

# Testing the Mega-Ray Zoologist Lamp: Preliminary Results

**This report describes a series of simple recordings of the UVB output and beam characteristics of a new mercury vapour lamp designed for use in large enclosures with reptiles with a high UVB requirement.**

## Introduction

Along with colleagues Rob Lane and Rachel Hitch, I am presently working on a project testing the UVB output of lighting equipment for reptile vivaria using hand-held UVB radiometers.

When Robert MacCargar of ReptileUV.com asked me if I would test a very long-range high UVB mercury vapour flood lamp here in the UK, I was very interested since to my knowledge, there is no comparable product on sale this side of the Atlantic.

The bulb I was sent was a "Zoologist Mega-Ray" PAR38 60watt 120volt electronically ballasted Mercury Vapour Flood lamp from [ReptileUV.com](http://ReptileUV.com).

I already have a 110-120 volt set-up with a voltage converter and an external ballast, for a 60 watt EB Mega-Ray lamp in one of my bearded dragon enclosures, so it was no problem to arrange the electrical supply. However, the Zoologist lamp has a recommended minimum distance of 30" from lamp face to subject. None of my vivaria are large enough to accommodate this, so it was necessary to rig up a test site in a separate room. The lamp was set up in a ceramic holder affixed to a wooden batten close to the ceiling at a height of 90". This allowed measurement of UVB output up to 72" from the face of the lamp.

## Testing Methods

The UVB meter used for all tests was a hand held ultraviolet radiometer, the Solarmeter Model 6.2 UVB manufactured by Solartech Inc. ([www.solarmeter.com](http://www.solarmeter.com))

Although it measures the complete UVB range (280 nanometers to 320 nanometers) the Solarmeter's peak sensitivity is at 295nm, right in the middle of the D-UV range, which makes it useful for checking UVB reptile lamps.

Many UVB-emitting lamps demonstrate a rapid period of decay in UVB output (often described as "burning-in") over the first few days of use, followed by a slower decline in output over subsequent months. To establish whether this occurs in the lamp under test, and to ensure each lamp is tested in a comparable manner, a burn-in time of 80 - 100 hours is allowed for in all our testing regimes.

Most lamps take several minutes to reach full brightness. Tests are only performed on lamps which have been alight for at least 30 minutes directly before testing.

Two types of recordings were made for this lamp.

Firstly, a series of **direct readings** were taken at increasing distances from directly beneath the lamp face, in 2" steps from 12" to 72". The first set was taken after 30 minutes burn; the next at 3 hours. The lamp was then allowed to burn for 15 hours a day and readings taken at intervals until an 80 hour burn-in had been completed. A detailed **spread chart** recording the output of the lamp was then made. This involves recording the output of the lamp in a two-dimensional plane directly beneath and to the sides of the lamp face. Direct readings are taken from several hundred points in this plane, and plotted on a chart so that a two-dimensional visualisation of the three-dimensional "cone" of radiation emitted by the lamp can be visualised.

The method used has been fully described in a previous article available on-line in the UVB\_Meter\_Owners group files at:

[http://groups.yahoo.com/group/UVB\\_Meter\\_Owners/files/Make%20Yourself%20a%20Simple%20UVB%20Spread%20Chart.doc](http://groups.yahoo.com/group/UVB_Meter_Owners/files/Make%20Yourself%20a%20Simple%20UVB%20Spread%20Chart.doc) (downloadable Microsoft Word Document size 139K)

## Results

The results of the first sets of readings are shown in Table 1 and Graph 1.

The results for the Spread Chart are shown in Figure 1.

Table 1. UVB Output ( $\mu\text{W}/\text{cm}^2$ ) during first 75 hours of use.

