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**DEVELOPMENT OF PROFICIENCY TESTING
FOR DETECTION OF IRRADIATED FOOD PROJECT E01068**

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**VOLUME I: PROJECT SUMMARY AND RESULTS OF FIRST ROUND PSL
TRIALS SEPTEMBER 2005**

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M. Thompson**

DEVELOPMENT OF PROFICIENCY TESTING FOR DETECTION OF IRRADIATED FOOD

PROJECT E01068

RESULTS OF FIRST ROUND PSL TRIALS SEPTEMBER 2005

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PROJECT SUMMARY

This project aimed to develop potential proficiency testing (PT) schemes for detection of irradiated foods, with initial focus on Photostimulated Luminescence (PSL, EN13751) and Thermoluminescence (TL, EN1788) methods, which are widely applied international standard methods for detecting irradiated food. The original validation studies that underpin the standard methods were conducted in the 1990's. Therefore one aim was to establish the extent to which the performance of the original studies can be reproduced today. The other main objective was to explore potential scoring methods for proficiency testing of these essentially qualitative methods, taking account of variability within and between products, and the differences between the measurement and classification approaches used in luminescence analysis of foods and those associated with established PT procedures for quantitative analytical chemistry. An advisory group drawn from FSA, the Universities of Glasgow and London and the Institute of Food Research was formed at an early stage and used to guide the work. The original work-plan envisaged two rounds of blind analysis of carefully selected and characterised materials using luminescence methods. Following two successful trials with high participation and return rates a short extension was implemented on the advisory group's recommendation to permit a third round.

Samples of herbs, spices, seasonings and dietary supplement ingredients were procured at the outset, and again at the start of the extension. Herbs, spices and seasonings were obtained pre-packed in retail containers. Dietary supplement ingredients were bulk purchased and packed by a commodity supplier. In the first stage 39 herb, spice and seasoning products were procured, plus 10 dietary supplement ingredients. In the second stage further sets of 10 herbs and spices and 10 dietary supplement ingredients were obtained. All products were from single batch sources and were replicated into 250 individual portions. These were sequentially numbered, re-arranged in random order and re-numbered so that equally representative samples could then be drawn from the stocks for processing, for homogeneity testing and reference analysis, and for distribution to participants as needed. Irradiations were performed under commercial conditions at the Isotron ⁶⁰Co facility in Swindon, with some additional irradiations in the Beatson Institute of the University of Glasgow. In later stages of the trial blended mixtures containing 0.1%, 1% and 10% irradiated material were also prepared and analysed. Extensive reference analyses were conducted at SUERC in all stages, involving duplicate analysis of at least 10 separate portions of each product in each condition (irradiated, unirradiated, blended).

Participants were recruited by questionnaire and invitation. On statistical grounds the targets were to recruit 10-20 PSL participants and up to 10 TL laboratories. The response was very positive with 32 PSL laboratories participating in the first trial, rising to 35 PSL laboratories and 16 TL laboratories by the third round. A good international mix was achieved, with EU, and US and Far Eastern participants, including national laboratories, regional food analysts and food industry quality control laboratories. The trial rounds were arranged progressively by method.

In the first round in 2005, PSL screening was explored. 49 test materials were used, presented in irradiated and unirradiated forms. A single irradiated paprika standard was also distributed and analysed to provide an indication of individual instrumental sensitivity. The 32 participants thus analysed 98 blind samples plus the standard, returning 3048 screening results comprising PSL intensity data and qualitative classifications as "negative", "intermediate" or "positive" bands according to EN13751. 980 reference analyses were conducted at SUERC, and used to define reference values and homogeneity of the materials. By comparison with

participants data it was possible to evaluate interlaboratory variations and overall performance. Data were reported and discussed at a participants' meeting in East Kilbride in November 2005 prior to the second round.

The second round in 2006 added calibrated PSL analysis, TL analysis, and blended mixtures to the study. A further 2160 PSL screening results were returned by 30 laboratories, from 72 samples, including 6 blended mixtures. Calibrated PSL data sets comprising 854 analyses were returned by 12 laboratories. TL analysis is far more time consuming. Nonetheless 18 samples, comprising 6 irradiated, 6 unirradiated and 6 blended samples, were analysed by 15 TL laboratories, resulting in 270 TL determinations under controlled conditions. Additional reference analyses were conducted for the blends (360 PSL analyses conducted during the blending process), for calibrated PSL (720 analyses) and TL (180 TL analyses). Following data analysis and collation participants were asked to complete a questionnaire on the utility of the work and their views on subsequent actions. These results were used to determine the structure of the final round.

The third round in May 2007, compared all three methods using a reduced sample set of 18 samples. TL participants were offered the choice of analysing the full set of 18 samples as before, or working with a half set (to limit the time commitment). PSL screening data were obtained from 35 participants at this stage (630 analyses); with a further 10 calibrated PSL data sets (180 results). TL analyses were performed by 16 laboratories. Complete reference data sets for all methods were also acquired.

The results from this project provide the most substantial data sets produced since the original validation studies to examine performance of the EN1788 and EN13751 under controlled conditions. The data are fully documented in the 3 volume technical report covering each of the trial rounds and forming the final project report. Overall the results are extremely encouraging. Qualitative concordance was achieved in the majority of determinations, performance exceeding the IUPAC criteria originally applied to the studies which underpin the international standards. By including dietary supplement ingredients for the first time under interlaboratory conditions, a case can be made for extending EN1788 and EN13751 to these materials. Beneath these positive conclusions the study also revealed evidence of interlaboratory variations. In the PSL screening data sets there was evidence of sample handling problems in some laboratories resulting in cross contamination of irradiated and unirradiated samples. This was eliminated by the third round as a result of feedback to laboratories from this study. This provides a clear example of the benefits of conducting regular PT work.

Attention was also given to scoring systems. For PSL screening the use of Z scores (standardised deviations relative to reference values) has been shown to be useful both for identifying outliers and for assuring uniform qualitative classification rates. This can be recommended for future trials work. For calibrated PSL graphical methods were initially explored and the data sets have also been used to assess regression methods which appear promising for future work. For TL analysis the data sets are necessarily more limited. At present it appears that qualitative scoring coupled to analysis of the signal to background ratio of positive TL signals relative to laboratory blanks may provide a useful scoring system.

The work conducted in this project proved extremely useful to participating laboratories, as reflected in the very substantial work contributions and data return rates from participants. It has also provided data of considerable value to users of the international standard methods, whether for regulatory or supply chain quality control purposes, in indicating the extent to which convergent outcomes can be expected from a wide community of application laboratories.

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SUMMARY

Food irradiation is used in many countries for the purposes of shelf life extension, reduction of spoilage and pathogen contents, retardation of ripening and sprouting processes in diverse foods. European Regulations require both licensing of plant and process and explicit product labelling at all stages of market presentation. However, in the absence of widespread consumer acceptance there is little evidence of properly labelled products in the UK or in Europe. Several analytical methods for detection of food irradiation have been developed, of which the CEN international standards (i.e. within the UK the BS EN series) based on luminescence are in quite widespread use. With this in mind the Food Standard Agency has commissioned work aimed at assessing the feasibility of developing a proficiency scheme appropriate for the detection of irradiated foods.

