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An agency of HSE

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Our Ref: TRIM 2011/331511
Unique No: BUR 77252N

21 June 2011

Dear [redacted]

West Berkshire Council's Core Strategy Examination
(Burghfield Licensed Nuclear Site – Nuclear Safeguarding Zones)

This correspondence serves to supplement ONR's previous response of 28 January 2011 in relation to actions placed on ONR at the hearing on 3 November 2010.[1]

It also addresses specific matters raised by the Inspector ([redacted] Planning Inspectorate) in his post hearing note of 8 November 2010, in which the Inspector stated:

> *As I indicated at the hearing, in order to assess whether the Core Strategy's proposals for the area are sound, I need to know whether the HSE currently consider that there is any restraint on residential development in or around Burghfield Common and Mortimer and what capacity there may be for development in this area in the future. These two large villages are identified as Rural Service Centres in the Core Strategy.*
>
> *If a locally specific headroom figure for Burghfield Common and Mortimer cannot be identified please explain why.*
>
> *It would also be important to acknowledge any uncertainty in the data used or in the outcome or whether there is a range of possible outcomes. It would be helpful to indicate whether you anticipate any changes in the HSE approach or whether you are aware of any planned or possible changes at AWE sites which would affect your advice.*
>
> [redacted]
> *Planning Inspectorate*
> *8 November 2010*

[1] ONR letter 28 January 2011, TRIM Folder 4.2.1.1439. Record No. 2011/54859

Population Headroom Limits

The analysis presented in Annex A attached, considers residential development phased scenarios A, B and C, as described in Appendix A of West Berkshire correspondence to ONR of 6 April 2011.[2]

As described and illustrated in Annex A, there is no unique solution to the determination of population headroom limits. It is not appropriate therefore, to specify a single figure for each of the Burghfield Common and Mortimer locations.

Notwithstanding the limitations of the demographic nuclear model outlined in Section A.1 of Annex A, and as applied within the safeguarding zones around the Burghfield nuclear site, it is demonstrated nonetheless that:

(a) Positive margins on headroom limits are demonstrated for the (4-5) km distance band for the three residential development phasing scenarios A, B and C for 2016, 2021 and 2026.

(b) Positive margins on headroom limits are demonstrated for developments lying in the range (1-4) km for the three residential development phasing scenarios A, B and C for 2016 and 2021.

(c) At 2026 positive margins are not apparent for the three residential development phasing scenarios A, B and C for developments lying in the range (1-4) km.

Residential Developments within the Nuclear Safeguarding Zones

In accordance with its previously stated position, ONR considers that its decision to *'advise against'* planning applications within the inner safeguarding zone of the AWE Aldermaston and Burghfield nuclear sites should be maintained until such time that:[3]

- the criteria for judging acceptable population density levels around nuclear licensed sites change, and/or
- requisite engineered safeguards are in place, and/or
- additional information relating to the off-site release of radioactive material is made available by AWE for assessment by HSE/ONR specialists.

In the interim, HSE/ONR's decision to *'advise against'* planning applications within the inner safeguarding zones of the AWE Aldermaston and Burghfield nuclear sites is contingent on the size, location and nature (residential, commercial, or institutional) of the proposed development.

[2] [redacted] West Berks to [redacted] ONR, letter of 6 April 2011, TRIM Folder 4.2.1.1439. Record No. 2011/329217
[3] Letter 12 December 2008, TRIM Folder 4.2.1.657 Records 2008/651477 and 2008/654425

MENSA Project

According to AWE's current programme for the MENSA project, the facility is scheduled to become operational in 2015. It is ONR's intention to review the position with regard to available demographic margins contingent on the demonstration of a period of successful operation.

If you require any further clarity in relation to the above, please do not hesitate to call.

Yours sincerely

HM DEPUTY CHIEF INSPECTOR
Office for Nuclear Regulation

Annex A

WEST BERKSHIRE COUNCIL - CORE STRATEGY EXAMINATION

Burghfield Licensed Nuclear Site: Population Headroom Limits

A.1 INTRODUCTION

The analysis presented in this Annex, examines the population headroom limits in the vicinity of the Burghfield licensed nuclear site. It has been produced in response to a request from West Berkshire Council to consider residential development phased scenarios A, B and C, as described in Appendix A of West Berkshire correspondence to ONR of 6 April 2011.[1]

With respect to the West Berkshire Core Strategy Examination, the three locations of primary interest in the immediate vicinity of the Burghfield nuclear site are Burghfield Common, Mortimer and Spencers Wood. The latter location has been included in the overall analysis of demographics although it is not a component part of the West Berkshire Core Strategy.

Burghfield Common and Mortimer are identified as Rural Service Centres in the West Berkshire Core Strategy.