Time lamp has been in use	Distance from face of lamp (inches)															
	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"	42"
0.5 hours	2000	1402	1226	946	801	668	568	495	420	378	321	300	270	234	212	195
3 hours	1966	1468	1209	932	803	657	564	480	422	375	326	293	263	234	215	196
15 hours	2000	1501	1206	972	777	641	559	478	410	374	328	293	266	237	219	197
30 hours	1959	1450	1202	958	771	649	558	478	416	369	330	299	266	244	213	196
60 hours	1926	1455	1169	930	752	641	524	459	408	360	316	289	258	230	212	193
75 hours	1945	1478	1206	945	768	651	536	486	413	362	324	285	254	228	214	194
	44"	46"	48"	50"	52"	54"	56"	58"	60"	62"	64"	66"	68"	70"	72"	
0.5 hours	176	162	153	145	130	124	112	107	100	-	-	-	-	-	-	
3 hours	182	166	151	142	132	123	114	109	102	95	88	83	78	74	70	
15 hours	183	165	153	145	131	120	113	106	101	94	88	84	80	75	70	
30 hours	179	166	151	141	132	124	116	111	101	95	90	84	80	76	71	
60 hours	174	165	151	139	130	120	107	101	91	90	86	81	76	72	62	
75 hours	180	165	150	142	131	119	109	107	100	93	89	82	78	73	70	

Graph 1. UVB Output ( $\mu\text{W}/\text{cm}^2$ ) during first 75 hours of use.

This chart has been scaled down to fit on the page. To view the full-size chart in a new window, click on image.