This report summarises the results from a trial Round 1 involving participants using the BS EN 13751:2002 photostimulated luminescence (PSL) method. Recognising the fundamentally qualitative nature of irradiation testing methods and the need to examine the relationship between underlying quantitative data and their associated qualitative outcomes led to a trial which attempts to utilise large numbers of test materials and large numbers of participants.

In this initial Round, 49 test materials of herbs, spices, seasonings and dietary supplement ingredients were obtained and prepared in both irradiated and unirradiated forms. 32 participating laboratories each conducted 98 PSL determinations and measurements from standard materials and returned results to the SUERC for analysis. Homogeneity testing was conducted within a Single-Laboratory and this data used to define assigned values and standard deviations for the calculation of z -scores. The SUERC reference data show a wide range of product sensitivities, typical of previous validation studies. Irradiated and unirradiated test materials are well separated. Participants data have been tabulated and used to evaluate quantitative z -scores which can be used to assess individual test materials and laboratory behaviour. Qualitative data have also been tabulated and compared with the reference set.

Participants results from this first Round are in general encouraging with very good correspondence between qualitative outcomes from irradiated test materials and the SUERC reference data sets. For unirradiated test materials there is evidence that some participants may have cross-contaminated unirradiated and irradiated material leading to some elevated results. Examination of z -scores confirms this, however the qualitative impact appears to be less severe. The report summarises the study design, first Round results and scoring methods based on both quantitative and qualitative approaches. The data sets will be used for further statistical analysis. Following dialogue with participants a second Round of distribution will be undertaken where participants will be able to benefit from the experience of the first Round.

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1. INTRODUCTION

In the UK, food irradiation is covered by Statutory Regulations^{1,2,3,4} which implement European Directives on Food Irradiation^{5,6} and require both process control and explicit labelling. Only foods from a permitted list of food classes can be irradiated, and mechanisms are in place for the importation of irradiated products, subject to a similar control regime. The UK Labelling Regulations demand explicit identification of irradiated foods and declared ingredients. Analytical methods are now available for a wide range of food^{7,8,9,10,11,12,13,14,15,16} and there are requirements in the European Directives on Food Irradiation for Member States to utilise validated and standardised methods, where available, in performing market surveillance, and to report results back to the Commission on an annual basis.

The majority of the CEN international standard methods for irradiated foods were developed in the late 1980's and early 1990's, and subjected to international collaborative trial during that period. Since this period there have inevitably been many changes in the laboratories engaged in development and validation of these methods with some no longer maintaining analytical capability and also some new laboratories and food test material types emerging. In this respect it is relevant to note that the CEN luminescence methods have been applied widely in UK and European surveys. Both photostimulated luminescence (PSL) screening and thermoluminescence (TL) analysis were used successfully in the 1996 MAFF survey of undeclared foods¹⁷ and also in the 2001 survey conducted by the Food Standards Agency¹⁸. These surveys have been successful in identifying undeclared irradiated spices, shellfish and particularly in drawing attention to the significant problems associated with dietary

¹ Food (Control of Irradiation) Regulations, 1990, SI 2490

² The Food Irradiation Provisions (England) Regulations 2000, 2000, SI 2254

³ The Food Irradiation Provisions (Wales) Regulations 2001, 2001, WSI 1232 (W.66)

⁴ The Food Irradiation Provisions (Scotland) Regulations 2000, 2000, SSI 309

⁵ European Directive 1999/2/EC, On approximation of the laws of the Member States concerning foods and food ingredients treated with Ionising Radiation, OJEC, February 1999

⁶ European Directive 1999/3/EC, On the establishment of a community list of foods and food ingredients treated with ionising radiation, OJEC, February 1999

⁷ BS EN 1784:1996 Foodstuffs - Detection of Irradiated Food Containing fat – Gas Chromatographic Analysis of Hydrocarbons

⁸ BS EN 1785:1996 Foodstuffs - Detection of Irradiated Food Containing fat – Gas Chromatographic/Mass Spectrometric Analysis of Alkylcyclobutanones

⁹ BS EN 1786:1996 Foodstuffs - Detection of Irradiated Food Containing Bone – Method by ESR Spectroscopy

¹⁰ BS EN 1787:2000 Foodstuffs - Detection of Irradiated Food Containing Cellulose by ESR Spectroscopy

¹¹ BS EN 13708:2001 Foodstuffs - Detection of Irradiated Food Containing Crystalline Sugar by ESR Spectroscopy

¹² BS EN 13783:2001 Foodstuffs - Detection of Irradiated Using Direct Epifluorescent Filter technique/Aerobic Plate count (DEFT/APC) – Screening Method

¹³ BS EN 13784:2001 Foodstuffs - DNA Comet Assay for the Detection of Irradiated Foodstuffs – Screening method

¹⁴ BS EN 1788:1997 Foodstuffs - Detection of Irradiated Food From Which Silicate Minerals can be Isolated: Method by Thermoluminescence

¹⁵ BS EN 13751:2000 Foodstuffs - Detection of Irradiated Food Using Photostimulated Luminescence

¹⁶ BS EN 14569:2004 Foodstuffs – Microbiological Screening for Irradiated Food Using LAL/GNB Procedures.

¹⁷ MAFF, 1997, Undeclared Irradiation of Foodstuffs Surveillance Exercise, Food Surveillance Information Sheet, 102

¹⁸ Food Standards Agency 2002, Survey for Irradiated Foods – Herbs and Spices, Dietary Supplements and Prawns and Shrimps, Food Survey Information Sheet 25/02

supplements¹⁹, which are the subject of current enforcement actions in the UK, and elsewhere in Europe.

International Harmonised Protocols for conducting proficiency testing of analytical methods and laboratories are available^{20,21}, and form the basis for schemes such as those operated by FAPAS® and others for quantitative analysis of foods. These approaches developed for quantitative chemical analysis, based on well homogenised materials, and the evaluation of *z*-scores relative to assigned reference values do not at first sight appear to adapt directly to the essentially qualitative CEN standard methods for detecting irradiated foods. In the case of the chemical^{7,8}, ESR^{9,11} and biological^{12,13,16} methods it might be necessary to vary the CEN standard methods to include quantitative evaluation criteria if the IUPAC approach were to be adopted fully.

The development of qualitative schemes, and incorporating quantitative criteria based on IUPAC protocols where possible, is arguably a more appropriate way forward. Proficiency testing schemes for both qualitative and quantitative data (e.g. for microbiological examination^{22,23} and GMOs^{24,25}) have been developed based on the IUPAC approach. Performance for these schemes was assessed using log-transformed data to calculate *z*-scores and may provide one way to assess the performance for the detection of irradiated foods using PSL and TL methods. However if the concept of “fitness for purpose” is extended to consideration of the qualitative nature of the irradiation problem, it might be argued that the scoring system should incorporate an understanding of the interplay quantitative *z*-scores and qualitative outcomes. To our knowledge this hybrid approach represents an extension of formal proficiency testing methodology. Thus this project has developmental aspects.

