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| ONR Guidance Document  Land Use Planning and The Siting of Nuclear Installations |



ONR Guidance Document

Land Use Planning and The Siting of Nuclear Installations

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Issue No.: 1.2

Publication Date: Nov-22

Next Major Review Date: Sept-24

Doc. Ref. No.: NS-LUP-GD-001

Record Ref. No.: 2018/215763

Table 1 - Revision Commentary

|  |  |
| --- | --- |
| Issue No. | Description of Update(s) |
|  | Minor revision:   * Updated to latest ‘guidance document’ format; * Review date extended by one year on the basis that guidance is for a work package that is not scheduled to occur again until 2024, and BEIS are currently considering changes that may impact the content of this document. |
| 1.2 | Review date extended to Sept-24 |

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# Introduction

Since the start of the civil nuclear power programme in the 1960s, the government has applied a policy of siting new nuclear power plants in areas where the population density does not exceed certain thresholds, and where the growth of that population can be monitored and controlled.

The application of exclusionary demographic criteria during site selection is independent of the detailed safety assessment that is undertaken by ONR prior to the decision to grant (or withhold) a nuclear site licence (although confirmation that the demographic criteria continue to be met is sought as part of this assessment). The detailed safety assessment is informed by ONR’s Safety Assessment Principles (SAPs), together with supporting Technical Assessment Guides (TAGs), which consider the provision of defence in depth to prevent and control fault conditions and to mitigate the consequences in the event that a radiological release occurs. Constraints on the distribution of population around nuclear power plants provide additional public protection against the remote possibility that the multiple defence in depth provisions should fail, by limiting the number of persons who may be affected by such a release and who would require protection via the implementation of countermeasures identified within the off-site emergency planning arrangements.

First generation civil nuclear power stations in the UK were sited in areas that were situated far away from major population centres (i.e. in accordance with “remote” demographic siting criteria). Later, second generation nuclear power stations were permitted to be sited closer to major population centres. The criteria applied are termed the “semi-urban” demographic siting criteria and are derived so that there is no single 30° sector around the site in which the population density exceeds 5000 persons per square kilometre and the population density all around the site is substantially less than this. The Government has retained and restated the semi-urban demographic siting criteria as being applicable to all third generation nuclear power stations that may be constructed within England and Wales.

This guide sets out ONR’s use of demographic criteria when considering: the strategic assessment of potentially suitable sites; the licensing of new nuclear power plant sites; the subsequent control of future development around such sites; and the periodic review of the distribution of population around them. It also consolidates and clarifies ONR’s position on the interpretation and application of the semi-urban demographic criteria, and provides a number of illustrative examples. It is primarily intended for use by ONR inspectors but it provides details of the numerical methodology used by ONR, which may be of interest to a wider technical audience.

## Purpose and Scope

This guide describes ONR’s current approach to the assessment of demographics during site selection and licensing. It also describes the administrative arrangements in place to ensure that the demographic basis for the licensing of nuclear power station sites is preserved and that the population distribution in the vicinity of all nuclear sites does not reach levels that may threaten the viability, operability or extendibility of off-site arrangements for dealing with potential radiation emergencies. Technical details of the basis for the demographics assessment are given in Section 5 and worked examples are given in Sections 6 and 7.

This guide also clarifies and confirms that the semi-urban demographic siting criteria will not be used as exclusionary criteria for the potential siting of proposed nuclear installations that are not nuclear power stations.

This guide revises and replaces previous guidance [1] produced by the Nuclear Directorate of the Health and Safety Executive in 2009.

# Development of Demographic Siting Criteria

First generation Magnox power stations were located in sites meeting “remote site” demographic criteria defined in terms of 10° sector limits (for population within radial distances of 1/3, 1½, 5 and 10 miles) with a site limit equal to 6 times the 10° sector limits [2]. These criteria were later revised and restated as 30° sector limits (in incremental bands of 1 mile intervals out to 20 miles) [3].

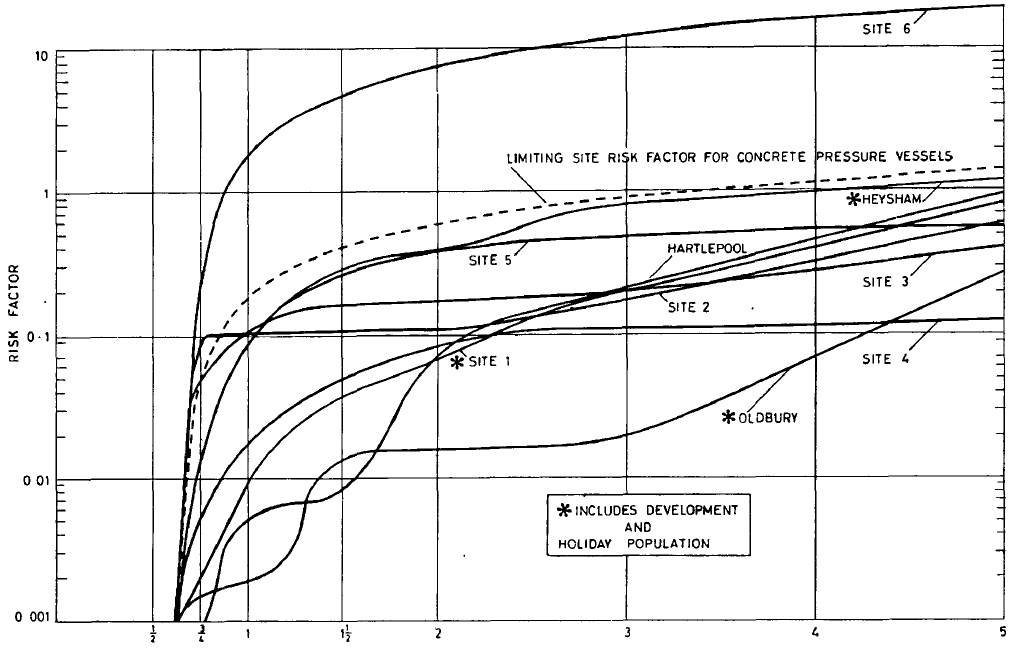
In 1968, the then Minister of Power, announced that second generation Advanced Gas-cooled Reactors (AGRs) could be built on sites where the local population distribution exceeded the “remote site” criteria applied to the earlier Magnox power station sites [4]. Initially no quantitative criteria were specified for AGR sites – the qualitative constraint was that, in response to any release that should warrant such action, the population within a few kilometres of the site in any 30° sector should be limited so that evacuation of any affected sector would be achievable within two hours.

However, it was thought desirable by the then Inspectorate of Nuclear Installations (INI) [5] to have some quantitative demographic siting criteria which specified acceptable population distributions, to provide:

* a guide to prospective licensees in the examination of potential sites (to prevent prospective licensees from expending resources on the development of proposed sites that would not be licensable due to demographic considerations);
* a measurable standard against which alternative sites could be assessed; and
* a mechanism for the subsequent control of residential developments around an approved site, to prevent population levels proximal to a site rising to undesirable levels.

Charlesworth and Gronow [6] developed a methodology that allowed the comparison of the demographics around potential reactor sites by deriving population weighting factors for a series of radial distance bands out to 20 miles. These weighting factors were derived from the atmospheric dispersion of a hypothetical release of radioiodine and represent the average doses to the thyroid that a standard person would receive in each radial band, if no protective measures were implemented. These weighting factors were then applied to the population distribution around the sites to determine site and (30°) sector risk factors, derived from the collective thyroid dose. Limiting site and 30° sector risk factors were then determined [7], which were approximately 1/10th of the risk factors evaluated for a fully urban site, and also bounded the risk factors for the Heysham site (with projected population increases due to future development having been taken into account).

A graphical presentation of the results for the site risk factors is shown in Figure 1 below. The dashed curve corresponds to the limiting risk factor for AGR sites and the curve labelled “Site 6” represents an urban site.



**Figure 1: Comparative evaluation of site risk characteristics (from Ref. 7)**

The limiting sector risk factors were equivalent to a uniform population density of ~ 5000 persons per square kilometre out from 0.67 to 20 miles from the site. The limiting site risk factors correspond to site uniform population densities that range from 1050 - 790 persons per square kilometre (decreasing as the radial distances increase).

In March 1988, the then Secretary of State for Energy tabled demographic criteria (in Parliament and thus referred to as the semi-urban Hansard 1988 criteria) for assessing potential sites, both for Magnox reactors and AGRs [8]. These were presented as cumulative weighted population values for 30° sector and all around the site, in bands of increasing radii out to 30 km. These were consistent with the previous criteria, subject to some slight variations arising from the conversion from imperial to metric units. Comparison of the range of limiting population densities and limiting populations, where uniform population distributions have been assumed, shows that the semi-urban INI and semi-urban Hansard 1988 criteria are consistent with one another.

In the Government’s 2008 Strategic Siting Assessment (SSA) [9], the AGR (semi-urban) criteria, were adopted as exclusionary criteria for “the future siting of international modern designs”. These criteria are also proposed as the exclusionary criteria to be applied to reactor sites to be developed beyond 2025 in the recent BEIS Consultation [10].

