	128	TNE	15-12-R2-95	101	85	103	111	96	96	98	108	91	111
16	10:27	TNE	133	TNE	15-12-R2-97	110	117	109	115	104	97	96	113	114	111
16	11:00	TNE	TNE	TNE	15-12-R2-101	108	112	105	117	105	99	98	115	113	112
16	14:48	152	TNE	TNE	15-12-R1-233 & R2-120	117	85	97	83	119	92	95	108	100	112
17	08:48	148	TNE	TNE	15-12-R1-236	116	119	94	115	110	88	92	85	101	103
17	10:25	152	TNE	TNE	15-12-R1-239	113	86	75	83	120	87	90	77	108	104
17	10:31	121	113	155	15-12-R1-241 & R2-124 & R3-132	109	111	94	112	103	87	93	87	101	103
17	12:19	151	TNE	TNE	15-12-R1-251 & R2-130 & R3-141	115	122	105	119	119	77	96	93	105	106
18 [1]	12:01	TNE	129	TNE	15-12-R1-258	105	112	107	116	98	105	113	106	112	108
22	11:11	TNE	128	TNE	15-12-R2-147	114	116	90	121	110	91	89	78	100	96

TABLE B7 (CTD): SUMMARY OF DATA CAPTURE – DECEMBER 2015

Notes:

TNE = *Trigger Threshold Not Exceeded;*

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Yellow shaded cells denote Uncertain Causality (UC) – insufficient statistical evidence to confirm that the on-Range Activity has caused an off-Range effect (i.e. possible causality);

Blue shaded cells denote No Causality (NC) – little or no statistical evidence to suggest that the on-Range Activity has caused an off-Range effect (i.e. unlikely causality); and

X = Activity not captured. See Volume 2 – Technical Appendices – Detailed Methodology, Chapter 3: Equipment Outages and Scheduled Maintenance [4] for full details.

Month	Wind Speed (m/s)	Temperature (°C)	Relative Humidity (%)	Rain Rate (mm/h)
July	5.7(1.9 - 11.0)	19.5(12.7 - 24.3)	71.1(46.3 - 92.0)	0.0(0.0 - 0.4)
August	6.9(0.8 - 11.0)	18.2(14.2 - 22.4)	75.6(52.0 - 98.0)	0.1(0.0 - 1.6)
September	5.7(1.2 - 9.9)	15.3(11.8 - 18.2)	78.7(54.5 - 99.8)	0.1(0.0 - 1.7)
October	5.3(0.8 - 7.7)	12.4(7.1 - 16.3)	81.8(66.6 - 100.0)	0.0(0.0 - 0.7)
November	6.9(1.4 - 15.2)	11.1(2.0 - 15.1)	85.7(70.0 - 100.0)	0.0(0.0 - 0.1)
December	6.5(1.4 - 11.5)	11.6(8.0 - 14.6)	90.2(81.0 - 100.0)	0.0(0.0 - 0.2)
Summary	**6.2(0.8 - 15.2)**	**15.4(2.0 - 24.3)**	**79.0(46.3 - 100.0)**	**0.0(0.0 - 1.7)**

TABLE B8: SUMMARY OF METEOROLOGICAL DATA DURING RANGE ACTIVITIES

Notes:
[1] – average presented outside of parenthesis with the range presented within.

Monitoring Location ID	NEQ / Calibre - Open Detonations											
	< 5 KG				5 – 9.9 KG				10 – 25 KG			
	L_{Cpeak}	L_{Zpeak}	PPV mms^{-1}	Maximum Displacement mm[3]	L_{Cpeak}	L_{Zpeak}	PPV mms^{-1}	Maximum Displacement mm[3]	L_{Cpeak}	L_{Zpeak}	PPV mms^{-1}	Maximum Displacement mm[3]
SHB_R1_DAT	152	153	1.96	0.05	150	150	2.50	0.04	156	156	3.09	0.07
SHB_R2_RUG	155	155	3.31	0.02	146	147	1.91	0.02	149	150	3.31	0.02
SHB_R3_BAT	156	156	7.30	0.03	156	156	8.24	0.03	156	156	8.24	0.04
SHB_OS1	105	112	0.25	0.00	117	120	0.12	0.00	117	124	0.13	0.00
SHB_OS2	112	117	0.75	0.05	116	120	0.76	0.05	117	122	0.79	2.60
SHB_OS3	108	113	0.14	0.00	107	111	0.34	0.01	107	112	0.27	0.00
SHB_OS4	112	121	0.28	0.00	112	118	0.26	0.00	116	124	0.75	0.01
SHB_OS5	107	116	0.04	0.00	109	117	0.16	0.00	111	119	0.17	0.00
SHB_OS6	116	122	0.18	0.00	115	119	0.06	0.00	118	124	0.20	0.00
SHB_OS7	106	113	0.05	0.00	104	107	0.06	0.00	112	117	0.32	0.00
SHB_OS8	99	106	0.16	0.00	104	111	0.14	0.00	114	121	0.51	0.01
SHB_OS9	107	112	0.20	0.00	102	113	0.17	0.01	116	121	0.12	0.00
SHB_OS10	101	108	0.05	0.00	104	110	0.04	0.00	110	118	0.06	0.00