In addressing these problems we propose to develop a proficiency testing scheme initially for the PSL¹⁵ and TL¹⁴ methods, before considering a feasibility study of a matrix suitable for extension to a multi-technique test material, suitable for analysis by any of the CEN methods. We intend to undertake 3 Rounds of proficiency testing over a two year period. The first two Rounds will be based on dried products to be analysed by PSL in the first Round, and by PSL and TL in the second. The decisions as to the form of the third Round will be reviewed when the second Round has been completed.

With the PSL method, it is possible to obtain relatively large numbers of participants and analyses. Moreover, since PSL measurement utilizes quantitative photon counting as the basis for qualitative screening classifications then this provides an excellent basis for combining IUPAC quantitative evaluation with an assessment of qualitative performance. The need for a larger numbers of test materials than usually associated with conventional PT schemes arises both in recognition of the variable PSL sensitivities of different products, and in recognition of the need for large data sets to provide a stable basis for analysis of detection rates.

¹⁹European Commission, 2002, Report from the Commission on Food Irradiation for the period September 2000 to December 2001, OJEC, 255,2-12

²⁰Thompson M., and Wood R, 1993, The International Harmonised Protocol for the Proficiency Testing of (Chemical) Analytical Laboratories, IUPAC/ISO/AOAC Protocol for Proficiency Testing, IUPAC, Geneva

²¹Thompson, M., et al, 2006, The International Harmonized Protocol For The Proficiency Testing Of Analytical Chemistry Laboratories, IUPAC Technical Report, in press

²²FAPAS Proficiency Testing Protocol, Third Edition, September 2002, CSL

²³Augustin C., and Carlier V., 2002, Journal of AOAC International, 85, (4), 952-959. French Laboratory Proficiency Program for Food Microbiology.

²⁴GeMMA organised by PTG at CSL using FAPAS Proficiency Testing Protocol, Sixth Edition, September 2002, CSL.

²⁵Thompson M., et. al., 2005, Journal of AOAC International (in press). Scoring in GMO Proficiency Tests based on Log-transformed results.

In extending to TL in the second Round, and finally in exploring the issues surrounding a wider set of methods, it is recognized that smaller numbers of products and participants will be involved. However we anticipate that the combination of information obtained from all three Rounds will significantly extend both the information available on current detection capabilities, and also the scope and approaches to proficiency testing. Both of these aims are highly relevant to the Food Standards Agency's work in support of EU and UK Regulations, and in support of consumer interests.

This report summarises the work undertaken in conducting the first Round of the trials. The selection, preparation and characterisation of study materials are documented, together with reference analysis within the co-ordinating laboratory. Participants are listed and their anonymous results, but known to each individual participant, are presented. The outcomes of PSL analysis of both irradiated and unirradiated test materials are tabulated, and considered both as z-scores relative to the reference data set and as qualitative classification frequencies in their own right and in comparison with reference data. The results provide a basis both for assessing individual participant performance and for examining the relationship between quantitative performance and qualitative outcome.

2. DESIGN AND IMPLEMENTATION

The aim of Round 1 was to obtain PSL data from a series of homogenous test materials from a representative subset of laboratories engaged in routine PSL analysis. The selection of test material types, numbers, and also participants was undertaken following presentations and discussions with the Food Standards Agency, with the UK Spice and Seasonings Association, and with statistical experts familiar with proficiency testing.

2.1 Test Materials

On the basis of the developmental work for the PSL technique and the standard CEN method (BS EN 13751:2002)¹⁵ a range of products was considered suitable for developing proficiency testing for users of this method. Herbs, spices and seasonings are all known to be suitable. Dietary supplements are less well understood although frequently analysed, especially in retail form (tablets, capsules, etc). BS EN 13751:2002 only applies explicitly to herbs, spices, seasonings and shellfish.

The key requirements were to obtain pre-packed material that had been homogenised under industrial conditions prior to packing with large numbers of products and replicates. A selection of herbs, spices, seasonings and dietary supplement ingredients was sought. Sufficient quantities were obtained for both Rounds 1 and 2 so that characterisation effort could be used over both Rounds. Commercially representative materials were obtained where possible to ensure the validity of the study relative to routine analyses for validated test material classes. The use of pre-packed test materials from single production batches where possible facilitated convenient handling while eliminating the potential risk of cross contaminating irradiated and unirradiated specimens by handling bulk materials in the distributing laboratories.

The British Pepper and Spice Company kindly donated 29 pre-packed herbs, spices and seasonings with approximately 250 replicated pots of each product. Product type was indicated on the base of the pots but the pots did not have commercial labels or batch details. A further set of 10 herb and spice products was purchased from Schwartz at a similar replication level to supplement these test materials with additional product in completely

market-representative form. For dietary supplements, raw materials were sourced to avoid introducing extra process variables at this stage. The raw materials selected were the herbal ingredients of 10 dietary supplements that have been frequently encountered in routine analysis of dietary supplements. These were purchased from Cambridge Commodities Ltd. 250 sealed pots of each were provided along with quality assurance documentation and batch information.

Test material details are given in Table 1.

2.2 Participants

At the outset of the project a target of at least 15-20 participants was set for first Round of the project. The PSL system is commercially available and to date 80 laboratories, producers and retailers are equipped with this instrumentation. An email circular was sent to 54 participants in June 2005 with an invitation to participate in the proficiency testing scheme and a request to extend the invitation to other laboratories. 32 positive responses were received to participate in the scheme (Table 2). Since the conclusion of the first Round of the project a further 6 laboratories have expressed interest in joining the second Round.

2.3 Test Material Preparation and Handling

Once all the test materials had arrived at SUERC each separate product was allocated a unique SP number. Each of the individual test material pots was labelled with the SP number, the product description and a pot number from 1 to 250.

49 Sequences of non-repeating random numbers were computer-generated thus enabling each set of 250 pots to be renumbered in a random sequence and re-packaged in that randomised sequence for use in the study. In this way it is possible to be confident that each individual test material drawn at any stage of the study is an unbiased replicate of the original material. Labels were affixed to each pot (i.e. distribution unit) bearing the new number derived from these sequences, hereafter referred to as Pot Number.

Pot numbers 1-10 were segregated for homogeneity testing of the materials as received. The next fifty pots from the random sequence were selected for irradiation at Isotron plc (Swindon, UK) where they received a ^{60}Co gamma dose between 8.5 and 9.8 kGy in June 2005. The remaining unirradiated test material pots were stored at ambient. In parallel, a bulk supply of paprika powder was obtained, homogenised and packed into 250 g containers. 100 sets of this material were also irradiated at the same time as the test materials so that a reference test material of identical irradiation age could be sent to each participant to provide a means of assessing instrument sensitivity. This new paprika reference standard replaces, for the purpose of the study, the routine paprika materials used by each PSL lab which were prepared with different test material ages from an older stock and could not therefore be relied on for comparative purposes.

When the list of participants had been finalised, kits were assembled for each participant consisting of 1 irradiated and 1 unirradiated pot of each test product, plus a paprika reference standard, Petri-dishes, scoops, data disk and instructions. Participants were asked to initially analyse the paprika reference standard (10 aliquots) followed by the “unknowns” in a specific sequence. This sequence consisted of alternate irradiated and unirradiated versions of each product in order of the SP numbers initially allocated. The individual pots given to each participant were chosen on the basis of the Pot Numbers (i.e. Lab 1 received Pot 11 of each product in irradiated form and Pot 61 of the unirradiated form, Lab 2 received Pots 12 and 62, etc.). This completed the distribution of test materials to participants for Round 1; they were

asked to return their data to the SUERC by 31 August 2005 on the enclosed floppy disk as both raw data files and also inserted into the spreadsheet provided. Many participants also returned copies of data by email.