ONR reviewed its own demographic criteria as part of the 2008 SSA process and the output of this review was a discussion paper presented to our independent Nuclear Safety Advisory Committee (NuSAC), titled “The Siting of Nuclear Installations in the United Kingdom” [11]. This paper introduced a revised methodology for the assessment of demographics based on the comparison of sites against a hypothetical site with a uniform distribution of population. The cumulative weighted population values for each 30° sector (from θ= 0° to θ = 355°, in 5° increments) and all around the site (0° to 360°), in 1 km increments from 0-2 km to 0-30 km were divided by the equivalent values for the hypothetical site with uniform population densities at the semi-urban population density limit (with a notional exclusion zone from 0-1 km from site) to generate a matrix of Site Population Factors (72 x 29 sector SPFs and 29 all around the site SPFs). The methodology allows the conditions for meeting all the semi-urban criteria to be succinctly expressed as a single criterion:

The paper also proposed that:

* the 30° sector cumulative weighted population values should be derived using a semi-urban population density limit of 5000 persons per square kilometre;
* the all around site cumulative weighted population values should be derived using a semi-urban population density limit of 1250 persons per square kilometre); and
* these semi-urban criteria should be applied as exclusionary criteria for the siting of all new nuclear installations within the UK.

This revised methodology was adopted by the then Nuclear Directorate of HSE in 2009 and presented in Ref. 1. However, review work undertaken in support of the BEIS 2017 Consultation [10] highlighted that the guidance does not provide a clear statement of the exclusionary criteria to be applied to new nuclear power station sites nor confirmation of whether such criteria would be applied to other nuclear facilities. It was also noted that the site uniform density constraint of 1,250 persons per square kilometre, proposed in the NuSAC paper differs from the limiting criteria applied to the siting of the AGR stations.

These issues are addressed via the revised ONR criteria described in Section 3 below.

# Application of the “Semi-Urban” Demographic Siting Criteria

The following demographic criteria will be used by ONR in determining the potential suitability of sites for the deployment of new nuclear power stations during both the site selection and site licensing processes:

* the cumulative weighted population values for any 30° sector in the ranges 0 – Ri (where Ri is a circle of radius i km and i varies from 2 to 30 km) shall not exceed those for a hypothetical 30° sector with a uniform population density of 5000 persons per km2 from 1 to 30 km and zero population within 1 km[[1]](#footnote-2).; and
* the cumulative weighted population values all around the site in the ranges 0 – Ri (where Ri is a circle of radius i km and i varies in 1 km increments from 2 to 30 km) shall not exceed those for a hypothetical circle with a uniform population density of 1000 persons per km2 from 1 to 30 km with zero population within 1 km;
* where the weighting factors applied to the population within each radial band shall be proportional to 1/R1.5 and R is the area-weighted average distance between the radial band and the site centre point.

A site shall be determined to be potentially suitable for the deployment of new nuclear power stations if all the ratios of the actual versus the hypothetical cumulative weighted population values (“Site Population Factors”) are less than unity, i.e.

SPFMAX < 1

These semi-urban demographic siting criteria will only used as exclusionary criteria for the potential siting of proposed nuclear power stations. They will not be used in siting considerations for other types of nuclear installations. For these installations, the suitability of the site will be considered during ONR’s detailed safety assessment undertaken during the site licensing process [12] against the requirement that the location must be suitable for the establishing an adequate emergency plan in accordance with the licence conditions and the Radiation (Emergency Preparedness and Public Information) Regulations (REPPIR).

# Demographics and Development Control

## Site Selection / Strategic Siting Assessment

For each nuclear power plant site under consideration ONR will determine whether the proposed site (or part of the proposed site) meets the exclusionary demographic criteria stated in Section 3, by considering the demographics out to 30 km around each 100 m x 100 m grid square on the proposed site. ONR will then advise BEIS as to whether the site is potentially suitable for development on demographic grounds, and, where applicable, of any parts of the site that would not be suitable for the siting of a reactor building (due to the semi-urban criteria being exceeded for a particular grid square).

The BEIS Consultation [10] introduced an additional discretionary[[2]](#footnote-3) demographic criterion relating to the practicality of developing appropriate emergency planning arrangements. Where appropriate, ONR will also provide advice with regard to this discretionary demographic criterion including projected population growth in the area and the feasibility of the implementation and maintenance of adequate emergency planning arrangements.

## Site Licensing

ONR undertakes a detailed safety assessment, taking into account the proposed reactor design. At this stage, the prospective licensee must be able to satisfy ONR that:

* the design safety case must show that the nuclear facility will have robust defences against a range of local external hazards, including seismic disturbances and extreme weather events such as flooding;
* the location must be suitable for the establishment of an adequate emergency plan in accordance with the licence conditions and REPPIR; and
* the proposal conforms with Government demographic siting policy.

As part of this process, for proposed new nuclear power plants, the assessment described in Section 4.1 (already undertaken previously as part of the site selection process) will be repeated.

After licensing ONR will undertake a series of further assessments (of the Pre-Construction, Pre-Inactive Commissioning, Pre-Active Commissioning; Pre-Operational, and Station Safety Cases) to ensure that the licensee has demonstrated compliance with its legal duties (e.g. to reduce risks to workers and the public so far as is reasonably practicable). These will include consideration of the licensee’s proposed emergency arrangements and (prior to operation) the establishment of an adequate off-site emergency plan.

## Future Development

Though ONR has no vires with regard to planning decisions by planning authorities, ONR seeks to be consulted in regard to proposed developments within specified consultation zones. These zones are established around those nuclear sites that have the requirement to have a detailed emergency planning zone under the Radiation (Emergency Preparedness and Public Information) Regulations (REPPIR). ONR’s advice is primarily determined by its Land Use Planning policy [13] which focuses on the potential impact of new development on the viability, operability and extendibility of the off-site plan and the potential introduction of industrial activities that may pose an external hazard to the nuclear site.

Should a planning authority be minded to grant a development consent order, planning permission or adopt a planning policy within their Local Plan in circumstances where ONR has advised against the proposal, ONR would consider whether the decision presented a serious safety concern. If such a concern was identified, ONR would consider seeking to refer the matter for determination by the relevant Minister, by the appropriate route.

Where potential development around a nuclear power station site is identified by ONR as having the potential to lead to a breach of the demographic siting criteria, ONR will provide advice to the relevant local authorities and government departments regarding the likelihood and safety significance of any such breach.

## Periodic Review of Demographics

ONR will conduct ten-yearly reviews of the demographics around each nuclear power station site, timed to follow the publication of the data from UK national censuses. These will consider the demographics around each reactor building on the site. ONR will then inform the relevant local authorities and government departments of any challenges to the demographic criteria foreseen as likely within the next ten year period.

For sites where such challenges have been identified, ONR may conduct more frequent reviews using population estimates taken from the most recent National Population Database data or derived from consideration of local authority population growth rates and/or population growth projections based on local authority development plans.

# Technical Basis of Demographic Assessments

Demographic assessments are carried out by analysis of the population distribution out to 30 km around each 100 x 100 m grid square on proposed new nuclear power station sites (or the centre points of reactor buildings on existing sites). Spatial population data (night time residential populations at each National Grid reference point) local to the site are imported into spreadsheets, and the distance and direction of each data point from the relevant reference point are calculated. The 30° sector and radial band within which each data point lies is then determined and the total population within each sector radial band calculated. Weighting factors are then applied to obtain weighted population values for each radial sector band. The weighted population values are then summed for each 30° sector (and all around the site) for radial bands in 1 km increments from 0 – 2 km to 0 – 30 km from the reference point. These Cumulative Weighted Population (CWP) values are then compared with those from a hypothetical site with a notional 0 - 1 km zero population zone and a constant uniform population density from 1 – 30 km.

The 30° sector CWP values for the hypothetical site establish limiting criteria based on the radiological consequences of any given radiological accident. The all around site CWP values for the hypothetical site establishes limiting criteria based on the societal risk associated with such an event.

In the equations below:

* CWP(θ, r) = Cumulative weighted population values for the sector extending from θ to θ+30° and from 0 to r km from the centre point;
* CWP360° (r) = Cumulative weighted population values for all around the site extending from 0 to r km from the centre point;
* = Cumulative weighted population values for the 30° sector with a uniform population density of 5000 persons/km2, from 0 to r km from the centre point of hypothetical site (with zero population within 1 km);
* = Cumulative weighted population values with a uniform population density of 1000 persons/km2 all around the site extending from 0 to r km from the centre point of hypothetical site (with zero population within 1 km);
* Pθ(r) = Population in the sector extending from θ to θ+30° and from (r-1) to r km from the centre point;
* P360°(r)= Population all around site from (r-1) to r km from the centre point;
* = Population in a 30°sector from (r-1) to r km from the centre point of a hypothetical site with a uniform population density of 5000 persons/km2;
* = Population all around site from (r-1) to r km from the centre point of a hypothetical site with a uniform population density of 1000 persons/km2;
* Wr = Weighting factor for populations within radial distance band between (r-1) and r km from the centre point;
* SPFθ(r) = Site Population Factor for the sector extending from θ to θ+30° and from 0 to r km from the centre point;
* SPF360°(r) = Site Population Factor for all around the site extending from 0 to r km from the centre point.

The following equations are used in demographic assessments:

(1)

(2)

(3)

(4)

(5)

(6)

(7)

(8)

(9)

(10)

Where: r ranges from 1 – 30 km in equations 1 - 4 and from 2 – 30 km in equations 5 – 10; and θ ranges from 0° to 355° in 5° increments.

A given 100 x 100 m grid square (or reactor centre point) meets the semi-urban demographic criteria if -

**all SPFθ(r) and all SPF360°(r) are less than 1** [ or, equivalently, **SPFMAX < 1** ].

# Worked Example 1

Tables 1 – 4 below show the radial distribution of population and the calculated SPFs for a hypothetical site which is mainly rural in nature, with a settlement of approximately 5000 persons between 1-2 km from the site centre point. Tables 1 and 2 show the population distribution in the twelve 30° sectors from 0° - 30° (A) to 330° -360° and all around site. From examination of the SPFs in Table 2, it can be seen that no SPF exceeds the limiting value of 1.