In his note of 8 November 2010, the Planning Inspector ([redacted]) requested additional information relating to the available capacity/headroom for future development in these two locations, and that ONR should advise on any uncertainties in the analysis or whether there is a range of possible outcomes. These matters are addressed in this Annex.

For the purpose of this analysis, the influence of the Reading urban area, a population centre in excess of two hundred thousand residents, has been removed from the demographic nuclear model. As a consequence, this analysis to determine population headroom limits should be considered as being non-conservative and cognisant of the above, should be restricted to problem situations involving sensitivity studies.

Furthermore, it is important to note that the analysis herein has been restricted exclusively to a consideration of night-time residents, with no allowance for either short term or long term transient populations.

Also, it needs to be recognised that there is no unique solution to the problem situation:

> *What is the appropriate limit on population headroom for residential developments around the Burghfield nuclear site within the (0-5) km safeguarding zones?*

Rather, the solution is one of many possible solutions as demonstrated herein, involving a linear combination of the cumulative effect of discrete population increments in the various distance bands around the nuclear site.

Constraints on development around a nuclear facility are established and restricted to,

[1] [redacted] West Berks to [redacted] ONR, letter of 6 April 2011, Appendix A.
TRIM Folder 4.2.1.1439. Record No. 2011/329217

an area where unrestrained population growth would have an adverse effect on the safeguards in place for the protection of people and society.

It is for the reasons above, that the application of the demographic nuclear model to a licensed site, typically requires information from Local Authorities relating to the following 3Ws:

- *What: the numbers of residential units,*
- *Where: the locations of the various development proposals,*
- *When: the phasing of the developments.*

The above approach is consistent with that previously adopted in ONR's response (ONR letter of 28 January 2011) to actions placed at the hearing on 3 November 2010 and reflects an appropriate application of the demographic nuclear model which was based on the information provided to ONR at a meeting with all relevant Local Authorities on 30 November 2010. [2]

A.2 POPULATION DATASETS – PHASED SCENARIOS A, B AND C

Figures 1(a) and 1(b) show the polar grid orientation for Sector rotations of 15° and 25° respectively. Grid rotation in 5° increments is undertaken to determine the most limiting 30° Sector configuration arising from a consideration of the population distribution around the Burghfield site as it accumulates with time for 2016, 2021 and 2026.

	15° Rotation Grid Sector	25° Rotation Grid Sector
Burgfield Common	8	8
Mortimer	7	7
Spencers Wood	4	3
Three Mile Cross Shinfield	3	3

A grid sector rotation of 15° is applicable to a consideration of the 2011 and 2016 population datasets for the three phased scenarios A, B and C, whereas a grid sector rotation of 25° is applicable for consideration of the 2021 and 2026 datasets.

For the three locations of interest, populations groupings (night-time residents) in each of the 1.0 km distance bands lying within the range (0-5) km from the nuclear site are summarised in Table 1.

Within the 1.5 km Detailed Emergency Planning Zone (DEPZ) there are currently 195 night-time residents with a total of 515 night-time residents within a radius of 2 km around the Burghfield nuclear site.[3]

[2] ONR letter 28 January 2011, TRIM Folder 4.2.1.1439. Record No. 2011/54859

[3] HSE (2005), National Population Database, Research Report RR297 http://www hse.gov.uk/research/rrpdf/rr297.pdf
HSE (2008), National Population Database 2, Research Report RR678 http://www hse.gov.uk/research/rrpdf/rr678.pdf

A.3 INTERACTION MATRIX FOR POPULATION INCREMENTS

Before considering any estimates for population headroom limits, there is a need for a thorough understanding of interaction effects, since it is for this very reason that there exists no unique solution to the problem situation posed earlier.

It is important to recognise that the influence of population increments in any given distance band, can propagate both away from the site, and towards the site in accordance with the interaction matrix presented in Table 2.

From the first row of Table 2, an increment of 10 persons in the (0-1) km distance band for example, would propagate from the site and would be equivalent to placing 111.803 persons in the (3-4) km distance band. The population headroom limit for the (3-4) km distance band would be reduced accordingly. Similarly an increment of 10 persons in the (1-2) km distance band would further reduce the population headroom limit in the (3-4) km distance band by 33.437 persons.

The influence of a population increment in a given distance band, will also propagate backwards towards the site in accordance with the weights given in the lower half of Table 2. For example, an increment of 100 persons in the (3-4) distance band would be equivalent to reducing the population headroom limit in the (1-2) km distance band by 29.91 persons.

A.4 POPULATION HEADROOM LIMITS

Populations headroom limits are presented in Table 3. Burghfield Common (shown highlighted) is the most constraining location which determines the potential headroom limits for the Burghfield site as a whole.