2.4 Homogeneity Testing

Homogeneity testing was performed at SUERC in July and August 2005 on the 10 reserved pots of unirradiated material and on ten pots of irradiated material for each product. These ten pots were the next ten from the random sequence after all participants had been sent their materials.

Homogeneity testing is designed to ensure that the bulk material is sufficiently homogeneous and that each participant will receive test materials that do not significantly differ from others being analysed. The results obtained from homogeneity testing can also provide assigned values for the calculation of z -scores. A recommended procedure for testing for sufficient homogeneity for proficiency test materials is described in the IUPAC Protocol^{20,21}.

Given the care that had been taken, initially to procure commercially homogenised pre-packed materials, and by double-random pot selection to ensure that each test material was equivalent for a given product, it was decided to prioritise the determination of pot-to-pot variations in PSL signals in the homogeneity testing stage rather than examine variations within pots for all products. It was also decided to base assigned values on the homogeneity results from the SUERC laboratory for a combination of reasons.

- a) The SUERC laboratory maintains a routine instrument that is closely calibrated relative to the original reference instrument used to evaluate each individual PSL system prior to delivery. Thus initial sensitivities for each participants instrument when new relative to this system can be obtained and compared with the results from the study and the new paprika reference standard.
- b) The decision to base homogeneity assessment and assigned values on a single instrument avoids introduction of system to system variations into determining the pot to pot variability of each product and thus provides a means of assessing the additional sources of variation that build up when participants results are compared with such assigned values.

At this exploratory stage it was thus decided to base assigned values on the arithmetic mean derived from 10 replicated measurements of single pots from each product in both irradiated and unirradiated condition.

Measurements performed on individual aliquots taken from the separate pots of each material can provide evidence of pot-to-pot variation and suitable assigned values for this stage of the study. An assessment of within-pot variation can also be made using additional measurements taken from other aliquots from each of the ten pots already analysed, for a reduced suite of 10 products. These were chosen following examination of the coefficients of variation of the original set to include all the test materials with higher than average coefficients of variation, plus 3 products chosen to balance the distribution of product type and sensitivity within the suite of 10. All 10 were measured in both irradiated and unirradiated form. The data from this additional series of measurements are included in this report for information. The products chosen were ground white pepper, ground mixed spice, tarragon, parsley, coriander, saw palmetto, guarana, ginger, garlic and Siberian ginseng.

Homogeneity testing was undertaken in two stages. PSL measurements were first carried out on the 49 unirradiated test materials, using one aliquot from each of the 10 pots, thus

measuring some 490 test materials plus paprika reference standards and blanks before the test materials were distributed. At a later date, in mid-August to synchronise the measurements with participants data, the irradiated test materials were measured again with 10 replicates and initially one aliquot per pot. The decision to split the measurements in this way was made for a combination of quality and workload management reasons. The main aim being to ensure that the data sets were as representative as possible of the data that should have been achieved by participants using good test material handling practices. In keeping with standard procedures at SUERC, all test materials were dispensed under a laminar flow hood taking care to avoid transfer of material to the external surfaces of the Petri-dishes. Test material products were handled one at a time, changing disposable gloves, bench coverings and cleaning the working area between each. Both dispensing and test material measurements were conducted in safe light areas.

Instrumental readings from the test materials were interposed between measurements from irradiated and unirradiated paprika reference standards. Frequent empty chamber blank measurements were made to verify positively that the system was free from contaminating material.

Ten aliquots of the new irradiated paprika reference standard were also measured to facilitate instrument comparisons with similar measurements carried out by the participants.

3. RESULTS

3.1 Homogeneity Testing

Table 3 summarises the paprika reference standard data as measured at time of the homogeneity testing.

The additional measurements taken from paprika reference standards in between each test material type (thus amounting to another 50 sets of paprika reference data for each of the two stages of the homogeneity test) have been examined to verify the form of the underlying distribution of PSL data. Raw PSL intensities showed significant skew, as expected, which is to first approximation corrected by \log_{10} transformation. It is interesting to note that the use of power transformations appears to produce the best fit to normality for this data set, but in the absence of an underlying physical model this observation has not so far been taken further in the study.

The PSL terminal counts from the 10-fold replicates of unirradiated and irradiated test materials measured are fully tabulated in Appendix B, as are data from the additional measurements undertaken from selected products as indicated in Section 2. The data were also used to estimate arithmetic mean (i.e. the assigned value), standard deviations and coefficients of variation of the raw data. These are shown in Table 4 which illustrates the good degree of separation between unirradiated and irradiated and also the very high range of signal intensities induced in irradiated test materials from different products. Irradiated test materials range in sensitivity from those producing perhaps 10^3 photon counts in 60 sec to others giving 10^7 - 10^8 counts at the upper limit of the instrument response. Indeed the four most sensitive test materials produced light sums that overflowed the 24 bit photon counters in the instrument several times. By examining the individual PSL data files for these measurements it was possible to correct the counting data for the number of overflows registered, and this was done for assigned values.

Figure 1 shows the PSL data for each test material as a log-scatter plot giving a clear indication of the range of values obtained and the degree of separation between irradiated and unirradiated test materials. 10 Test materials show intermediate band PSL results from the unirradiated products. These were: barbecue seasoning SP8514; paprika SP8516; ground mixed spice SP8525, ginger SP8531; chilli powder SP8535; garlic SP8536; paprika SP8548; guarana seed powder SP8575; Siberian ginseng root powder SP8577; and garlic powder SP8580. The data are also shown as a histogram in Figure 2. In keeping with the original exploratory PSL sensitivity distributions from herbs spice and seasonings²⁶, and the later international validation trial²⁷ signals from irradiated test materials span 5 orders of magnitude (ranging from approximately 10^3 counts in 60 sec to over 10^8 counts). Those from unirradiated test materials range from the lowest recorded signals possible (which include the instrumental pre-loaded starting count of 256 events) to approximately 10^3 - 10^4 counts. Figure 3 simulates calibrated PSL using the pairs of unirradiated and irradiated test materials from the paprika reference data set. All test materials appear to occupy the domain of unirradiated test materials in this plot; those that gave intermediate results in the unirradiated portion being apparently associated with high PSL sensitivities. A short suite of TL analyses from duplicate pots of each product has been undertaken, and will be considered further in the second Round of the study. These TL results appear to confirm the finding of the calibrated PSL plot, in that none of the test materials appear to have been irradiated prior to incorporation in the trial. The presence of small low temperature peaks in a few test materials will need to be assessed further in the second Round prior to reviewing the question as to whether any of the test materials contain traces of irradiated material.

Given the very large sensitivity range demonstrated by the data, which is entirely consistent with published PSL data sets and earlier inter-laboratory trial data sets¹⁵, it was decided to use \log_{10} transformed data to calculate assigned values. The underlying distribution of PSL measurements from a single product is expected to conform to \log_{10} normal distributions on the basis of expected sub-sampling variations in proportions of mineral grains exposed in surface layers for measurement. It is however recognised that individual test materials have different sensitivity levels, both within the study and in general. Thus the use of \log_{10} transformation does not imply that all test materials conform for predictive purposes to a single \log_{10} normal distribution. Further distribution analysis would be merited with these data.