However, when the sectors are rotated by 15°, the settlement between 1-2 km from the site centre point lies entirely within a single 30° sector (“E” in Tables 3 and 4, corresponding to 135° - 165° from North). Table 4 shows that this results in the SPF for this sector, in the radial band from 0-2 km from the site centre point, is greater than 1. The site centre point therefore does not meet the semi-urban demographic criteria.

This example illustrates the importance of the use of 5° increments when considering sector-based criteria and the significant impact that population centres close to the site can have on the suitability of a site.

**Table 1: Population by radial band (RB) – no rotation, sector A = 0°-30°**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A | B | C | D | E | F | G | H | I | J | K | L | All |
| 0 - 1 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 1 - 2 | 1 | 0 | 19 | 35 | 2686 | 2705 | 116 | 82 | 0 | 0 | 0 | 0 | 5643 |
| 2 - 3 | 1 | 1 | 20 | 19 | 5 | 9 | 114 | 110 | 0 | 0 | 0 | 0 | 281 |
| 3 - 4 | 2 | 0 | 0 | 22 | 22 | 40 | 62 | 22 | 0 | 0 | 0 | 0 | 169 |
| 4 - 5 | 2 | 0 | 0 | 30 | 1433 | 2012 | 681 | 147 | 75 | 0 | 40 | 101 | 4521 |
| 5 - 6 | 3 | 212 | 22 | 36 | 1386 | 5164 | 3829 | 84 | 47 | 535 | 634 | 163 | 12115 |
| 6 - 7 | 335 | 585 | 16 | 41 | 2676 | 4976 | 3040 | 843 | 461 | 2692 | 2587 | 304 | 18557 |
| 7 - 8 | 4 | 487 | 318 | 276 | 599 | 475 | 1607 | 1510 | 52 | 5532 | 5535 | 12 | 16408 |
| 8 - 9 | 4 | 1198 | 1500 | 400 | 166 | 340 | 561 | 410 | 99 | 1213 | 1405 | 248 | 7544 |
| 9 - 10 | 5 | 2739 | 3717 | 1162 | 594 | 613 | 411 | 281 | 35 | 266 | 451 | 590 | 10863 |
| 10 - 11 | 111 | 1483 | 1773 | 927 | 458 | 342 | 1391 | 2039 | 787 | 122 | 93 | 441 | 9967 |
| 11 - 12 | 544 | 1747 | 460 | 192 | 690 | 781 | 3342 | 4390 | 1731 | 626 | 176 | 217 | 14896 |
| 12 - 13 | 732 | 1031 | 987 | 292 | 951 | 1251 | 7820 | 8532 | 1845 | 1200 | 668 | 655 | 25965 |
| 13 - 14 | 1413 | 1813 | 1103 | 523 | 1505 | 1666 | 9028 | 8648 | 1669 | 2953 | 1751 | 397 | 32470 |
| 14 - 15 | 2051 | 1006 | 509 | 2051 | 2844 | 3780 | 10757 | 8384 | 2621 | 3225 | 1241 | 333 | 38801 |
| 15 - 16 | 143 | 1251 | 235 | 7176 | 8193 | 8682 | 13389 | 12974 | 7259 | 706 | 747 | 374 | 61130 |
| 16 - 17 | 84 | 3163 | 810 | 1760 | 1445 | 7061 | 15818 | 16582 | 7706 | 585 | 636 | 321 | 55973 |
| 17 - 18 | 9 | 1320 | 597 | 436 | 477 | 6284 | 21033 | 24175 | 9169 | 218 | 297 | 210 | 64226 |
| 18 - 19 | 27 | 2259 | 1046 | 946 | 1044 | 803 | 23104 | 36985 | 14432 | 2089 | 2219 | 365 | 85320 |
| 19 - 20 | 22 | 3227 | 3338 | 491 | 677 | 928 | 26204 | 38234 | 12454 | 1746 | 1814 | 1035 | 90170 |
| 20 - 21 | 11 | 3632 | 4483 | 1657 | 289 | 1443 | 35155 | 46645 | 12883 | 377 | 545 | 2579 | 109701 |
| 21 - 22 | 2529 | 1242 | 1272 | 1388 | 613 | 166 | 23792 | 33635 | 12509 | 2677 | 331 | 2303 | 82455 |
| 22 - 23 | 2895 | 1675 | 3548 | 3709 | 1624 | 588 | 19063 | 27416 | 11442 | 4450 | 1667 | 769 | 78847 |
| 23 - 24 | 3608 | 2113 | 3594 | 3152 | 967 | 467 | 25604 | 33152 | 11417 | 4416 | 3382 | 2766 | 94639 |
| 24 - 25 | 2094 | 1627 | 3286 | 6288 | 4384 | 456 | 14949 | 20062 | 7378 | 2778 | 875 | 308 | 64486 |
| 25 - 26 | 1226 | 1645 | 3530 | 6066 | 4106 | 602 | 8948 | 14780 | 7196 | 4482 | 3404 | 313 | 56298 |
| 26 - 27 | 175 | 1057 | 2340 | 4627 | 3696 | 1545 | 13666 | 21137 | 8268 | 5383 | 5352 | 293 | 67540 |
| 27 - 28 | 170 | 1664 | 7054 | 12000 | 6442 | 771 | 8072 | 15541 | 8273 | 10244 | 10405 | 460 | 81098 |
| 28 - 29 | 255 | 2541 | 6660 | 11034 | 5040 | 383 | 3119 | 7189 | 4534 | 12795 | 12811 | 395 | 66756 |
| 29 - 30 | 2123 | 2850 | 4824 | 6597 | 2422 | 786 | 1624 | 1974 | 2968 | 13961 | 12829 | 1244 | 54201 |

**Table 2: Calculated Site Population Factors – no rotation, sector A = 0°-30°**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A | B | C | D | E | F | G | H | I | J | K | L | All |
| 0 - 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 - 2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.69 | 0.69 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 |
| 0 - 3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.38 | 0.38 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.34 |
| 0 - 4 | 0.00 | 0.00 | 0.00 | 0.01 | 0.27 | 0.28 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 |
| 0 - 5 | 0.00 | 0.00 | 0.00 | 0.01 | 0.24 | 0.26 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.23 |
| 0 - 6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.27 | 0.06 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.25 |
| 0 - 7 | 0.00 | 0.01 | 0.00 | 0.00 | 0.21 | 0.27 | 0.08 | 0.02 | 0.00 | 0.02 | 0.03 | 0.00 | 0.27 |
| 0 - 8 | 0.00 | 0.01 | 0.00 | 0.01 | 0.19 | 0.25 | 0.08 | 0.02 | 0.00 | 0.05 | 0.05 | 0.00 | 0.28 |
| 0 - 9 | 0.00 | 0.01 | 0.01 | 0.01 | 0.18 | 0.23 | 0.07 | 0.02 | 0.00 | 0.05 | 0.05 | 0.01 | 0.27 |
| 0 - 10 | 0.00 | 0.02 | 0.02 | 0.01 | 0.17 | 0.21 | 0.07 | 0.02 | 0.00 | 0.05 | 0.05 | 0.01 | 0.26 |
| 0 - 11 | 0.00 | 0.02 | 0.02 | 0.01 | 0.16 | 0.20 | 0.07 | 0.03 | 0.01 | 0.05 | 0.05 | 0.01 | 0.25 |
| 0 - 12 | 0.00 | 0.02 | 0.02 | 0.01 | 0.15 | 0.19 | 0.07 | 0.03 | 0.01 | 0.04 | 0.04 | 0.01 | 0.25 |
| 0 - 13 | 0.00 | 0.02 | 0.02 | 0.01 | 0.14 | 0.18 | 0.08 | 0.05 | 0.01 | 0.04 | 0.04 | 0.01 | 0.26 |
| 0 - 14 | 0.01 | 0.03 | 0.02 | 0.01 | 0.14 | 0.17 | 0.09 | 0.06 | 0.01 | 0.05 | 0.04 | 0.01 | 0.26 |
| 0 - 15 | 0.01 | 0.03 | 0.02 | 0.01 | 0.13 | 0.17 | 0.10 | 0.06 | 0.02 | 0.05 | 0.04 | 0.01 | 0.27 |
| 0 - 16 | 0.01 | 0.03 | 0.02 | 0.02 | 0.14 | 0.17 | 0.11 | 0.07 | 0.02 | 0.05 | 0.04 | 0.01 | 0.29 |
| 0 - 17 | 0.01 | 0.03 | 0.02 | 0.02 | 0.13 | 0.17 | 0.12 | 0.09 | 0.03 | 0.04 | 0.04 | 0.01 | 0.30 |
| 0 - 18 | 0.01 | 0.03 | 0.02 | 0.02 | 0.13 | 0.17 | 0.13 | 0.10 | 0.04 | 0.04 | 0.04 | 0.01 | 0.31 |
| 0 - 19 | 0.01 | 0.03 | 0.02 | 0.02 | 0.12 | 0.16 | 0.14 | 0.13 | 0.04 | 0.04 | 0.04 | 0.01 | 0.32 |
| 0 - 20 | 0.01 | 0.03 | 0.02 | 0.02 | 0.12 | 0.16 | 0.16 | 0.15 | 0.05 | 0.04 | 0.04 | 0.01 | 0.34 |
| 0 - 21 | 0.01 | 0.03 | 0.03 | 0.02 | 0.12 | 0.16 | 0.17 | 0.17 | 0.06 | 0.04 | 0.04 | 0.01 | 0.35 |
| 0 - 22 | 0.01 | 0.03 | 0.02 | 0.02 | 0.11 | 0.15 | 0.18 | 0.18 | 0.06 | 0.04 | 0.04 | 0.01 | 0.36 |
| 0 - 23 | 0.01 | 0.03 | 0.03 | 0.02 | 0.11 | 0.15 | 0.18 | 0.19 | 0.07 | 0.04 | 0.04 | 0.01 | 0.36 |
| 0 - 24 | 0.01 | 0.03 | 0.03 | 0.02 | 0.11 | 0.14 | 0.19 | 0.20 | 0.07 | 0.04 | 0.04 | 0.01 | 0.37 |
| 0 - 25 | 0.01 | 0.03 | 0.03 | 0.02 | 0.11 | 0.14 | 0.19 | 0.20 | 0.07 | 0.04 | 0.04 | 0.01 | 0.37 |
| 0 - 26 | 0.01 | 0.03 | 0.03 | 0.03 | 0.11 | 0.14 | 0.19 | 0.20 | 0.07 | 0.04 | 0.04 | 0.01 | 0.37 |
| 0 - 27 | 0.01 | 0.03 | 0.03 | 0.03 | 0.11 | 0.13 | 0.19 | 0.21 | 0.07 | 0.04 | 0.04 | 0.01 | 0.37 |
| 0 - 28 | 0.01 | 0.03 | 0.03 | 0.03 | 0.10 | 0.13 | 0.19 | 0.21 | 0.07 | 0.05 | 0.04 | 0.01 | 0.38 |
| 0 - 29 | 0.01 | 0.03 | 0.03 | 0.03 | 0.10 | 0.13 | 0.18 | 0.20 | 0.07 | 0.05 | 0.04 | 0.01 | 0.38 |
| 0 - 30 | 0.01 | 0.03 | 0.03 | 0.03 | 0.10 | 0.13 | 0.18 | 0.20 | 0.07 | 0.05 | 0.05 | 0.01 | 0.37 |