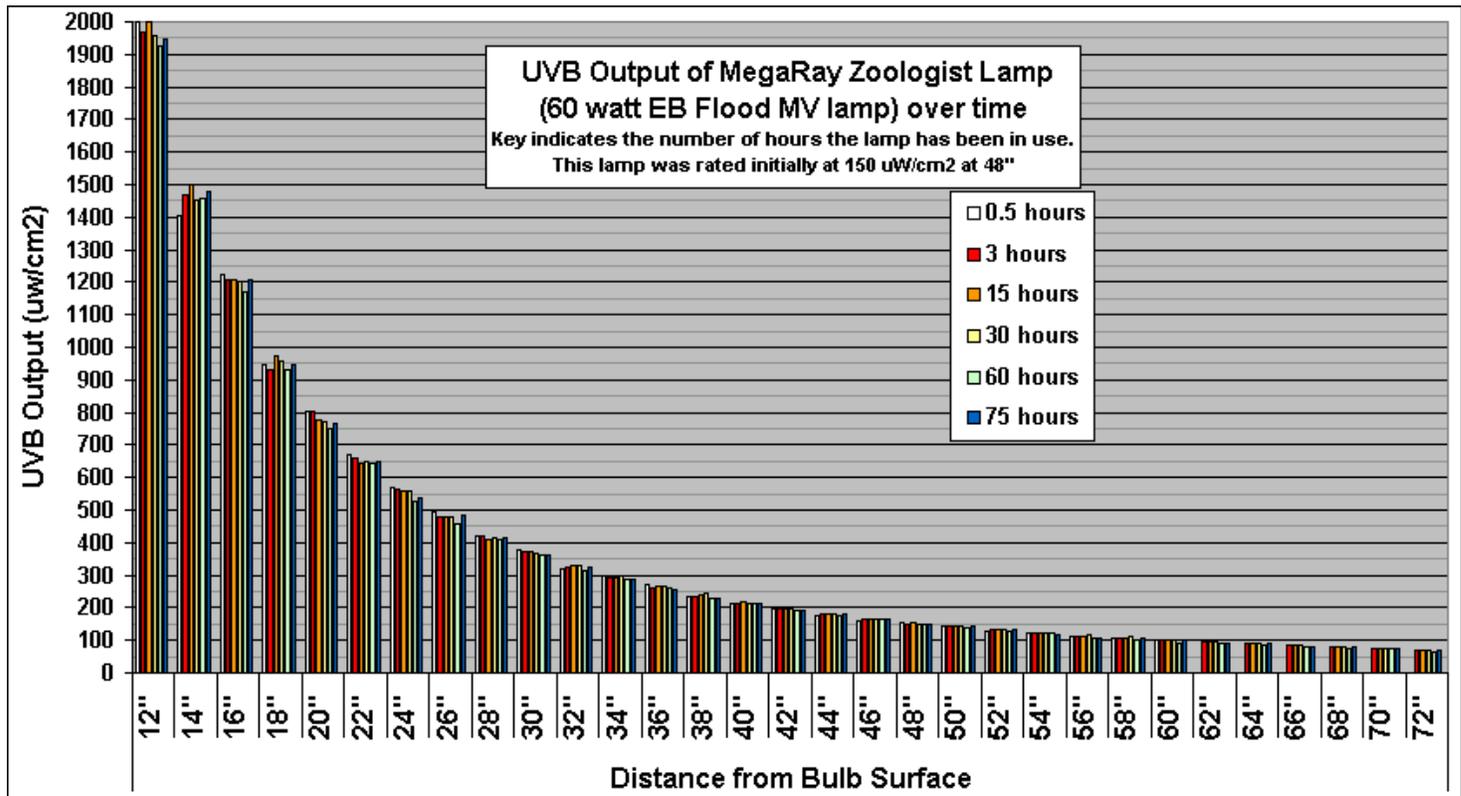
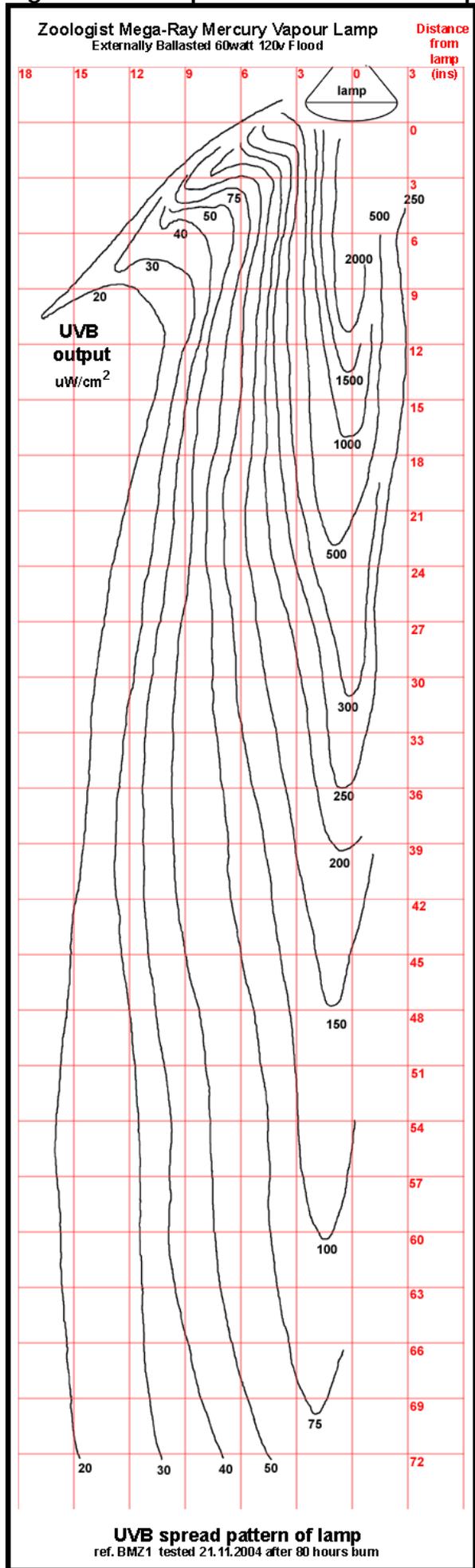


Figure 1. UVB Spread Chart of this lamp after 80 hours of use.



This is the actual UVB Spread Chart I made for this lamp, showing the contours plotted for UVB output from 20uW/cm<sup>2</sup> to the point at which the meter goes "off the scale" at fractionally over 1999uW/cm<sup>2</sup> (deemed to be 2000uW/cm<sup>2</sup> at that point.)

[This chart has been scaled down to fit on the page.](#)  
[To view the full-size chart in a new window, click on image.](#)

**Discussion.**

**General Observations.**

The lamp performed like other Mega-Ray mercury vapour lamps I have tested, in that when first switched on, it produced a faint light which developed over a few minutes into a very bright light with (to the human eye) a purplish-blue tint.

As with all mercury vapour lights I have tested so far, the readings "danced" at close range, and in fact the visible light can often be seen to "dance" as well, casting flickering shadows at the edge of the beam. Presumably this is a normal artefact due to the way the radiation is generated.