The assigned values and proficiency testing standard deviations given in Table 5 are based on \log_{10} transformed data for both unirradiated and irradiated homogeneity data.

3.2 Robust Statistics and the Paprika Reference Data Set

Where proficiency testing encounters significant numbers of outlying values it has been suggested^{28,29,30,21} that robust parameter estimates provide a practical means of

²⁶Sanderson D.C.W. Carmichael L.A. Spencer J. Q. Naylor J.D., 1996, Recent advances in Thermoluminescence and Photostimulated Luminescence Detection Methods for Irradiated Foods, in Detection Methods for Irradiated Foods: Current Status, ed McMurray, C. Stewart, E. Gray R. Pearce J. ISBN 0 85404 770 , Royal Society of Chemistry, Cambridge.

²⁷Sanderson D.C.W. Carmichael L.A. & Fisk S., 2003, Photostimulated Luminescence Detection of Irradiated Herbs, Spices, and seasonings: International Interlaboratory Trial, Journal of AOAC International Vol. 86, No. 5, 2003

²⁸Analytical Methods Committee, 1989, Analyst, 114, 1693-1697. Robust Statistics – How not to reject outliers Part 1. Basic Concepts.

²⁹Analytical Methods Committee, AMC Technical Brief, 2002, No 11, Royal Society of Chemistry. Understanding and acting on scores obtained in proficiency testing schemes.

³⁰Analytical Methods Committee, AMC Technical Brief, 2004, No 18, Royal Society of Chemistry. GMO Proficiency testing: Interpreting z-scores derived from log-transformed data.

accommodating such values without allowing them to bias statistical estimates. The majority of the SUERC homogeneity data observations appear to be quite well reproduced within their sets of replicates. Moreover \log_{10} variance estimates are similar from test material to test material suggesting that these data sets are not particularly affected by outliers. Nonetheless it was thought useful to assess the possible impact of robust statistics. The EXCEL add-ons from the Analytical Methods Committee pages of the Royal Society of Chemistry Web site³¹ were used to estimate the A15 and H15 robust means of \log_{10} transformed data, and also the H15 robust variance estimate. The results of these calculations are tabulated below in Table 6. It can be seen from this table and Figures 4 and 5 that the robust means estimates from either method are essentially equivalent to the arithmetic means. The slight differences between variance estimates shown in Figure 5 are potentially indicative of the few outlying observations associated with test materials with slightly greater heterogeneity than most reflecting the greater sensitivity of variance estimates to such observations. On the basis of these comparisons it was decided to retain the assigned values and standard deviations from Table 5 for calculating z -scores.

3.3 Participants Results

28 Participants submitted results before the closing date and three late results were received by the end of September 2005. Participants were asked to return their classification data, PSL terminals counts, summary and raw data files. One participant returned only qualitative results as they work in standalone mode.

Participants also returned data from the irradiated paprika reference standard. The means, standard deviations and standard errors are tabulated in Table 7 and can be used for an initial assessment of the relative sensitivity of each instrument to this material. Mean values are constrained within an approximate value of 2 from participant to participant and variance estimates range from less than 5-10% up to 25% depending on the data set.

Raw test material data, comprising the PSL intensities and classification bands for each test material and participant are tabulated in Appendix C together with mean values, standard deviation and standard error for all test materials. These have been represented graphically in Figures 6 and 7 which show broadly similar patterns of behaviour to the SUERC reference data. There is some evidence of greater scatter compared with SUERC reference data, which is perhaps to be expected when inter-laboratory variables are introduced. Participants data are also presented as scatter diagrams for irradiated and unirradiated test materials respectively in Figures 8 and 9, arranged by participant.

Within the irradiated data sets the brightest test materials, which showed overflows in reference analyses, were not corrected for participants data although several participants noticed this and identified those measurements with counter overflows. It can also be seen that significant numbers of unirradiated observations fall into higher bands in the participants data sets than the SUERC reference data set. This is suggestive of some instances of contamination of unirradiated test materials, presumably from the highly sensitive irradiated materials analysed within the same series. Clearly in this respect the trial conditions will have been more challenging than routine analyses where high sensitivity irradiated may be less common but this aspect appears to require further attention.

3.4 Summary Statistics

Typical proficiency schemes calculate z -scores to assess the performance of the participants relative to an assigned value, as a means of scoring quantitative performance for analytical

³¹ <http://www.rsc.org/Membership/Networking/InterestGroups/Analytical/AMC/Software/RobustStatistics.asp>

chemistry. Within this study, as described above, it was decided to investigate the use of z -scores in combination with qualitative performance as potential performance indicators. The decision to use Single-Laboratory reference values as assigned values was discussed earlier.

Participants' z -scores were calculated as:

$$z = (\log x - \log x_a) / \sigma_p$$

where,

x is the reported value in the test material.

x_a the assigned value (from Table 5).

σ_p is the standard deviation for proficiency assessment, based in this case also on Table 5.

Tables 8 to 13 show each participants z -score for the unirradiated and irradiated test materials using the assigned value calculated from the logarithmic SUERC reference data set.

Interpretation of z -scores is in general based on the properties of the normal distribution, although consideration of the underlying distributions of the physical systems is of course in all cases appropriate. If \log_{10} normal single distributions are encountered and all data sets were equivalent it would be expected that 95% of observation would lead to z -scores within between -2 and $+2$. Significant positive values in the Tables imply data sets that are biased towards higher values than the paprika reference data; conversely negative values imply a systematic underestimation.

The Tables allow each participant to assess their outcomes on a test material by test material basis. Figures 6 and 7 show the z -scores by test material for all participants combined for irradiated and unirradiated test materials, respectively. The irradiated test materials with uncorrected overflows can be clearly seen in Figure 6 as negative outlying values. A small number of observations also appear as positive outliers, but the majority of irradiated test materials fall within a centre band which has a slight negative bias relative to the SUERC reference data. The possibility that this trend arises from difference in measurement date, or the practice in some laboratories of working under normal lighting conditions (thus perhaps partially bleaching test materials) remains to be assessed, but it can be seen that the z -scores are carrying useful information in these respects. Moreover the dispersion within the central data band is encouragingly small. The unirradiated test materials show a more closely zero centred majority data set with a set of positive outliers that are probably the result of some participants suffering from cross contamination, as suggested above. Examination of the z -score Tables confirms that such positive values for unirradiated test materials appear to be more prominent in some participant data sets than others, consistent with this interpretation.