**Table 3: Population by radial band – 15° rotation, sector A = 15°-45°**

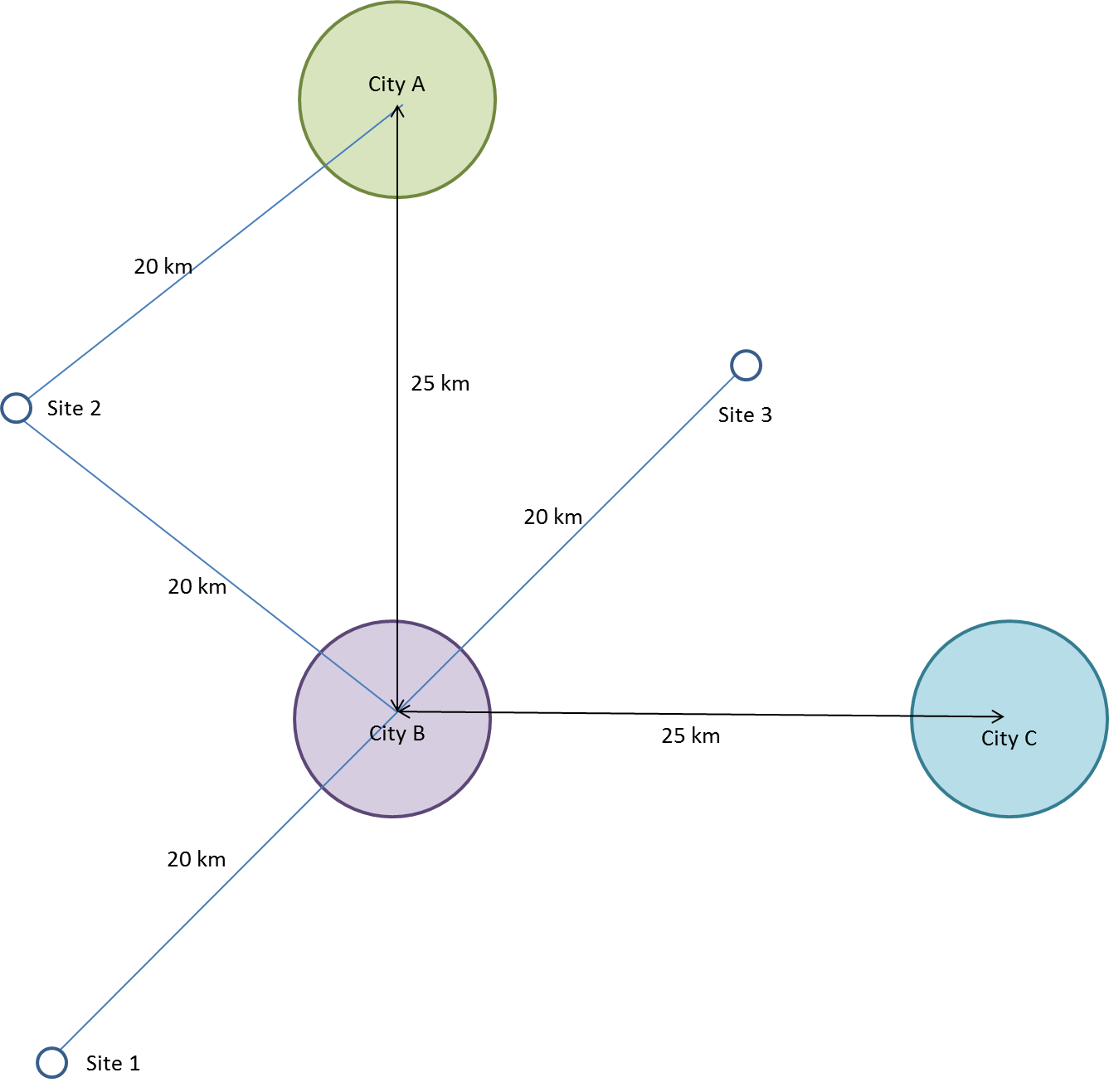
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A+15° | B+15° | C+15° | D+15° | E+15° | F+15° | G+15° | H+15° | I+15° | J+15° | K+15° | L+15° | All |
| 0 - 1 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 1 - 2 | 0 | 0 | 39 | 31 | 5341 | 68 | 164 | 0 | 0 | 0 | 0 | 0 | 5642 |
| 2 - 3 | 0 | 2 | 39 | 0 | 10 | 8 | 221 | 0 | 0 | 0 | 0 | 0 | 280 |
| 3 - 4 | 0 | 0 | 0 | 43 | 0 | 80 | 44 | 0 | 0 | 0 | 0 | 0 | 168 |
| 4 - 5 | 0 | 0 | 0 | 60 | 2807 | 1218 | 144 | 150 | 0 | 0 | 80 | 121 | 4579 |
| 5 - 6 | 424 | 0 | 44 | 27 | 2745 | 7583 | 75 | 94 | 0 | 1070 | 198 | 127 | 12388 |
| 6 - 7 | 1169 | 0 | 33 | 50 | 5302 | 4651 | 1428 | 257 | 665 | 4719 | 455 | 152 | 18881 |
| 7 - 8 | 347 | 628 | 8 | 545 | 654 | 297 | 2917 | 103 | 0 | 11064 | 7 | 18 | 16586 |
| 8 - 9 | 44 | 2353 | 647 | 154 | 178 | 502 | 621 | 198 | 0 | 2426 | 383 | 112 | 7618 |
| 9 - 10 | 76 | 5402 | 2032 | 292 | 896 | 330 | 493 | 69 | 0 | 531 | 372 | 808 | 11301 |
| 10 - 11 | 979 | 1988 | 1558 | 297 | 619 | 65 | 2716 | 1362 | 213 | 31 | 156 | 725 | 10707 |
| 11 - 12 | 2849 | 646 | 275 | 109 | 1271 | 291 | 6392 | 2387 | 1076 | 177 | 174 | 259 | 15907 |
| 12 - 13 | 458 | 1605 | 368 | 216 | 1686 | 816 | 14825 | 2238 | 1452 | 948 | 389 | 921 | 25922 |
| 13 - 14 | 1503 | 2123 | 83 | 963 | 2047 | 1285 | 16772 | 524 | 2814 | 3093 | 410 | 384 | 32000 |
| 14 - 15 | 1068 | 944 | 74 | 4029 | 1658 | 5901 | 15613 | 1154 | 4087 | 2363 | 119 | 547 | 37558 |
| 15 - 16 | 2286 | 215 | 255 | 14097 | 2289 | 15075 | 11703 | 14246 | 272 | 1141 | 352 | 396 | 62328 |
| 16 - 17 | 5724 | 603 | 1017 | 2502 | 389 | 13733 | 17904 | 15260 | 153 | 1017 | 255 | 387 | 58944 |
| 17 - 18 | 1878 | 762 | 432 | 441 | 514 | 12054 | 30011 | 18339 | 0 | 436 | 159 | 262 | 65288 |
| 18 - 19 | 2769 | 1749 | 343 | 1550 | 539 | 1067 | 45141 | 28829 | 36 | 4143 | 296 | 434 | 86895 |
| 19 - 20 | 437 | 6016 | 660 | 322 | 1033 | 824 | 51584 | 24883 | 25 | 3466 | 162 | 1908 | 91320 |
| 20 - 21 | 1135 | 6130 | 2837 | 478 | 101 | 2786 | 67525 | 25764 | 2 | 752 | 339 | 4820 | 112668 |
| 21 - 22 | 1528 | 955 | 1588 | 1187 | 39 | 293 | 47290 | 19980 | 5038 | 317 | 344 | 4262 | 82821 |
| 22 - 23 | 1191 | 2160 | 4937 | 2481 | 767 | 409 | 37718 | 17115 | 5768 | 3132 | 202 | 1336 | 77215 |
| 23 - 24 | 1797 | 2430 | 4759 | 1545 | 390 | 544 | 50664 | 15641 | 7193 | 1638 | 5126 | 407 | 92133 |
| 24 - 25 | 1038 | 2217 | 4354 | 8222 | 547 | 365 | 29533 | 10592 | 4164 | 1392 | 358 | 257 | 63039 |
| 25 - 26 | 1050 | 2240 | 4821 | 7310 | 903 | 300 | 17596 | 11963 | 2428 | 6537 | 271 | 356 | 55774 |
| 26 - 27 | 1117 | 998 | 3682 | 5573 | 1818 | 1271 | 26061 | 16213 | 324 | 10442 | 263 | 323 | 68084 |
| 27 - 28 | 582 | 2746 | 11363 | 12637 | 247 | 1296 | 14849 | 16233 | 313 | 20176 | 634 | 287 | 81363 |
| 28 - 29 | 4068 | 1014 | 12307 | 9761 | 318 | 447 | 5791 | 8587 | 481 | 25110 | 512 | 278 | 68673 |
| 29 - 30 | 4954 | 747 | 8902 | 4292 | 552 | 1020 | 2228 | 1720 | 4216 | 23706 | 1952 | 536 | 54823 |