Positive margins on headroom limits are demonstrated for the (4-5) km distance band for the three population phased scenarios A, B and C for 2016, 2021 and 2026.

Positive margins on headroom limits are demonstrated for developments lying in the range (1-4) km for the three population phased scenarios A, B and C for 2016 and 2021.

However, at 2026 positive margins are not apparent for the three population phased scenarios A, B and C for developments lying in the range (1-4) km.

The remainder of this Annex gives consideration to an examination of the population headroom limits for the 2021 Scenario C shown highlighted in Table 4 (reproduced from Table 3) with respect to the complexity of interaction effects, and the appropriate interpretation of the results presented in Table 3.

A.5 INTERACTION EFFECTS

It is important to note that the column entries for population headroom limits listed in Table 4 are mutually exclusive as illustrated below.

Consider the column entries for 2021 scenario C, highlighted in Table 4. A population increment

of 86 persons in the (1-2) km distance band would produce the results shown in Table 5(c). Note that the headroom limits in each successive distance band have reduced according to the weights given in row 2 of Table 2.

Similarly, a population increment of 628 persons in the (3-4) km distance band would produce the results shown in Table 5(e) according to weights given in rows 4 and 7 of Table 2. There is a concomitant reduction in the headroom limit in the (4-5) km distance band by 910 persons.

Population headroom limits for discrete incremental population increases in successive distance bands are illustrated graphically in Figures 2 to 5. The results presented in Figures 2 to 5 should be viewed as being complementary to the limits given in Table 5.

A.6 CONCLUSIONS

(a) Population headroom limits in the vicinity of the Burghfield licensed nuclear site have been examined in response to a request from West Berkshire Council to consider residential development phased scenarios A, B and C.

(b) The three locations of primary interest in the immediate vicinity of the Burghfield licensed nuclear site are Burghfield Common, Mortimer and Spencers Wood.

(c) The influence of the Reading urban area, a population centre in excess of two hundred thousand residents, has been removed from the demographic nuclear model. As a consequence, the analysis herein to determine population headroom limits should be considered as non-conservative.

(d) The analysis has been restricted to a consideration of night-time residents, with no allowance for either short term or long term transient populations.

(e) It needs to be recognised that there is no unique solution to the problem situation of population headroom limits.

(f) The solution is one of many possible solutions involving a linear combination of the cumulative effect of discrete population increments in the various distance bands around the nuclear site.

(g) Because of interaction effects, the influence of population increments in any given distance band, can propagate both away from the site, and back towards the site.

(h) An appropriate application of the demographic nuclear model to a licensed site always requires information relating to 3Ws:

- *What: the numbers of residential units,*
- *Where: the locations of the various development proposals,*
- *When: the phasing of the developments.*

(i) Burghfield Common is the most constraining location which determines the population headroom limits for the Burghfield site as a whole.

(j) Positive margins on headroom limits are demonstrated for the (4-5) km distance band for the three population phased scenarios A, B and C for 2016, 2021 and 2026.

(k) Positive margins on headroom limits are demonstrated for developments lying in the range (1-4) km for the three population phased scenarios A, B and C for 2016 and 2021.

(l) At 2026 positive margins are not apparent for the three population phased scenarios A, B and C for developments lying in the range (1-4) km.

[redacted]

20 June 2011

HM Principal Inspector of Nuclear Installations
Office for Nuclear Regulation (An Agency of HSE)

Population Dataset - Scenario A

15° Grid Rotation	Distance Band (km) - 2011				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	5	89	2575	2163	668
Mortimer	5	18	97	224	2875
Three Mile Cross Shinfield	3	5	46	1742	2926
Spencers Wood	0	45	69	2144	1091

15° Grid Rotation	Distance Band (km) - 2016 Scenario A				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	5	169	2575	2163	668
Mortimer	5	18	97	260	2892
Three Mile Cross Shinfield	3	5	46	3038	3567
Spencers Wood	0	45	69	2144	1854

25° Grid Rotation	Distance Band (km) - 2021 Scenario A				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	7	573	3258	2714	286
Mortimer	3	32	104	389	3331
Three Mile Cross Shinfield Spencers Wood	0	12	51	3957	4720

25° Grid Rotation	Distance Band (km) - 2026 Scenario A				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	7	890	3258	2714	286
Mortimer	3	32	104	533	3331
Three Mile Cross Shinfield Spencers Wood	0	12	51	3957	4720

Population Dataset - Scenario B

15° Grid Rotation	Distance Band (km) - 2011				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	5	89	2575	2163	668
Mortimer	5	18	97	224	2875
Three Mile Cross Shinfield	3	5	46	1742	2926
Spencers Wood	0	45	69	2144	1091