It is revealing to examine the z -scores graphically. Figure 10 and 11 shows participants z -scores for irradiated test materials arranged firstly by test materials, and then by participant. In Figure 10 the test materials which have the highest PSL sensitivities and suffered uncorrected counting overflows in participants data can all be seen to stand out with negative z -scores, which scatter well beyond the limits of random or laboratory to laboratory variations. Test materials 3, 4, 14 and 17 are underestimated by all participants and can readily be identified as the test materials that showed overflows. By contrast, test materials 18, 23, 34, 43, 45, 46, and 48, for example, include some data sets that in certain participants also generate negative z -scores. In Figure 11 it can be seen that participants 2, 8, 13, 19, 20, 22, 24, 25, 28 and 31 have examples of extreme negative values within their returned data. It is noted that following the participants' meeting and draft report, that participant 13 investigated the irradiated test material that had generated their most negative z -score. Re-dispensing two more aliquots from the retained test material in question generated PSL data that sat very closely to the rest of the

participants results, and the assigned value for this test material. On this basis it was concluded that there must have been a dispensing error during the measurements of that particular test material in participant 13. The extent to which such events may have occurred in other participants is unknown, although it may be inferred from the data sets that they are extremely infrequent. Using duplicated aliquots, which is standard practice in most laboratories, would be expected to detect and overcome such situations.

The z -score plots for the unirradiated test materials are shown in Figures 12 and 13, arranged by test materials and by participant respectively. From Figure 12 it is apparent that test materials 1, 2, 3, 14, 17, 18, 20, 23, 26, 27, 32, 34 and 46 are amongst those most susceptible to cross contamination by their neighbouring irradiated test material. This is presumed to relate to the proximity in the readout sequence to the highest sensitivity test materials. Figure 13 however also shows that some participants have experienced greater difficulties with segregation of irradiated and unirradiated materials. Participants 1, 8, 18 and 29 in particular, showed the greatest evidence of such problems with apparent transfers of up to percent levels of the irradiated test material into unirradiated specimens. By contrast the participants with the best test material handling performance, based on these data, appear to be numbers 3, 13, 20 and 32. These participants have been able to match the segregation performance of the reference data set, which is clearly able to maintain less than one part in 10^5 cross-talk levels. Other participants' data sit between these limits.

Figures 14 and 15 present participants z -scores in the form of colour contour plots. This forms of presentation permits identification of the interaction between test materials and participants with outlying results. In Figure 14 the irradiated test materials that tended to be underestimated by all participants can be identified (test materials 3, 14, 17 and 23), as can some participants whose data tended to be lower than the rest (participants 15 and 27 and to a lesser extent 4). The extent to which this is a reflection of instrumental sensitivity or is suggestive of test material handling remains to be examined. Figure 15 confirms the observations concerning test material handling of unirradiated materials in the participants identified above and also identifies those test materials which presented the greatest challenge.

3.5 Qualitative Results

Participants results were classified into the 3 conventional screening bands (negative, intermediate and positive) using the two arbitrary threshold values (set at 700 and 5000 counts in keeping with BS EN 13751:2002) established for general use during development of the method and in the validation studies. These threshold values do not take account of individual test material sensitivities, and may be of limited applicability to some matrices for which research or validation data are missing. They do not at present take account of individual instrument sensitivities and one potential opportunity furnished by this study would be to assess the benefits of standardising data sets prior to classification to results from the paprika reference standard or test material mean values prior to classification. At this stage however the qualitative outcomes are presented in descriptive form based on the data as received. Table 14 shows these data tabulated by participant. Table 15 shows them by test material. For an initial assessment of the qualitative data it is useful to make comparisons with the reference set. Table 16 summarises the qualitative classifications for the reference set. In Tables 14 to 16 the sums of all three band results are tabulated as well as individual results.

The SUERC reference data set for unirradiated test materials shows 411 (83.88%) negative outcomes, and 78 (15.92%) intermediate outcomes with only one positive value (0.2%). Thus 99.8% of the SUERC reference data set for unirradiated test materials fall within negative or intermediate bands. The corresponding figures for irradiated test materials show 448 (91.43%)

of test materials in the positive band and the remaining 42 (8.57%) in intermediate bands. Thus 100% of irradiated test materials would appear in positive or intermediate bands and be selected correctly under BS EN 13751:2002 criteria for further investigation.

Participants data show slightly higher proportions of unirradiated test materials in the intermediate band (24.36% compared with 72.88% in the negative band) and even show 2.76% of observations in the positive band. Examination of Tables 14 and 15 shows that some test materials are more susceptible than others to this and also some participants show more of these higher level signals than others. This may, as suspected, be a consequence of laboratory contamination with those observations that follow high sensitivity positive test materials being more susceptible but further data analysis is needed to confirm this interpretation. If correct it is moreover hoped that improved test material handling in Round 2 will help to alleviate this trend. For irradiated test materials the participants outcomes are very much closer to the SUERC reference set with only 5 observations (0.33%) in the negative band, and split between positive and intermediate bands (90.06% vs 9.61%) being in very similar proportions. Table 17 summarises the qualitative outcomes grouped into double and single bands. The correspondence between participants and reference performance, as noted above suggests that the slight quantitative underestimation implied by *z*-scores makes little difference in practice to qualitative outcomes at least for these test materials. The unirradiated test materials do show a small proportion of false positive band results in participant data sets that are attributed at this stage to test material handling problems in certain laboratories and test materials. Nonetheless even these test materials show 97.2% of test materials classified into negative or intermediate bands. The main detrimental effect of elevated readings in unirradiated would be to select a greater proportion for other investigations than necessary which clearly represents a cost but does not necessarily lead to errors.

4. DISCUSSION AND CONCLUSIONS

As shown in the previous sections the first Round of the trial was successfully implemented, with test material procurement, preparation, recruitment of participants, test material distribution homogeneity testing and the first measurement Round taking place within a few months. The reference data sets obtained in the organising laboratory resemble earlier published data from the original PSL research and inter-laboratory trial data sets. Quantitative results from 30 participating laboratories were returned in a timely manner and generally show equivalence to the SUERC reference data. The difficulties that some participants have experienced with cross contamination have been noted, and should be avoidable in future Rounds. Unsurprisingly those participants that have experienced these difficulties tended to have greater proportions of unirradiated test materials in higher qualitative classification categories than the reference data set or those data sets from participants that did not suffer this problem. The evidence of underestimation for particularly bright test materials can be attributed to uncorrected overflows in many cases although the influence of laboratory lighting on signal levels has yet to be established. The data sets have been explored using descriptive statistics and in tabular and graphical forms. Unsurprisingly there is evidence of additional inter-laboratory variation in comparison with the reference set even when outliers have been taken into account. There is scope for further examination of this, and also for a consideration of the relationship between qualitative and quantitative assessment criteria. As shown in Section 3.5 the qualitative performance is influenced to some extent by laboratory to laboratory and test material to test material differences, although it seems to be relatively robust in comparison with the apparent sensitivity of quantitative indicators to minor variations.

Table 18 summarises the response of each participant to the paprika reference standard, together with pooled z -scores and the qualitative outcomes, and provides a basis for starting to analyse the relationship between laboratory sensitivity, quantitative PT score and qualitative outcome.