**Table 4: Calculated Site Population Factors – 15° rotation, sector A = 15°-45°**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A+15° | B+15° | C+15° | D+15° | E+15° | F+15° | G+15° | H+15° | I+15° | J+15° | K+15° | L+15° | All |
| 0 - 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 - 2 | 0.00 | 0.00 | 0.01 | 0.01 | 1.36 | 0.02 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 |
| 0 - 3 | 0.00 | 0.00 | 0.01 | 0.01 | 0.75 | 0.01 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.34 |
| 0 - 4 | 0.00 | 0.00 | 0.01 | 0.01 | 0.54 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 |
| 0 - 5 | 0.00 | 0.00 | 0.00 | 0.01 | 0.48 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.23 |
| 0 - 6 | 0.00 | 0.00 | 0.00 | 0.01 | 0.44 | 0.10 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.25 |
| 0 - 7 | 0.01 | 0.00 | 0.00 | 0.00 | 0.42 | 0.12 | 0.03 | 0.00 | 0.00 | 0.04 | 0.01 | 0.00 | 0.27 |
| 0 - 8 | 0.01 | 0.00 | 0.00 | 0.01 | 0.38 | 0.11 | 0.04 | 0.00 | 0.00 | 0.10 | 0.01 | 0.00 | 0.28 |
| 0 - 9 | 0.01 | 0.01 | 0.01 | 0.01 | 0.35 | 0.11 | 0.04 | 0.01 | 0.00 | 0.10 | 0.01 | 0.00 | 0.27 |
| 0 - 10 | 0.01 | 0.03 | 0.01 | 0.01 | 0.33 | 0.10 | 0.04 | 0.00 | 0.00 | 0.09 | 0.01 | 0.01 | 0.26 |
| 0 - 11 | 0.01 | 0.03 | 0.01 | 0.01 | 0.30 | 0.09 | 0.04 | 0.01 | 0.00 | 0.09 | 0.01 | 0.01 | 0.25 |
| 0 - 12 | 0.02 | 0.03 | 0.01 | 0.01 | 0.29 | 0.09 | 0.05 | 0.01 | 0.01 | 0.08 | 0.01 | 0.01 | 0.25 |
| 0 - 13 | 0.02 | 0.03 | 0.01 | 0.01 | 0.28 | 0.08 | 0.08 | 0.02 | 0.01 | 0.08 | 0.01 | 0.01 | 0.26 |
| 0 - 14 | 0.02 | 0.03 | 0.01 | 0.01 | 0.26 | 0.08 | 0.10 | 0.02 | 0.01 | 0.08 | 0.01 | 0.01 | 0.26 |
| 0 - 15 | 0.02 | 0.03 | 0.01 | 0.01 | 0.25 | 0.08 | 0.11 | 0.02 | 0.02 | 0.08 | 0.01 | 0.01 | 0.27 |
| 0 - 16 | 0.02 | 0.03 | 0.01 | 0.03 | 0.25 | 0.10 | 0.12 | 0.03 | 0.02 | 0.08 | 0.01 | 0.01 | 0.29 |
| 0 - 17 | 0.03 | 0.03 | 0.01 | 0.03 | 0.24 | 0.11 | 0.13 | 0.04 | 0.02 | 0.07 | 0.01 | 0.01 | 0.30 |
| 0 - 18 | 0.03 | 0.03 | 0.01 | 0.03 | 0.23 | 0.11 | 0.15 | 0.06 | 0.01 | 0.07 | 0.01 | 0.01 | 0.31 |
| 0 - 19 | 0.03 | 0.03 | 0.01 | 0.03 | 0.22 | 0.11 | 0.18 | 0.08 | 0.01 | 0.07 | 0.01 | 0.01 | 0.32 |
| 0 - 20 | 0.03 | 0.03 | 0.01 | 0.03 | 0.21 | 0.11 | 0.21 | 0.09 | 0.01 | 0.07 | 0.01 | 0.01 | 0.34 |
| 0 - 21 | 0.03 | 0.04 | 0.01 | 0.03 | 0.21 | 0.10 | 0.24 | 0.10 | 0.01 | 0.07 | 0.01 | 0.01 | 0.35 |
| 0 - 22 | 0.03 | 0.04 | 0.01 | 0.03 | 0.20 | 0.10 | 0.26 | 0.11 | 0.02 | 0.07 | 0.01 | 0.01 | 0.36 |
| 0 - 23 | 0.03 | 0.04 | 0.02 | 0.03 | 0.20 | 0.10 | 0.27 | 0.11 | 0.02 | 0.07 | 0.01 | 0.01 | 0.36 |
| 0 - 24 | 0.03 | 0.04 | 0.02 | 0.03 | 0.19 | 0.10 | 0.28 | 0.12 | 0.02 | 0.07 | 0.01 | 0.01 | 0.37 |
| 0 - 25 | 0.03 | 0.04 | 0.02 | 0.03 | 0.19 | 0.09 | 0.29 | 0.12 | 0.02 | 0.07 | 0.01 | 0.01 | 0.37 |
| 0 - 26 | 0.03 | 0.04 | 0.02 | 0.03 | 0.18 | 0.09 | 0.29 | 0.12 | 0.02 | 0.07 | 0.01 | 0.01 | 0.37 |
| 0 - 27 | 0.03 | 0.03 | 0.02 | 0.03 | 0.18 | 0.09 | 0.29 | 0.12 | 0.02 | 0.07 | 0.01 | 0.01 | 0.37 |
| 0 - 28 | 0.03 | 0.03 | 0.02 | 0.04 | 0.17 | 0.09 | 0.29 | 0.13 | 0.02 | 0.07 | 0.01 | 0.01 | 0.38 |
| 0 - 29 | 0.03 | 0.03 | 0.03 | 0.04 | 0.17 | 0.09 | 0.28 | 0.13 | 0.02 | 0.08 | 0.01 | 0.01 | 0.38 |
| 0 - 30 | 0.03 | 0.03 | 0.03 | 0.04 | 0.17 | 0.08 | 0.28 | 0.12 | 0.02 | 0.08 | 0.01 | 0.01 | 0.37 |

# Worked Example 2

Three potential sites (Sites 1, 2 and 3) for a new nuclear power station are under consideration during a strategic siting assessment. Each site is 20 km from the centre of City B: Site 1 is to the southwest, Site 2 is (approximately) to the northwest; and Site 3 is to the northeast. City B extends radially for 4 km from the city centre and an assumed uniform population density of 20000 persons per square kilometre, with a total population being just over 1 million persons. Identical cities lie 25 km to the north (City A) and 25 km to the east (City C) of City B (where distances are measured from each city centre). Outside of these three metropolitan areas, population density is roughly 400 persons per square kilometre. The relationship between city and site locations is shown in Figure 2 below.



**Figure 2: Relationship between city and site locations in Worked Example 2.**

Tables 5 and 6 show the radial distribution of population and the calculated SPFs for Site 1. The maximum SPF is 0.66 for sector B in the radial band from 0-24 km. The application of 5° rotations does not increase the maximum SPF, and these are not presented below. The site therefore meets the semi-urban criteria and would be considered potentially suitable for the deployment of a nuclear power station based on demographics.

Tables 7 and 8 show the radial distribution of population and the calculated SPFs for Site 2. The maximum SPF is 0.89 for all around site in the radial band from 0-24 km. The application of 5° rotations does not increase the maximum SPF, and again these are not presented below. The site therefore meets the semi-urban criteria and would be considered potentially suitable for the deployment of a nuclear power station based on demographics. However, as the maximum all around site SPF is close to the limit, constraints on future development around the site may be required to ensure that the semi-urban criteria are met at the time of the licensing of the site and to maintain the demographic characteristics of the area throughout the operational lifetime of the power station. Such constraints may be applied in all sectors out to at least 24 km from the site and, although the site meets the semi-urban criteria, it would be likely to be excluded from further consideration if such constraints were considered to be impractical.

Tables 9 and 10 show the radial distribution of population and the calculated SPFs for Site 3. Although all sector SPFs (including those under rotation) are less than 1, the cumulative effect of having three major population centres within 20 km of the site results in all around site SPFs of greater than 1 for multiple sector bands from 0 – 20 km outwards. The site therefore fails to meet the semi-urban criteria and would be excluded from further consideration based on demographics.