**Direct Readings.**

The lamp produced almost exactly the same output of UVB as the rating hand-written on the bulb at the time of dispatch from the manufacturer (150 uW/cm<sup>2</sup> at 48") and even at 72" (the furthest my testing would allow) the beam was producing about 70 uW/cm<sup>2</sup> at its most intense spot.

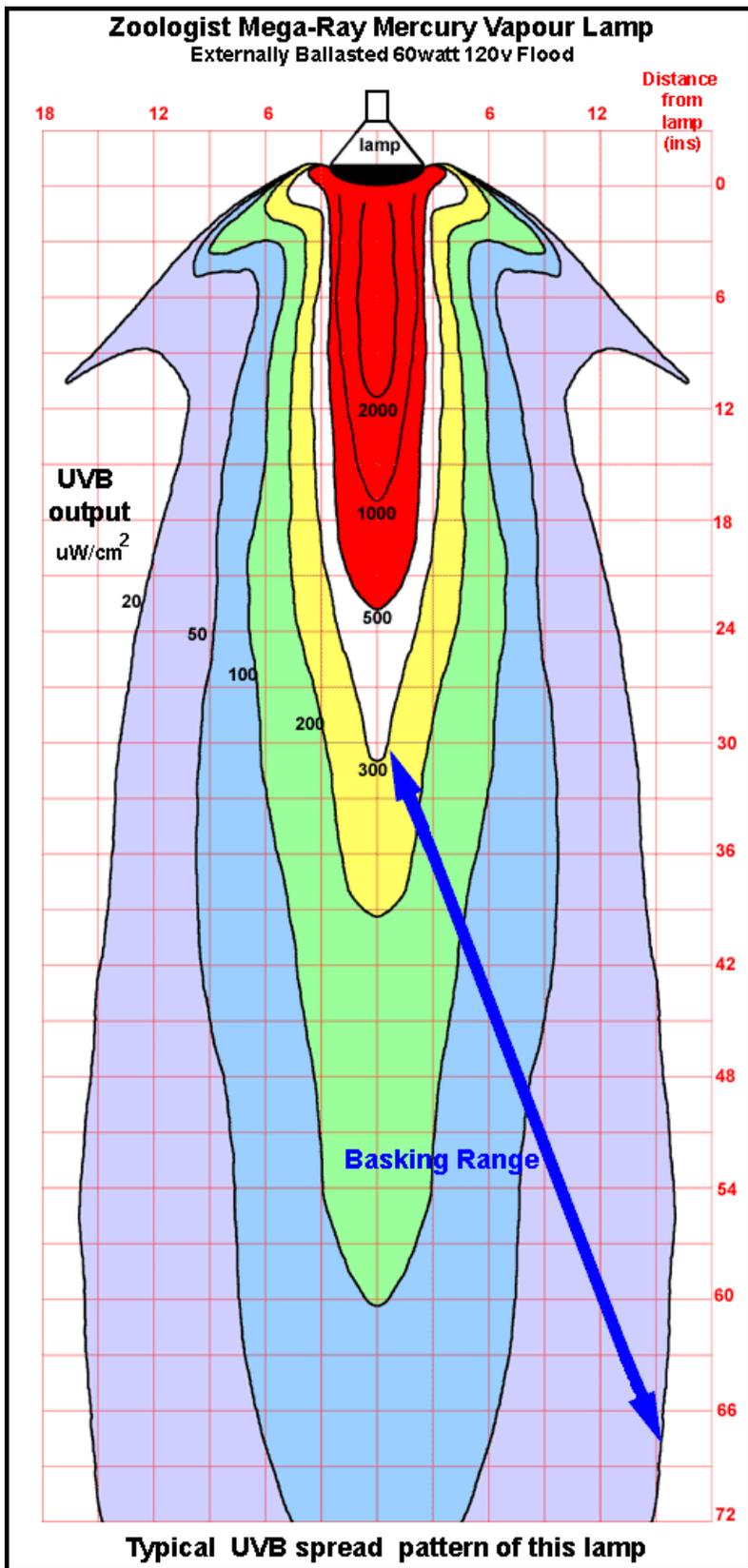
The manufacturers state that the minimum distance at which the lamp should be used is 30". At this distance I was recording a maximum of about 360 - 380 uW/cm<sup>2</sup>. This is equivalent to the UVB readings I have seen given for mid-day sunshine in several parts of the world including the Australian outback, the Cayman Islands and Tenerife, and so it might be considered within the normal basking range for some species of sun-loving lizards, for example.