It is apparent that at the time of the study the 30 instruments used exhibited relative sensitivities that differ by up to a factor of 3. While this seems at first sight to be a substantial range of relative sensitivities, it may be worth recalling that the dynamic range of PSL data cover at least 6 orders of magnitude. On a logarithmic scale the sensitivity variation factor corresponds to variation of 0.5 out of a log scale range of 6-8 orders of magnitude, or some 5-8% variation across the log space. At this stage it is not clear whether the sensitivity variations are partly the result of the condition of each instrument (for example some of the instruments are 5-10 years old, and may have variable stimulation powers or be in need of servicing), or whether they reflect the spectral response of each unit to the emitted light of the paprika reference standard. It is therefore useful to examine the extent to which the paprika results can be related to both quantitative and qualitative outcomes from the 49 test materials. Figure 16 shows the relationship between the pooled z -score from irradiated test materials in the study and the paprika reference relative sensitivity. There is evidence of a positive correlation with more than 50% of the variation in the pooled z -score apparently explained by the paprika data. Figure 17 examines the qualitative classification percentages of irradiated test materials into positive and intermediate bands, also as a function of pooled z -score. Figure 18 performs the same analysis for unirradiated test materials. These Figures confirm that there are strong relationships between the quantitative z -scores and the qualitative performance of each data set. It follows therefore that a greater degree of qualitative agreement can be expected if participants are able to converge to a greater extent on their quantitative performance. For the irradiated category it further appears that a significant proportion of inter-laboratory variations may be accounted for by the response to the paprika standard, although at this stage it is not clear whether part of this variation can be mitigated by improvements to the maintenance condition of the individual instrument. The use of standardised photon counts relative to the paprika reference results may represent a way of improving qualitative concordance, although it should be noted that this would represent an extension of current methodology beyond that suggested in BS EN 13751:2002.

While there may be ways of utilising the paprika reference standard, or potentially another material developed to simulate the full PSL sensitivity but in a matrix of greater homogeneity than a natural spice, the differences in qualitative outcomes for the unirradiated test materials are another matter. In this Round it can be shown that the major reason for inter-laboratory variations relates to cross contamination in the test material handling stages, particularly for certain participants. This affects both the z -scores and the qualitative outcomes. Again there may be potential for utilising this relationship to advantage in design of routine proficiency testing studies, which will be examined at later stages of this project. At this stage it is encouraging that both indicators appear to be consistent with each other.

The first trial Round was followed by a participants meeting in mid-November 2005, which was attended by some 18 people. Their comments, and those of the participants who were unable to attend, have been noted. In the second trial Round, which is scheduled for 2006, it is intended to use duplicate analysis from a slightly reduced set of test materials, so that participants can use their normal procedures for PSL analysis of unknown test materials. There will also be opportunities for exploration of calibrated PSL and for incorporation of TL laboratories. It is to be hoped that the 2nd Round will be equally productive and that PSL participants will be able to demonstrate the benefits of their participation by improving further as a group, as the study progresses.

Table 1: Round 1 Test Material List

Test Material No.	Product Description	Abbreviation	SUERC Ref No	Suppliers Code
1	Italian Seasoning	Ital	SP8511	Not supplied
2	Basil	Basil	SP8512	Not supplied
3	Curry Powder No 3	CP3	SP8513	Not supplied
4	Barbeque Seasoning	BBQ	SP8514	Not supplied
5	Ground Cinnamon	Cinn	SP8515	Not supplied
6	Paprika	Pap	SP8516	Not supplied
7	Ground Cumin	Cum	SP8517	Not supplied
8	Oregano	Oreg	SP8518	Not supplied
9	Ground Black Pepper	GBP	SP8519	Not supplied
10	Chives	Chives	SP8520	Not supplied
11	Mint	Mint	SP8521	Not supplied
12	Ground White Pepper	GWP	SP8522	Not supplied
13	Sage	Sage	SP8523	Not supplied
14	Thai Seasoning	Thai	SP8524	Not supplied
15	Ground Mixed Spice	GMS	SP8525	Not supplied
16	Ground Coriander	Cori	SP8526	Not supplied
17	Steak Seasoning	Steak	SP8527	Not supplied
18	Medium Curry Powder	MCP	SP8528	Not supplied
19	Ground Nutmeg	Nut	SP8529	Not supplied
20	Whole Black Pepper	WBP	SP8530	Not supplied
21	Ground Ginger	Ginger	SP8531	Not supplied
22	Thyme	Thyme	SP8532	Not supplied
23	Rosemary	Rose	SP8533	Not supplied
24	Turmeric	Turm	SP8534	Not supplied
25	Chilli Powder	Chilli	SP8535	Not supplied
26	Garlic Powder (Chinese)	Gar	SP8536	Not supplied
27	Rubbed Mixed Herbs	RMH	SP8537	Not supplied
28	Parsley	Pars	SP8538	Not supplied
29	Tarragon	Tar	SP8539	Not supplied
30	Basil	Basil	SP8540	L4344E 12.2007
31	Mint	Mint	SP8541	L5019A 01.2008
32	Parsley	Pars	SP8542	L5068A 09.2006
33	Tarragon	Tar	SP8543	L5004A 01.2007
34	Thyme	Thyme	SP8544	L5005A 01.2008
35	Ground Cinnamon	Cinn	SP8545	L5035A 02.2008
36	Ground Coriander	Cori	SP8546	L4351B 12.2007
37	Ground Cumin	Cum	SP8547	L43130 11.2007
38	Paprika	Pap	SP8548	L4336H 11.2006
39	Turmeric	Tur	SP8549	L4352A 12.2007
40	Milk Thistle Seed Powder	MTSP	SP8571	P13225 Batch 041104
41	Alfalfa Herb Fine Powder	AHFP	SP8572	P01102 Batch 4978
42	Saw Palmetto Berry Fine Powder	SPBFP	SP8573	P1906 Batch 031103
43	Dong Quai Root Powder	DQRP	SP8574	P04083 Batch 031209
44	Guarana Seed Powder	GSP	SP8575	P07385 Batch 7781
45	Powdered Gingko biloba Leaves	GBL	SP8576	P0711 Batch 1518
46	Siberian Ginseng Root Powder	SGRP	SP8577	P0714 Batch 040206
47	Green Tea Powder	GTP	SP8578	P07358 Batch 040419
48	Echinacea Powder	EP	SP8579	P05005 Batch 101673
49	Garlic Powder	GARP	SP8580	P07065 Batch 04527