15° Grid Rotation	Distance Band (km) - 2016 Scenario B				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	5	169	2575	2163	668
Mortimer	5	18	97	260	2892
Three Mile Cross Shinfield	3	5	46	3038	3567
Spencers Wood	0	45	69	2144	1854

25° Grid Rotation	Distance Band (km) - 2021 Scenario B				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	7	573	3258	2714	286
Mortimer	3	32	104	389	3331
Three Mile Cross Shinfield Spencers Wood	0	12	51	3957	4720

25° Grid Rotation	Distance Band (km) - 2026 Scenario B				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	7	890	3258	2714	286
Mortimer	3	32	104	533	3331
Three Mile Cross Shinfield Spencers Wood	0	12	51	3957	4720

Population Dataset - Scenario C

15° Grid Rotation	Distance Band (km) - 2011				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	5	89	2575	2163	668
Mortimer	5	18	97	224	2875
Three Mile Cross Shinfield	3	5	46	1742	2926
Spencers Wood	0	45	69	2144	1091

15° Grid Rotation	Distance Band (km) - 2016 Scenario C				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	5	185	2575	2163	668
Mortimer	5	18	97	289	2892
Three Mile Cross Shinfield	3	5	46	3038	3567
Spencers Wood	0	45	69	2144	1854

25° Grid Rotation	Distance Band (km) - 2021 Scenario C				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	17	674	3258	2714	286
Mortimer	3	32	104	562	3331
Three Mile Cross Shinfield Spencers Wood	0	12	51	3957	4720

25° Grid Rotation	Distance Band (km) - 2026 Scenario C				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	7	1058	3258	2714	286
Mortimer	3	32	104	821	3331
Three Mile Cross Shinfield Spencers Wood	0	12	51	3957	4720

Table 1: Burghfield - Population Datasets for Phasing Scenarios A, B and C

Note: Burghfield - within the 1.5 kilometre radius DEPZ, there are currently 195 night-time residents, with a total of 515 night-time residents within a 2 kilometre radius, (2011).

Interaction Matrix for Population Headroom Limits

Distance Band (km)	0-1	1-2	2-3	3-4	4-5
0-1	1.0000	3.3437	6.8463	11.1803	16.2027
1-2	-	1.0000	2.0475	3.3437	4.8457
2-3	-	-	1.0000	1.6330	2.3666
3-4	-	-	-	1.0000	1.4492
4-5	-	-	-	-	1.0000
4-5	0.0617	0.2064	0.4225	0.6900	1.0000
3-4	0.0894	0.2991	0.6124	1.0000	-
2-3	0.1461	0.4884	1.0000	-	-
1-2	0.2991	1.0000	-	-	-
0-1	1.0000	-	-	-	-

Table 2

Scenarios A & B

15° Grid Rotation	Distance Band (km) - 2016 Scenarios A & B				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	-5	931	1907	4005	9063
Mortimer	-5	1274	4694	10459	16193
Three Mile Cross Shinfield	-3	1294	4785	7831	11708
Spencers Wood	0	1264	4701	8587	14517

25° Grid Rotation	Distance Band (km) - 2021 Scenarios A & B				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	-7	187	383	965	5040
Mortimer	-3	1267	4672	10295	15515
Three Mile Cross Shinfield Spencers Wood	0	1297	3898	6366	9226

25° Grid Rotation	Distance Band (km) - 2026 Scenarios A & B				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	-39	-130	-266	-95	3504
Mortimer	-3	1267	4672	10151	15306
Three Mile Cross Shinfield Spencers Wood	0	1297	3898	6366	9226

Scenario C

15° Grid Rotation	Distance Band (km) - 2016 Scenario C				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	-5	915	1874	3951	8985
Mortimer	-5	1274	4694	10430	16151
Three Mile Cross Shinfield	-3	1294	4785	7831	11708
Spencers Wood	0	1264	4701	8587	14517

25° Grid Rotation	Distance Band (km) - 2021 Scenario C				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	-7	86	176	628	4551
Mortimer	-3	1267	4672	10122	15264
Three Mile Cross Shinfield Spencers Wood	0	1297	3898	6366	9226

25° Grid Rotation	Distance Band (km) - 2026 Scenario C				
	0-1	1-2	2-3	3-4	4-5
Burghfield Common	-89	-298	-610	-656	2690
Mortimer	-3	1267	4672	9863	14889
Three Mile Cross Shinfield Spencers Wood	0	1297	3898	6366	9226