**Table 5: Population by radial band (RB) around Site 1, 20 km SW of City B – no rotation, sector A = 0°-30°**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A | B | C | D | E | F | G | H | I | J | K | L | All |
| 0 - 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 - 2 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 4800 |
| 2 - 3 | 800 | 0 | 800 | 400 | 800 | 400 | 800 | 400 | 800 | 400 | 800 | 400 | 6800 |
| 3 - 4 | 800 | 1200 | 800 | 400 | 800 | 800 | 400 | 800 | 400 | 800 | 800 | 400 | 8400 |
| 4 - 5 | 1200 | 400 | 1200 | 800 | 800 | 1600 | 800 | 1200 | 800 | 1600 | 800 | 800 | 12000 |
| 5 - 6 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 800 | 1200 | 800 | 1200 | 1200 | 1200 | 13600 |
| 6 - 7 | 1600 | 1600 | 1600 | 1200 | 800 | 1600 | 1200 | 1200 | 1200 | 1600 | 800 | 1200 | 15600 |
| 7 - 8 | 1600 | 1200 | 1600 | 1200 | 2000 | 1600 | 1600 | 1600 | 1600 | 1600 | 2000 | 1200 | 18800 |
| 8 - 9 | 1600 | 2800 | 1600 | 1600 | 1600 | 2000 | 1600 | 1200 | 1600 | 2000 | 1600 | 1600 | 20800 |
| 9 - 10 | 2000 | 1600 | 2000 | 2000 | 2400 | 2000 | 1600 | 2800 | 1600 | 2000 | 2400 | 2000 | 24400 |
| 10 - 11 | 2800 | 2000 | 2800 | 2000 | 2400 | 2000 | 2400 | 1600 | 2400 | 2000 | 2400 | 2000 | 26800 |
| 11 - 12 | 2400 | 2800 | 2400 | 2000 | 2000 | 2400 | 2000 | 2800 | 2000 | 2400 | 2000 | 2000 | 27200 |
| 12 - 13 | 2800 | 2000 | 2800 | 2400 | 3200 | 3200 | 2800 | 2800 | 2800 | 3200 | 3200 | 2400 | 33600 |
| 13 - 14 | 2800 | 3200 | 2800 | 2800 | 2400 | 2800 | 2400 | 2800 | 2400 | 2800 | 2400 | 2800 | 32400 |
| 14 - 15 | 3200 | 6600 | 3200 | 3200 | 3200 | 3200 | 2800 | 3200 | 2800 | 3200 | 3200 | 3200 | 41000 |
| 15 - 16 | 3600 | 8800 | 3600 | 2800 | 3200 | 3200 | 3600 | 2800 | 3600 | 3200 | 3200 | 2800 | 44400 |
| 16 - 17 | 3600 | 67200 | 3600 | 3200 | 3200 | 4000 | 3200 | 3600 | 3200 | 4000 | 3200 | 3200 | 105200 |
| 17 - 18 | 3600 | 120600 | 3600 | 3600 | 4400 | 4000 | 3200 | 4000 | 3200 | 4000 | 4400 | 3600 | 162200 |
| 18 - 19 | 4400 | 146200 | 4400 | 3600 | 3200 | 4000 | 3600 | 3600 | 3600 | 4000 | 3200 | 3600 | 187400 |
| 19 - 20 | 4000 | 161800 | 4000 | 4000 | 4400 | 4000 | 4000 | 4400 | 4000 | 4000 | 4400 | 4000 | 207000 |
| 20 - 21 | 5600 | 167000 | 4400 | 4400 | 3600 | 4800 | 4000 | 4000 | 4000 | 4800 | 3600 | 4400 | 214600 |
| 21 - 22 | 4400 | 158200 | 4400 | 4000 | 4800 | 4400 | 4800 | 4400 | 4800 | 4400 | 4800 | 4000 | 207400 |
| 22 - 23 | 4800 | 139000 | 4800 | 5200 | 4800 | 5200 | 4400 | 4400 | 4400 | 5200 | 4800 | 5200 | 192200 |
| 23 - 24 | 5600 | 89400 | 5600 | 4400 | 4400 | 4800 | 5200 | 5200 | 5200 | 4800 | 4400 | 4400 | 143400 |
| 24 - 25 | 5200 | 6800 | 5200 | 4800 | 6000 | 4800 | 4800 | 4800 | 4800 | 4800 | 6000 | 4800 | 62800 |
| 25 - 26 | 5200 | 5200 | 5200 | 4800 | 4800 | 6000 | 4800 | 6000 | 4800 | 6000 | 4800 | 4800 | 62400 |
| 26 - 27 | 5600 | 4800 | 5600 | 5600 | 6400 | 4400 | 4400 | 5200 | 4400 | 4400 | 6400 | 5600 | 62800 |
| 27 - 28 | 6000 | 6800 | 6000 | 6400 | 5200 | 2400 | 2800 | 5600 | 2800 | 2400 | 5200 | 6400 | 58000 |
| 28 - 29 | 6400 | 5200 | 6400 | 5600 | 5200 | 1600 | 1600 | 6800 | 1600 | 1600 | 5200 | 5600 | 52800 |
| 29 - 30 | 6000 | 6800 | 6000 | 5600 | 7200 | 800 | 800 | 5200 | 800 | 800 | 7200 | 5600 | 52800 |

**Table 6: Calculated Site Population Factors for Site 1, 20 km SW of City B – no rotation, sector A = 0°-30°**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A | B | C | D | E | F | G | H | I | J | K | L | **All** |
| 0 - 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 - 2 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.51 |
| 0 - 3 | 0.11 | 0.06 | 0.11 | 0.08 | 0.11 | 0.08 | 0.11 | 0.08 | 0.11 | 0.08 | 0.11 | 0.08 | 0.48 |
| 0 - 4 | 0.10 | 0.08 | 0.10 | 0.07 | 0.10 | 0.08 | 0.09 | 0.08 | 0.09 | 0.08 | 0.10 | 0.07 | 0.45 |
| 0 - 5 | 0.10 | 0.07 | 0.10 | 0.07 | 0.10 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.10 | 0.07 | 0.44 |
| 0 - 6 | 0.10 | 0.07 | 0.10 | 0.07 | 0.10 | 0.09 | 0.08 | 0.09 | 0.08 | 0.09 | 0.10 | 0.07 | 0.44 |
| 0 - 7 | 0.10 | 0.07 | 0.10 | 0.07 | 0.09 | 0.09 | 0.08 | 0.09 | 0.08 | 0.09 | 0.09 | 0.07 | 0.43 |
| 0 - 8 | 0.10 | 0.07 | 0.10 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.43 |
| 0 - 9 | 0.10 | 0.08 | 0.10 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.42 |
| 0 - 10 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.42 |
| 0 - 11 | 0.10 | 0.08 | 0.10 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.42 |
| 0 - 12 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.42 |
| 0 - 13 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.42 |
| 0 - 14 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.42 |
| 0 - 15 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.42 |
| 0 - 16 | 0.09 | 0.09 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.42 |
| 0 - 17 | 0.09 | 0.15 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.44 |
| 0 - 18 | 0.09 | 0.24 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.48 |
| 0 - 19 | 0.09 | 0.34 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.52 |
| 0 - 20 | 0.09 | 0.43 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.56 |
| 0 - 21 | 0.09 | 0.52 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.60 |
| 0 - 22 | 0.09 | 0.58 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.62 |
| 0 - 23 | 0.09 | 0.63 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.64 |
| 0 - 24 | 0.09 | 0.66 | 0.09 | 0.07 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.08 | 0.07 | 0.65 |
| 0 - 25 | 0.09 | 0.64 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.65 |
| 0 - 26 | 0.09 | 0.63 | 0.09 | 0.07 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.08 | 0.07 | 0.64 |
| 0 - 27 | 0.09 | 0.61 | 0.09 | 0.07 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.63 |
| 0 - 28 | 0.09 | 0.60 | 0.09 | 0.07 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.09 | 0.08 | 0.07 | 0.63 |
| 0 - 29 | 0.09 | 0.59 | 0.09 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 | 0.62 |
| 0 - 30 | 0.09 | 0.58 | 0.09 | 0.07 | 0.08 | 0.08 | 0.07 | 0.08 | 0.07 | 0.08 | 0.08 | 0.07 | 0.61 |