At distances closer than 30", it produced extremely high levels of UVB radiation; presumably this is unavoidable if such a powerful beam is to be created. Directly under the lamp, levels of UVB radiation exceed 1,500 uW/cm<sup>2</sup> at 12". Care must be taken to exclude animals or humans from the hazardous levels of UVB radiation at such close range. When testing this lamp, as when testing any UVB-emitting device, eye protection should be worn.

Successive readings taken over the 75 hour initial burn of this lamp did not show any marked "burn-in" decay taking place. There is a slight suggestion of a fall in output over the period, when visually examining the graphs, but I have not had the opportunity to perform a statistical analysis on the figures to see if this is mathematically significant.

**UVB Spread Chart.**

This is a particularly useful tool for visualising the extent of the UVB coverage of a lamp such as this. The lamp can be seen to produce a tear-drop shaped beam which does not spread far on either side of the bulb, at close range, except for a curious "spur" effect close to the edge of the beam, which looks as if it is



caused by the curvature of the bulb face just below the silvered upper zone.

The shape of the beam ensures that the hazardous zone close to the bulb is well contained. Although very high levels of UVB (such as are not found in nature) extend for just over 2 feet directly below the lamp, this area is confined to a thin cone barely 6 inches across. Keeping animals and people out of this zone should not prove a difficult task.

Further away from the lamp, the beam widens sufficiently to provide what would seem to be a most useful area within which a basking reptile can receive high levels of UVB, as if basking in a patch of natural sunlight. For example, at a distance of six feet from the lamp, the area within which a reptile may receive a useful but natural level of UVB radiation, is a large circle approximately 30 inches across. (20 uW/cm<sup>2</sup> at its edge, to just over 100 uW/cm<sup>2</sup> at its centre.)

When taking readings for spread charts, I have found that mercury vapour lamps do not produce a perfectly symmetrical beam. This is presumably due to the off-centre positioning of some of the elements inside the lamp plus minor eccentricities in the shape of the glass envelope, the orientation of the lamp in its socket, and so forth. This lamp, for example, has a beam which "wobbles" slightly to the left.

Nevertheless it seems likely that all lamps of the same brand and design will have a similar spread pattern - since this depends upon the shape of the bulb and type of reflector. Once I had the basic pattern to look at, I could see that this lamp is producing a fairly predictable spread and I felt confident that this data was adequate to construct a simple full spread diagram, to give a helpful impression of the type of spread produced by a "typical" Zoologist Mega-Ray lamp. This is shown in Figure 2, below.

**Figure 2. A Stylised Spread Chart for a Typical Mega-Ray Zoologist Lamp, based upon the readings from the lamp described above.**

[This chart has been scaled down to fit on the page.](#)

[To view the full-size chart in a new window, click on image.](#)

Individual lamps will, however, vary in their UVB output, depending upon their original specifications (Mega-Rays, for example, are all calibrated individually as they leave the manufacturer) and upon their age, the condition of the ballast, the quality of the electrical supply and doubtless, other factors. I hope this diagram gives a useful insight into the sort of UVB I think one can expect from this bulb. However, it can never replace the need for owners of such a powerful lamp to take their own UVB readings, with their own UVB meter, when setting up and maintaining the vivarium in which it is to be used.

I am grateful to Robert MacCargar for the opportunity to test this new lamp, which has been a very interesting task. Although this version relies upon a 110 volt, American external ballast I understand that a 220volt, self ballasting version of this same lamp, suitable for the UK electrical system, is now available for import into the UK. I believe this lamp may have interesting implications for zoos, reptile sanctuaries, or private keepers needing to furnish large indoor enclosures with ample UVB, who have access to a UVB meter to monitor its use.

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