Table 3: Population Headroom Limits

Site Population Headroom Limits - Scenarios A, B and C

Distance Band (km)	2016		2021		2026	
	A & B	C	A & B	C	A & B	C
0-1	-5	-5	-7	-7	-39	-89
1-2	931	915	187	86	-130	-298
2-3	1907	1874	383	176	-266	-610
3-4	4005	3951	965	628	-95	-656
4-5	9063	8985	5040	4551	3504	2690

Table 4

(a) Population Increment (persons)

Distance Band (km)	0-1	1-2	2-3	3-4	4-5
	-	-	-	-	-
0-1	-7				
1-2	183	612			
2-3	26	86	176		
3-4	56	188	384	628	
4-5	281	939	1,923	3,140	4,551
Headroom (persons)	-7	86	176	628	4,551

(b) Population Increment (persons)

Distance Band (km)	0-1	1-2	2-3	3-4	4-5
	(-7)	-	-	-	-
0-1	0				
1-2	190	635			
2-3	33	109	224		
3-4	63	211	432	706	
4-5	288	962	1,971	3,218	4,664
Headroom (persons)	0	109	224	706	4,664

(c) Population Increment (persons)

Distance Band (km)	0-1	1-2	2-3	3-4	4-5
	-	(+86)	-	-	-
0-1	-7				
1-2	157	526			
2-3	0	0	0		
3-4	30	102	208	340	
4-5	255	853	1,747	2,853	4,134
Headroom (persons)	-7	0	0	340	4,134

(d) Population Increment (persons)

Distance Band (km)	0-1	1-2	2-3	3-4	4-5
	-	-	(+176)	-	-
0-1	-7				
1-2	183	612			
2-3	0	0	0		
3-4	30	102	208	340	
4-5	255	853	1,747	2,853	4,134
Headroom (persons)	-7	0	0	340	4,134

(e) Population Increment (persons)

Distance Band (km)	0-1	1-2	2-3	3-4	4-5
	-	-	-	(+628)	-
0-1	-7				
1-2	183	612			
2-3	26	86	176		
3-4	0	0	0	0	
4-5	225	751	1,538	2,512	3,641
Headroom (persons)	-7	0	0	0	3,641

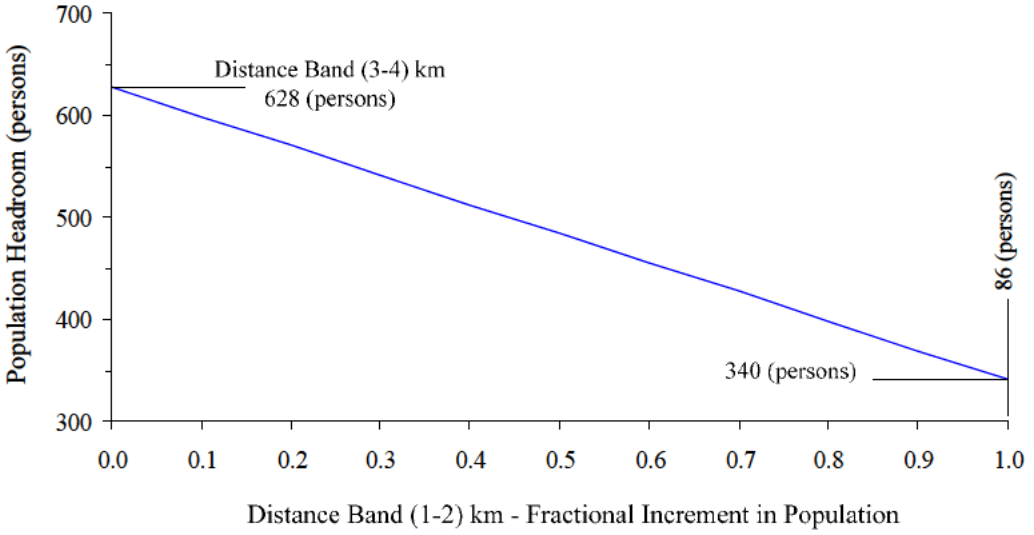
(f) Population Increment (persons)

Distance Band (km)	0-1	1-2	2-3	3-4	4-5
	-	-	-	-	(+4551)
0-1	-7				
1-2	183	612			
2-3	26	86	176		
3-4	56	188	384	628	
4-5	0	0	0	0	0
Headroom (persons)	-7	0	0	0	0

Table 5 : Burghfield 2021 Phasing Scenario C – Illustration of Interaction Effects

Figure 1(a): Burghfield Polar Grid with 15º Sector Rotation

Figure 1(b): Burghfield Polar Grid with 25º Sector Rotation


700
600
500
400
300
Population Headroom (persons)
Distance Band (3-4) km
628 (persons)
86 (persons)
340 (persons)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Distance Band (1-2) km - Fractional Increment in Population