**Table 7: Population by radial band around Site 2, 20 km from centres of Cities A and B, no rotation**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A | B | C | D | E | F | G | H | I | J | K | L | All |
| 0 - 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 - 2 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 4800 |
| 2 - 3 | 400 | 800 | 400 | 400 | 800 | 400 | 800 | 800 | 400 | 400 | 800 | 800 | 7200 |
| 3 - 4 | 800 | 400 | 1200 | 1200 | 400 | 800 | 800 | 400 | 800 | 800 | 400 | 800 | 8800 |
| 4 - 5 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 1200 | 800 | 800 | 1200 | 800 | 10400 |
| 5 - 6 | 800 | 1600 | 1200 | 1200 | 1600 | 800 | 1600 | 800 | 1600 | 1600 | 800 | 1600 | 15200 |
| 6 - 7 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 14400 |
| 7 - 8 | 2000 | 2000 | 1600 | 1600 | 2000 | 2000 | 1600 | 2000 | 1600 | 1600 | 2000 | 1600 | 21600 |
| 8 - 9 | 1600 | 1600 | 2000 | 2000 | 1600 | 1600 | 1600 | 1600 | 1600 | 1600 | 1600 | 1600 | 20000 |
| 9 - 10 | 2000 | 1600 | 2000 | 2000 | 1600 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 23200 |
| 10 - 11 | 2000 | 2400 | 2000 | 2000 | 2400 | 2000 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 27200 |
| 11 - 12 | 2400 | 2000 | 2800 | 2800 | 2000 | 2400 | 2800 | 2000 | 2400 | 2400 | 2000 | 2800 | 28800 |
| 12 - 13 | 2400 | 3600 | 2400 | 2400 | 3600 | 2400 | 2400 | 3200 | 2400 | 2400 | 3200 | 2400 | 32800 |
| 13 - 14 | 3200 | 2000 | 2800 | 2800 | 2000 | 3200 | 2800 | 2000 | 3200 | 3200 | 2000 | 2800 | 32000 |
| 14 - 15 | 2800 | 3200 | 2800 | 2800 | 5200 | 2800 | 3200 | 3600 | 2800 | 2800 | 3600 | 3200 | 38800 |
| 15 - 16 | 3600 | 2800 | 4000 | 4000 | 6000 | 3600 | 3200 | 3200 | 3200 | 3200 | 3200 | 3200 | 43200 |
| 16 - 17 | 3200 | 63000 | 3200 | 3200 | 71800 | 3200 | 3200 | 3600 | 3600 | 3600 | 3600 | 3200 | 168400 |
| 17 - 18 | 3600 | 114200 | 7800 | 9800 | 118200 | 3600 | 3600 | 3600 | 3600 | 3600 | 3600 | 3600 | 278800 |
| 18 - 19 | 3600 | 129400 | 18000 | 20000 | 133600 | 3600 | 4400 | 3600 | 4000 | 4000 | 3600 | 4400 | 332200 |
| 19 - 20 | 4000 | 142200 | 22400 | 24200 | 146000 | 4000 | 4400 | 4400 | 4000 | 4000 | 4400 | 4400 | 368400 |
| 20 - 21 | 4400 | 145800 | 22800 | 24400 | 145400 | 4400 | 4000 | 4400 | 4000 | 4000 | 4400 | 4000 | 372000 |
| 21 - 22 | 4800 | 146400 | 16200 | 17600 | 144400 | 4800 | 4400 | 4400 | 4400 | 4400 | 4400 | 4400 | 360600 |
| 22 - 23 | 4400 | 138800 | 6000 | 6400 | 136400 | 4400 | 4800 | 4800 | 4800 | 4800 | 4800 | 4800 | 325200 |
| 23 - 24 | 5200 | 88400 | 4800 | 4800 | 82600 | 5200 | 4800 | 5200 | 5200 | 5200 | 5200 | 4800 | 221400 |
| 24 - 25 | 4800 | 8200 | 5200 | 5200 | 6800 | 4800 | 5600 | 4800 | 4800 | 4800 | 4800 | 5600 | 65400 |
| 25 - 26 | 5600 | 4400 | 5200 | 5200 | 4400 | 5600 | 5200 | 4800 | 3200 | 3200 | 4800 | 5200 | 56800 |
| 26 - 27 | 5200 | 5600 | 6000 | 6000 | 5600 | 5200 | 5200 | 6000 | 2000 | 2000 | 6000 | 5200 | 60000 |
| 27 - 28 | 5200 | 6400 | 5600 | 5600 | 6400 | 5200 | 6400 | 5200 | 1200 | 1200 | 5200 | 6400 | 60000 |
| 28 - 29 | 4400 | 4800 | 6400 | 6400 | 4800 | 6400 | 5600 | 6800 | 6800 | 6800 | 6800 | 3600 | 69600 |
| 29 - 30 | 2400 | 7600 | 6000 | 6000 | 7600 | 6000 | 6400 | 5200 | 5200 | 5200 | 5200 | 2400 | 65200 |

**Table 8: Calculated Site Population Factors for Site 2, 20 km from centres of Cities A and B, no rotation**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A | B | C | D | E | F | G | H | I | J | K | L | **All** |
| 0 - 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 - 2 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.51 |
| 0 - 3 | 0.08 | 0.11 | 0.08 | 0.08 | 0.11 | 0.08 | 0.11 | 0.11 | 0.08 | 0.08 | 0.11 | 0.11 | 0.49 |
| 0 - 4 | 0.08 | 0.09 | 0.10 | 0.10 | 0.09 | 0.08 | 0.10 | 0.09 | 0.08 | 0.08 | 0.09 | 0.10 | 0.46 |
| 0 - 5 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.10 | 0.09 | 0.08 | 0.08 | 0.09 | 0.10 | 0.44 |
| 0 - 6 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.10 | 0.09 | 0.09 | 0.09 | 0.09 | 0.10 | 0.44 |
| 0 - 7 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.10 | 0.09 | 0.08 | 0.08 | 0.09 | 0.10 | 0.43 |
| 0 - 8 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.43 |
| 0 - 9 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.43 |
| 0 - 10 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.43 |
| 0 - 11 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.43 |
| 0 - 12 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.42 |
| 0 - 13 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.42 |
| 0 - 14 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.42 |
| 0 - 15 | 0.08 | 0.09 | 0.08 | 0.08 | 0.09 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.42 |
| 0 - 16 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.42 |
| 0 - 17 | 0.08 | 0.14 | 0.08 | 0.08 | 0.15 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.47 |
| 0 - 18 | 0.08 | 0.23 | 0.09 | 0.09 | 0.24 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.55 |
| 0 - 19 | 0.08 | 0.31 | 0.10 | 0.10 | 0.33 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.63 |
| 0 - 20 | 0.08 | 0.40 | 0.11 | 0.11 | 0.42 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.71 |
| 0 - 21 | 0.08 | 0.47 | 0.12 | 0.12 | 0.49 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.78 |
| 0 - 22 | 0.08 | 0.53 | 0.12 | 0.13 | 0.55 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.83 |
| 0 - 23 | 0.08 | 0.58 | 0.12 | 0.13 | 0.60 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.87 |
| 0 - 24 | 0.08 | 0.61 | 0.12 | 0.13 | 0.62 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.89 |
| 0 - 25 | 0.08 | 0.59 | 0.12 | 0.13 | 0.61 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.88 |
| 0 - 26 | 0.08 | 0.58 | 0.12 | 0.13 | 0.59 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.87 |
| 0 - 27 | 0.08 | 0.57 | 0.12 | 0.12 | 0.58 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.85 |
| 0 - 28 | 0.08 | 0.56 | 0.12 | 0.12 | 0.57 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.84 |
| 0 - 29 | 0.08 | 0.55 | 0.12 | 0.12 | 0.56 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.83 |
| 0 - 30 | 0.08 | 0.54 | 0.12 | 0.12 | 0.55 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.82 |

**Table 9: Population by radial band around Site 3, 20 km NE of City B, no rotation**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A | B | C | D | E | F | G | H | I | J | K | L | All |
| 0 - 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 - 2 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 4800 |
| 2 - 3 | 800 | 400 | 800 | 400 | 800 | 400 | 800 | 0 | 800 | 400 | 800 | 400 | 6800 |
| 3 - 4 | 400 | 800 | 400 | 800 | 800 | 400 | 800 | 1200 | 800 | 400 | 800 | 800 | 8400 |
| 4 - 5 | 800 | 1200 | 800 | 1600 | 800 | 800 | 1200 | 400 | 1200 | 800 | 800 | 1600 | 12000 |
| 5 - 6 | 800 | 1200 | 800 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 13600 |
| 6 - 7 | 1200 | 1200 | 1200 | 1600 | 800 | 1200 | 1600 | 1600 | 1600 | 1200 | 800 | 1600 | 15600 |
| 7 - 8 | 1600 | 1600 | 1600 | 1600 | 2000 | 1200 | 1600 | 1200 | 1600 | 1200 | 2000 | 1600 | 18800 |
| 8 - 9 | 1600 | 1200 | 1600 | 2000 | 1600 | 1600 | 1600 | 2800 | 1600 | 1600 | 1600 | 2000 | 20800 |
| 9 - 10 | 1600 | 2800 | 1600 | 2000 | 2400 | 2000 | 2000 | 1600 | 2000 | 2000 | 2400 | 2000 | 24400 |
| 10 - 11 | 2400 | 1600 | 2400 | 2000 | 2400 | 2000 | 2800 | 2000 | 2800 | 2000 | 2400 | 2000 | 26800 |
| 11 - 12 | 2000 | 2800 | 2000 | 2400 | 2000 | 2000 | 2400 | 2800 | 2400 | 2000 | 2000 | 2400 | 27200 |
| 12 - 13 | 2800 | 2800 | 2800 | 3200 | 3200 | 2400 | 2800 | 2000 | 2800 | 2400 | 3200 | 3200 | 33600 |
| 13 - 14 | 2400 | 2800 | 2400 | 2800 | 7400 | 2800 | 2800 | 3200 | 2800 | 2800 | 7400 | 2800 | 42400 |
| 14 - 15 | 2800 | 3200 | 2800 | 3200 | 78600 | 6400 | 3200 | 2800 | 3200 | 6400 | 78600 | 3200 | 194400 |
| 15 - 16 | 3600 | 2800 | 3600 | 3200 | 105600 | 21800 | 3600 | 5200 | 3600 | 21800 | 105600 | 3200 | 283600 |
| 16 - 17 | 3200 | 3600 | 3200 | 4000 | 120200 | 31000 | 3600 | 74600 | 3600 | 31000 | 120200 | 4000 | 402200 |
| 17 - 18 | 3200 | 4000 | 3200 | 4000 | 130600 | 35200 | 3600 | 122200 | 3600 | 35200 | 130600 | 4000 | 479400 |
| 18 - 19 | 3600 | 3600 | 3600 | 4000 | 133200 | 34000 | 4400 | 146600 | 4400 | 34000 | 133200 | 4000 | 508600 |
| 19 - 20 | 4000 | 4400 | 4000 | 4000 | 132200 | 26800 | 4000 | 161200 | 4000 | 26800 | 132200 | 4000 | 507600 |
| 20 - 21 | 4000 | 4000 | 4000 | 4800 | 122000 | 12400 | 4400 | 166000 | 5200 | 12400 | 122000 | 4800 | 466000 |
| 21 - 22 | 4800 | 4400 | 4800 | 4400 | 64600 | 4000 | 4400 | 160400 | 4400 | 4000 | 64600 | 4400 | 329200 |
| 22 - 23 | 4400 | 4400 | 4400 | 5200 | 4800 | 5200 | 4800 | 137800 | 4800 | 5200 | 4800 | 5200 | 191000 |
| 23 - 24 | 5200 | 5200 | 5200 | 4800 | 4400 | 4400 | 5600 | 80200 | 5600 | 4400 | 4400 | 4800 | 134200 |
| 24 - 25 | 4800 | 4800 | 4800 | 4800 | 6000 | 4800 | 5200 | 11200 | 5200 | 4800 | 6000 | 4800 | 67200 |
| 25 - 26 | 4800 | 6000 | 4800 | 6000 | 4800 | 4800 | 5200 | 9000 | 5200 | 4800 | 4800 | 6000 | 66200 |
| 26 - 27 | 4400 | 5200 | 4400 | 4400 | 6400 | 5600 | 5600 | 4800 | 5600 | 5600 | 6400 | 4400 | 62800 |
| 27 - 28 | 5600 | 5600 | 5600 | 5600 | 5200 | 6400 | 6000 | 6800 | 6000 | 6400 | 5200 | 5600 | 70000 |
| 28 - 29 | 5800 | 6800 | 5800 | 5800 | 5200 | 5600 | 6400 | 5200 | 6400 | 5600 | 5200 | 5800 | 69600 |
| 29 - 30 | 6200 | 5200 | 6200 | 6200 | 7200 | 5600 | 6000 | 6800 | 6000 | 5600 | 7200 | 6200 | 74400 |