TABLE B9: SUMMARY OF MAXIMUM MEASURED NOISE LEVELS

Notes:
[1] "-" indicates where no event has been recorded for the NEQ category;
[2] All events presented fall into Positive Causality or Uncertain Causality categories; and
[3] Maximum Displacement <4Hz

Monitoring Location ID	NEQ / Calibre - Open Detonations											
	25 – 49 KG				50 –75KG				> 75KG			
	L_{Cpeak}	L_{Zpeak}	PPV mms^{-1}	Maximum Displacement mm[3]	L_{Cpeak}	L_{Zpeak}	PPV mms^{-1}	Maximum Displacement mm[3]	L_{Cpeak}	L_{Zpeak}	PPV mms^{-1}	Maximum Displacement mm[3]
SHB_R1_DAT	155	156	2.50	0.09	154	154	2.13	0.10	103	106	2.04	0.00
SHB_R2_RUG	157	158	7.71	0.12	107	107	0.01	0.00	113	113	0.01	0.00
SHB_R3_BAT	102	102	8.24	0.04	-	-	0.14	0.00	-	-	-	-
SHB_OS1	111	114	0.11	0.00	88	97	0.06	0.00	-	-	-	-
SHB_OS2	110	121	0.80	0.14	79	88	0.46	0.01	-	-	-	-
SHB_OS3	102	111	0.37	0.01	97	99	0.12	0.00	97	100	0.02	0.00
SHB_OS4	114	122	0.35	0.01	93	102	0.28	0.00	-	-	-	-
SHB_OS5	108	117	0.11	0.00	81	91	0.03	0.00	-	-	-	-
SHB_OS6	107	115	0.17	0.00	96	107	0.03	0.00	99	105	0.01	0.00
SHB_OS7	98	108	0.08	0.00	83	86	0.04	0.00	-	-	-	-
SHB_OS8	97	105	0.45	0.01	85	96	0.13	0.00	90	99	0.02	0.00
SHB_OS9	105	114	0.25	0.00	83	89	0.11	0.00	-	-	-	-
SHB_OS10	105	114	0.03	0.00	87	95	0.02	0.00	-	-	-	-

TABLE B10: SUMMARY OF MAXIMUM MEASURED NOISE LEVELS

Notes:
[1] "-" indicates where no event has been recorded for the NEQ category;
[2] All events presented fall into Positive Causality or Uncertain Causality categories; and
[3] Maximum Displacement <4Hz

Monitoring Location ID	No. Events Maximum in Component Axis			% Events Maximum in Component Axis		
	x	y	z	x	y	z
SHB_R1_DAT	5	21	173	3%	11%	86%
SHB_R2_RUG	21	41	94	14%	26%	60%
SHB_R3_BAT	0	82	43	0%	66%	34%
SHB_OS1	11	22	213	5%	9%	86%
SHB_OS2	60	88	97	25%	36%	39%
SHB_OS3	0	12	248	0%	5%	95%
SHB_OS4	12	26	218	5%	10%	85%
SHB_OS5	94	14	173	34%	5%	61%
SHB_OS6	40	214	33	14%	74%	12%
SHB_OS7	19	29	228	7%	11%	82%
SHB_OS8	42	8	229	15%	3%	82%
SHB_OS9	15	28	245	5%	10%	85%
SHB_OS10	57	128	49	24%	55%	21%
Total	376	713	2043	12%	23%	65%

TABLE B11: DISTRIBUTION OF MAXIMUM COMPONENT VELOCITY PER AXIS

Monitoring Location ID	No of Off-Range Triggered Events Caused by Local Activity[1]	L_{Zpeak}[2]	L_{Cpeak}[3]	Max Component PPV mms^{-1}	Comments / Cause of Max Event
SHB_OS1	99	90 - 126	89 - 125	0.01 - 17.22	Fireworks[4]
SHB_OS2	785	93- 143	92 - 141	0.01 - 48.45	Wind noise[4]
SHB_OS3	237	95 - 134	94 - 132	0.01 - 2.62	Fireworks[4]
SHB_OS4	83	93 – 139	93 - 137	0.00 - 0.38	Wind noise
SHB_OS5	79	95 – 120	95 - 119	0.00 - 0.34	Hammering
SHB_OS6	107	95 - 130	94 - 130	0.00 - 0.09	Fireworks
SHB_OS7	116	90 - 148	98 – 144	0.01 - 12.02	Wind noise[4]
SHB_OS8	403	95 - 140	94 - 139	0.00 - 1.80	Fireworks[4]
SHB_OS9	37	94 - 129	94 - 127	0.00 - 0.23	Fireworks
SHB_OS10	74	94 - 136	94 - 135	0.00 - 1.61	Fireworks[4]

TABLE B12: SUMMARY OF LOCALLY TRIGGERED EVENTS AT OFF-RANGE LOCATIONS

Notes:
[1] indicates the number of triggers attributable to events in the vicinity of individual off-Range monitoring locations (not Range firing events) e.g. wind noise, road traffic, train movements, fireworks;
[2] presents the range of L_{ZPeak} levels attributable to triggered events caused by local activity;
[3] presents the range of L_{CPeak} levels attributable to triggered events caused by local activity; and
[4] indicates vibration magnitudes due to local activity / interference.