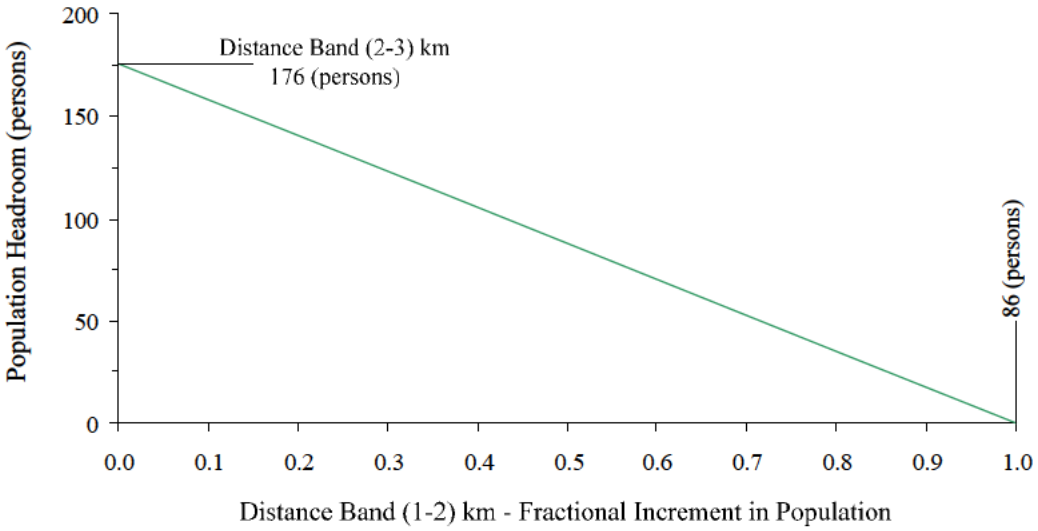

200
150
100
50
0
Population Headroom (persons)
Distance Band (2-3) km
176 (persons)
86 (persons)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Distance Band (1-2) km - Fractional Increment in Population