**Table 10: Calculated Site Population Factors for Site 3, 20 km northwest of City B, no rotation**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RB (km) | A | B | C | D | E | F | G | H | I | J | K | L | **All** |
| 0 - 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 - 2 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.51 |
| 0 - 3 | 0.11 | 0.08 | 0.11 | 0.08 | 0.11 | 0.08 | 0.11 | 0.06 | 0.11 | 0.08 | 0.11 | 0.08 | 0.48 |
| 0 - 4 | 0.09 | 0.08 | 0.09 | 0.08 | 0.10 | 0.07 | 0.10 | 0.08 | 0.10 | 0.07 | 0.10 | 0.08 | 0.45 |
| 0 - 5 | 0.09 | 0.09 | 0.09 | 0.09 | 0.10 | 0.07 | 0.10 | 0.07 | 0.10 | 0.07 | 0.10 | 0.09 | 0.44 |
| 0 - 6 | 0.08 | 0.09 | 0.08 | 0.09 | 0.10 | 0.07 | 0.10 | 0.07 | 0.10 | 0.07 | 0.10 | 0.09 | 0.44 |
| 0 - 7 | 0.08 | 0.09 | 0.08 | 0.09 | 0.09 | 0.07 | 0.10 | 0.07 | 0.10 | 0.07 | 0.09 | 0.09 | 0.43 |
| 0 - 8 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.10 | 0.07 | 0.10 | 0.07 | 0.09 | 0.09 | 0.43 |
| 0 - 9 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.10 | 0.08 | 0.10 | 0.07 | 0.09 | 0.09 | 0.42 |
| 0 - 10 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.42 |
| 0 - 11 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.10 | 0.08 | 0.10 | 0.07 | 0.09 | 0.09 | 0.42 |
| 0 - 12 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.42 |
| 0 - 13 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.42 |
| 0 - 14 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.07 | 0.09 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.42 |
| 0 - 15 | 0.08 | 0.08 | 0.08 | 0.09 | 0.19 | 0.08 | 0.09 | 0.08 | 0.09 | 0.08 | 0.19 | 0.09 | 0.50 |
| 0 - 16 | 0.08 | 0.08 | 0.08 | 0.09 | 0.29 | 0.10 | 0.09 | 0.08 | 0.09 | 0.10 | 0.29 | 0.09 | 0.61 |
| 0 - 17 | 0.08 | 0.08 | 0.08 | 0.09 | 0.39 | 0.12 | 0.09 | 0.15 | 0.09 | 0.12 | 0.39 | 0.09 | 0.74 |
| 0 - 18 | 0.08 | 0.08 | 0.08 | 0.09 | 0.48 | 0.15 | 0.09 | 0.24 | 0.09 | 0.15 | 0.48 | 0.09 | 0.87 |
| 0 - 19 | 0.08 | 0.08 | 0.08 | 0.09 | 0.56 | 0.17 | 0.09 | 0.34 | 0.09 | 0.17 | 0.56 | 0.09 | 1.00 |
| 0 - 20 | 0.08 | 0.08 | 0.08 | 0.09 | 0.63 | 0.18 | 0.09 | 0.43 | 0.09 | 0.18 | 0.63 | 0.09 | 1.10 |
| 0 - 21 | 0.08 | 0.08 | 0.08 | 0.09 | 0.68 | 0.18 | 0.09 | 0.51 | 0.09 | 0.18 | 0.68 | 0.09 | 1.18 |
| 0 - 22 | 0.08 | 0.08 | 0.08 | 0.09 | 0.70 | 0.18 | 0.09 | 0.58 | 0.09 | 0.18 | 0.70 | 0.09 | 1.22 |
| 0 - 23 | 0.08 | 0.08 | 0.08 | 0.09 | 0.68 | 0.17 | 0.09 | 0.63 | 0.09 | 0.17 | 0.68 | 0.09 | 1.22 |
| 0 - 24 | 0.08 | 0.08 | 0.08 | 0.09 | 0.66 | 0.17 | 0.09 | 0.65 | 0.09 | 0.17 | 0.66 | 0.09 | 1.21 |
| 0 - 25 | 0.08 | 0.08 | 0.08 | 0.09 | 0.65 | 0.17 | 0.09 | 0.64 | 0.09 | 0.17 | 0.65 | 0.09 | 1.19 |
| 0 - 26 | 0.08 | 0.08 | 0.08 | 0.09 | 0.63 | 0.17 | 0.09 | 0.63 | 0.09 | 0.17 | 0.63 | 0.09 | 1.17 |
| 0 - 27 | 0.08 | 0.08 | 0.08 | 0.09 | 0.62 | 0.16 | 0.09 | 0.61 | 0.09 | 0.16 | 0.62 | 0.09 | 1.16 |
| 0 - 28 | 0.08 | 0.08 | 0.08 | 0.09 | 0.61 | 0.16 | 0.09 | 0.60 | 0.09 | 0.16 | 0.61 | 0.09 | 1.14 |
| 0 - 29 | 0.08 | 0.08 | 0.08 | 0.09 | 0.60 | 0.16 | 0.09 | 0.59 | 0.09 | 0.16 | 0.60 | 0.09 | 1.12 |
| 0 - 30 | 0.08 | 0.08 | 0.08 | 0.09 | 0.59 | 0.16 | 0.09 | 0.58 | 0.09 | 0.16 | 0.59 | 0.09 | 1.11 |

# References

[1] HSE (2009), Land Use Planning and the Siting of Nuclear Installations in the United Kingdom. [www.hse.gov.uk/landuseplanning/land-use-planning.pdf](http://www.hse.gov.uk/landuseplanning/land-use-planning.pdf)

[2] Marley W G and Fry T M (1955) *Radiological hazards from an escape of fission products and the implications in power reactor location*, Proc. Int. Conf. on the Peaceful Uses of Atomic Energy (Geneva, United Nations)

[3] Farmer, F. R. (1962) *The evaluation of power reactor sites*, DPR/INF/266, UKAEA, Harwell

[4] HC Deb 06 February 1968 vol 758 cc235-8

[5] Openshaw, S. *The Geography of Reactor Siting Policies in the U. K.* Transactions of the Institute of British Geographers, New Series, Vol. 7, No. 2 (1982),pp. 150-162

[6] Charlesworth, F.R., Gronow (1967), W.S. *A Summary of Experience in the Practical Application of Siting Policy in the United Kingdom*, Containment and Siting of Nuclear Power Plants. Proceedings of a Symposium on the Containment and Siting of Nuclear Power Plants p. 143-168. (IAEA, Vienna)

[7] Gronow, W. S. (1969) *Application of Safety and Siting Policy to Nuclear Plants in the United Kingdom* Environmental Contamination by Radioactive Materials (pp 549-559)

[8] HC Deb 11 March 1988 vol 129 cc358-60

[9] Department for Business Enterprise and Regulatory Reform (July 2008) Towards a nuclear national policy statement Consultation on the Strategic Siting Assessment Process and Siting Criteria for New Nuclear Power Stations in the UK. <http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file47136.pdf>

[10] Department for Business, Energy and Industrial Strategy (December 2017) Consultation on the siting criteria and process for a new national policy statement for nuclear power with single reactor capacity over 1 gigawatt beyond 2025. <https://www.gov.uk/government/consultations/national-policy-statement-for-new-nuclear-above-1gw-post-2025-siting-criteria-and-process> .

[11] Highton J and Senior D (2008) *The siting of nuclear installations in the United Kingdom*, HSE ‘Nuclear Installations Inspectorate’. <http://www.hse.gov.uk/aboutus/meetings/iacs/nusac/030708/p12-sittingpaper.pdf>

[12] Office for Nuclear Regulation (2015), Licensing Nuclear Installations, 4th Edition. <http://www.onr.org.uk/licensing-nuclear-installations.pdf>

[13] Office for Nuclear Regulation (2013), Land use planning - Nuclear installations. <http://www.onr.org.uk/land-use-planning.htm>

1. When considering actual sites, it is recognised that there may be some residential dwellings within the 0 – 1 km zone. These are accounted for within the methodology with a significantly higher weighting factor being applied to such populations. [↑](#footnote-ref-2)
2. Should one or more discretionary criteria not be met, potential mitigation of the adverse impact can be taken into consideration in determining the potential suitability of the site. By contrast, exclusionary criteria are absolute. [↑](#footnote-ref-3)