Figure 2

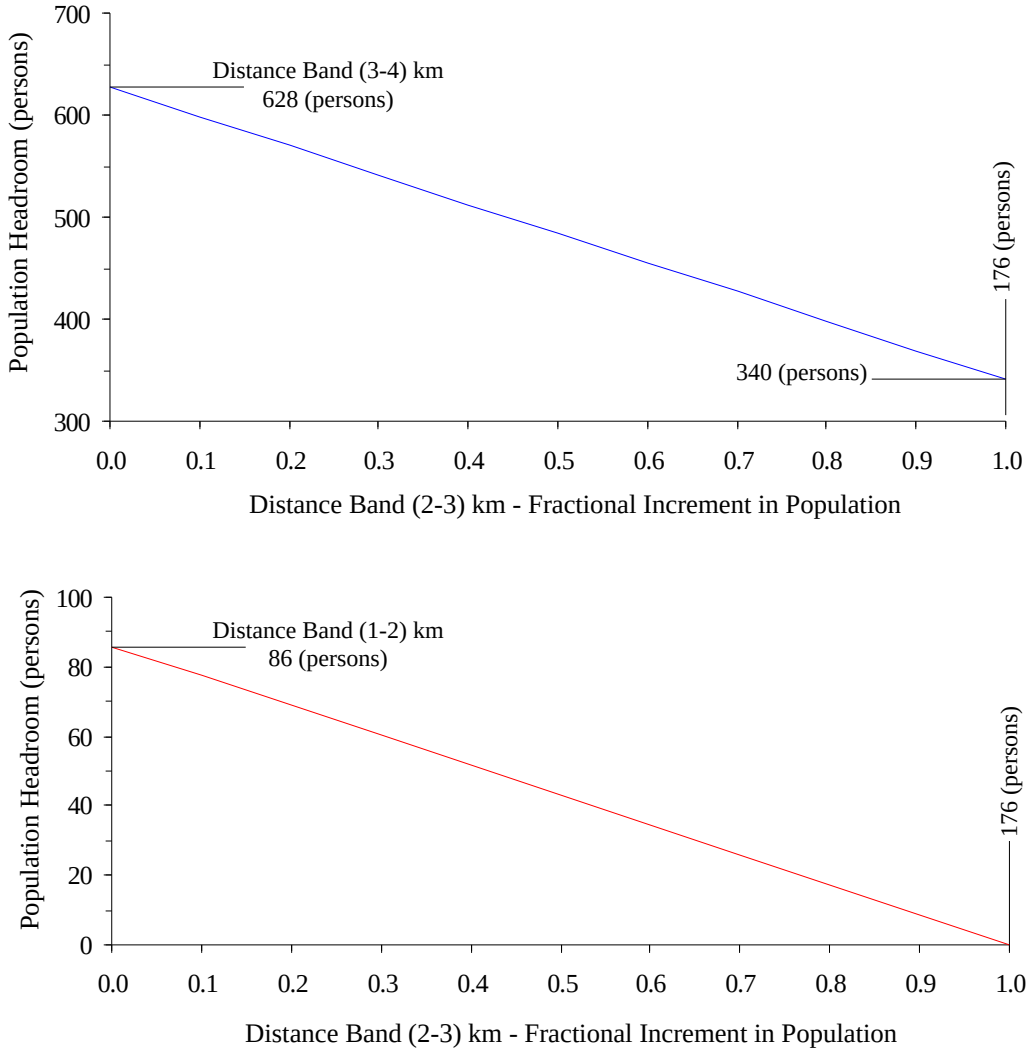
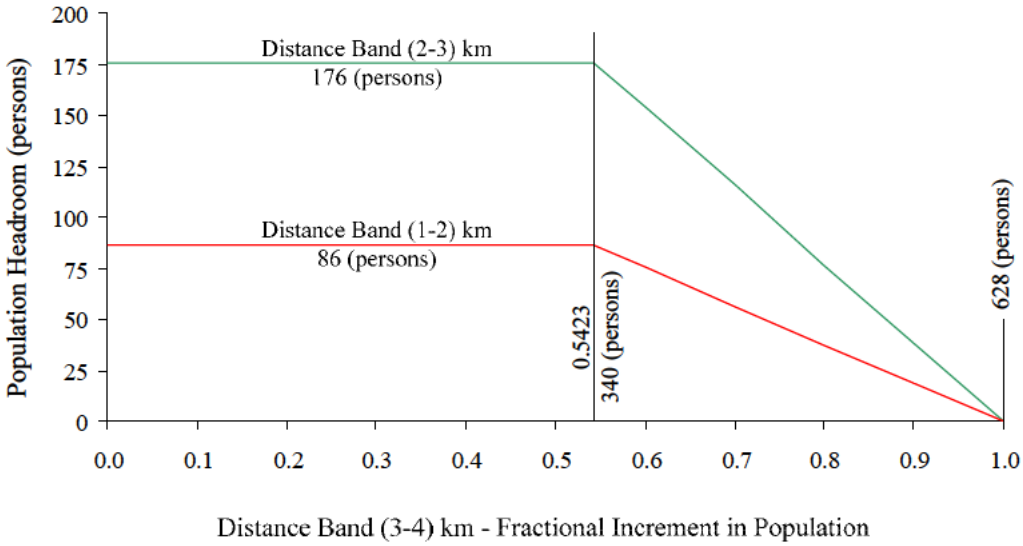

700
600
500
400
300
Population Headroom (persons)
Distance Band (3-4) km
628 (persons)
176 (persons)
340 (persons)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Distance Band (2-3) km - Fractional Increment in Population
100
80
60
40
20
0
Population Headroom (persons)
Distance Band (1-2) km
86 (persons)
176 (persons)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Distance Band (2-3) km - Fractional Increment in Population

Figure 3


Population Headroom (persons)
200
175
150
125
100
75
50
25
0
Distance Band (2-3) km
176 (persons)
Distance Band (1-2) km
86 (persons)
0.5423
340 (persons)
628 (persons)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Distance Band (3-4) km - Fractional Increment in Population

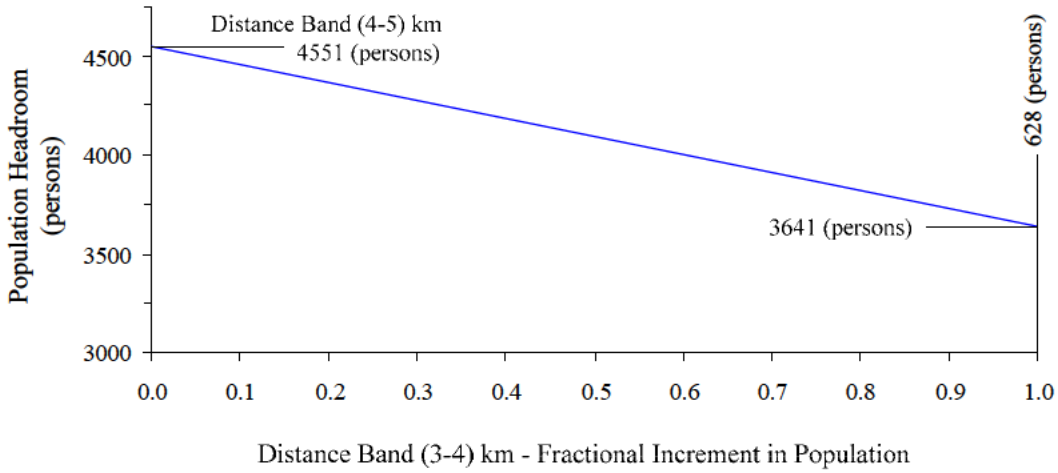
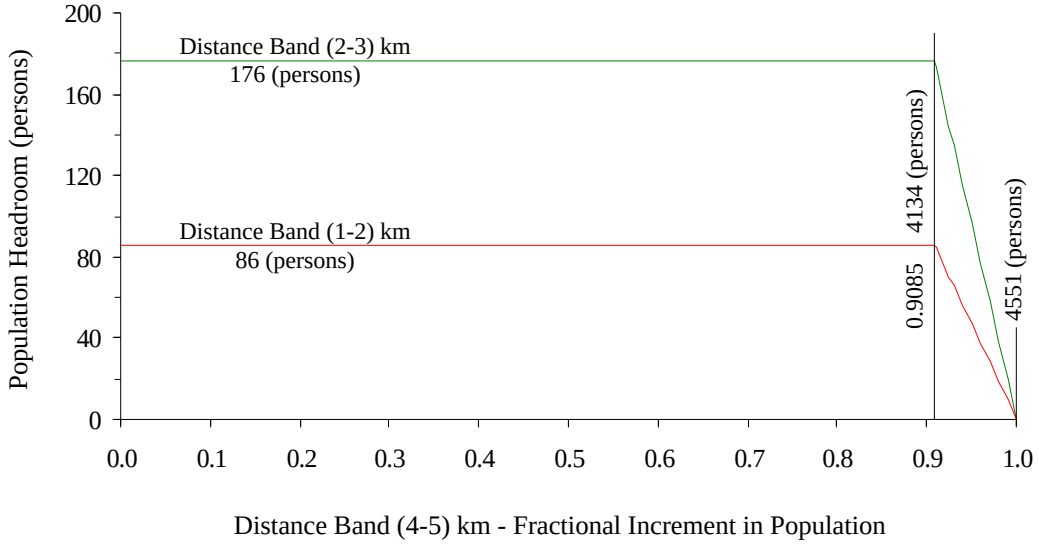

Population Headroom (persons)
4500
4000
3500
3000
Distance Band (4-5) km
4551 (persons)
3641 (persons)
628 (persons)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Distance Band (3-4) km - Fractional Increment in Population

Figure 4


Population Headroom (persons)
200
160
120
80
40
0
Distance Band (2-3) km
176 (persons)
Distance Band (1-2) km
86 (persons)
4134 (persons)
0.9085
4551 (persons)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Distance Band (4-5) km - Fractional Increment in Population

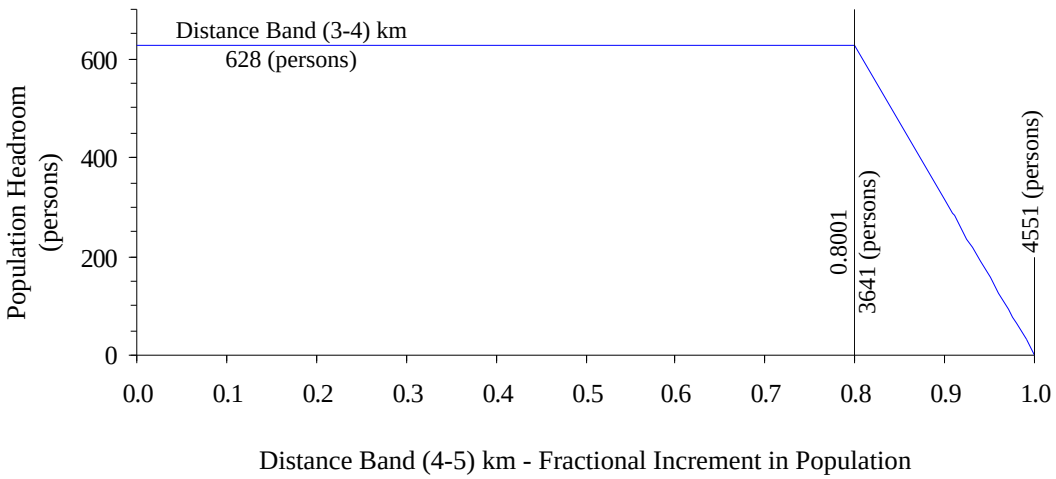

Population Headroom (persons)
600
400
200
0
Distance Band (3-4) km
628 (persons)
0.8001
3641 (persons)
4551 (persons)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Distance Band (4-5) km - Fractional Increment in Population

Figure 5