Table 2: List of Participants, Institutions and Instrument Serial Numbers

Name	Address	PSL
Dr Angelo Alberti	Consiglio Nazionale delle Ricerche Istituto per la Sintesi Organica e la Fotoreattività (ISOF-CNR), Bologna, Italy	69
Dr Stephan Barth	Federal Research Centre of Nutrition & Food (BfEL), Karlsruhe, Germany	22
Simone Baudino	Chemical Control S.R.L, Cuneo, Italy	58
Neil Baumann	McCormicks (UK) Ltd, UK	6
Dr Rainer Brockmann	Chemisches und Veterinaruntersuchungsamt Ostwestfalen-Lippe CVUA OWL, Bielefeld, Germany	27
Peter Brown	Lincolne Sutton & Wood Ltd, UK	4
Songhop Buranasilp	Thai President Foods Public Company Limited, Thailand	54
Joanne Chan Sheot Harn	Centre for Analytical Science, Health Sciences Authority, Singapore	66
Rupa Das	BI Nutraceuticals, USA	42
Frank Dittmar	Landesbetrieb Hessisches Landeslabor, Kassel, Germany	13
Dr Alberto Gatti	NEOTRON S.p.A, Italy	39
Dr Claudius Gemperle	Kantonales Labor, Aarau, Switzerland	34
Jo Jung Heon	Nong Shim Co.Ltd, Korea	49
Christina Kay	Manhattan Drug Company Inc, USA	70
Reena Kiriyanthan	NBTY Inc., USA	31
Dr Caroline Lardner	Public Analyst Laboratory (Galway), Eire	15
Stuart MacFarlane	East Anglian Food Ingredients Ltd, UK	9
Keith McKay	Glasgow Scientific Services, UK	38
Esko Niemi	Finnish Customs Laboratory, Finland	63
Dr Sandro Onori	Istituto Superiore di Sanita, Rome, Italy	56
Dr Tang.S Peng	Pure World Botanicals Inc., USA	46
Dr Juergen Pfordt	LAVES - Lebensmittelinstitut Oldenburg	20
Dr Bert Popping	Eurofins Scientific Group, Hamburg, Germany	41
Mike Pugh	British Pepper and Spice Co, Ltd, UK	12
Dr Nicola Sardone	Indena SpA, Settala, Italy	30
In-Sang Song	TaeKyung NongSan Co Ltd, Korea	71
Irene Straub	Chemisches- und Veterinaruntersuchungsamt, Karlsruhe, Germany	7
Setsuko Todoriki	National Food Research Institute, Japan	67
Dr Claus Wiezorek	Chem. Landes Staatl. Vet. U. Amt., Münster, Germany	10
Kang Woo Suk	Nong Shim Company, Korea	57
Christiane Zoost	Berliner Betrieb für Zentrale Gesundheitliche Aufgaben, Institute für Lebensmittel, Arzneimittel und Tierseuchen, Berlin, Germany	11

Table 3: Results of 10 Replicate Measurements from the Paprika Reference Material, Measured by the SUERC.

Paprika Test Material	Terminal Counts
1	56966
2	81439
3	53897
4	57585
5	46516
6	64932
7	82231
8	49081
9	88290
10	46532
Mean	62747
Std Dev	15768
Std Error	4986

Table 4: Reference Values Based on Linear Statistics for Unirradiated and Irradiated Test Materials

Test Material	Unirradiated Test Materials			Irradiated Test Materials		
	Mean	Std Dev	CV (%)	Mean	Std Dev	CV (%)
1	292.3	47.5	16.25	223797.4	31548.56	14.10
2	301.0	52.7	17.52	34773.2	6497.72	18.69
3	228.3	42.4	18.56	22916707	2825351	12.33
4	1431.6	427.7	29.87	39475091	11047372	27.99
5	261.1	52.9	20.26	18961.8	6422.989	33.87
6	892.1	211.2	23.67	257410.1	35900.94	13.95
7	349.5	88.5	25.32	463145.1	71397.75	15.42
8	322.6	50.1	15.52	342180.4	57637.73	16.84
9	259.7	39.0	15.01	65960	20507.65	31.09
10	341.6	32.1	9.38	17306.1	7597.157	43.90
11	301.1	33.1	11.00	30127.7	5384.624	17.87
12	258.8	53.7	20.74	1428.5	1111.868	77.83
13	284.9	80.8	28.36	368957.5	83619.03	22.66
14	284.3	37.8	13.31	42105660	9034143	21.46
15	1403.8	1137.4	81.02	82877.4	63226.01	76.29
16	258	69.8	27.06	25652.1	4899.101	19.10
17	279	49.1	17.61	57895462	6365788	11.00
18	424.7	123.4	29.05	14040445	965406	6.88
19	356.4	152.9	42.90	134462.4	35320.47	26.27
20	217.1	45.1	20.76	2160.5	829.2967	38.38
21	891.5	790.1	88.63	319084.7	102843.7	32.23
22	309	52.0	16.84	109682	17287.6	15.76
23	285.4	43.3	15.16	68466.2	4943.811	7.22
24	286.9	47.8	16.67	12211.1	2953.813	24.19
25	642.3	207.1	32.25	132938.6	27094	20.38
26	2491.4	1204.0	48.33	1015050	156913.8	15.46
27	305.9	46.31	15.14	197854.9	49252.18	24.89
28	361.6	54.8	15.16	3762.6	1251.485	33.26
29	392.8	56.9	14.49	45325.2	68200.75	150.47
30	276.3	30.2	10.91	24571	3724.845	15.16
31	258	34.6	13.41	36966.6	6270.191	16.96
32	299.3	32.6	10.88	80897.3	31805.14	39.32
33	377.1	59.5	15.79	7903.8	2180.116	27.58
34	443.6	57.3	12.91	2108468	143662.3	6.81
35	250.6	33.7	13.47	9105	2343.811	25.74
36	241.1	38.5	15.99	8282.6	6205.738	74.92
37	238.7	98.5	41.25	21485.4	3161.51	14.71
38	864.3	302.6	35.01	102864.3	14448.01	14.05
39	274.3	33.2	12.10	64436	15054.44	23.36
40	432.1	97.1	22.46	171770.4	46572.03	27.11
41	383.1	55.2	14.42	40385.5	8849.406	21.91
42	287.3	59.2	20.62	5830.3	6073.023	104.16
43	1359.7	299.2	22.00	1492905	175380.5	11.75
44	249.8	55.0	22.03	6402.6	5800.614	90.60
45	525.5	114.6	21.81	270408.6	27044.38	10.00
46	3323.4	831.2	25.01	917868.6	88866.16	9.68
47	444.4	43.05	9.69	103468	28037.17	27.10
48	342.5	52.2	15.24	132615	17168.54	12.95
49	1644.8	669.9	40.73	1347214	163559.6	12.14

Table 5: Reference Values Based on Log₁₀ Statistics for Unirradiated and Irradiated Test Materials

Test Material	Unirradiated Test Materials		Irradiated Test Materials	
	Log ₁₀ Mean	Standard Deviation	Log ₁₀ Mean	Standard Deviation
1	2.4609	0.068205	5.346154	0.059157
2	2.472423	0.077485	4.534607	0.079514
3	2.35132	0.084789	7.357321	0.051723
4	3.136449	0.141062	7.576755	0.147792
5	2.408506	0.090399	4.258986	0.129376
6	2.939199	0.105036	5.407047	0.057992
7	2.530385	0.113627	5.661081	0.066891
8	2.50342	0.073334	5.52862	0.074159
9	2.410359	0.061955	4.801923	0.126934
10	2.531842	0.039961	4.20277	0.183424
11	2.476162	0.050599	4.473201	0.073269
12	2.403092	0.101929	3.084458	0.229096
13	2.442492	0.102191	5.557579	0.094091
14	2.449869	0.063367	7.61542	0.092845
15	3.053562	0.284323	4.821666	0.293884
16	2.397408	0.117235	4.402189	0.081388
17	2.43972	0.074833	7.760231	0.048546
18	2.612378	0.122334	7.146437	0.030363
19	2.521464	0.16432	5.115665	0.111017
20	2.328049	0.091769	3.306588	0.162989
21	2.867256	0.242839	5.484461	0.136701
22	2.484737	0.069917	5.035135	0.070057
23	2.450869	0.066997	4.834491	0.030588
24	2.452031	0.075116	4.075948	0.100917
25	2.790042	0.126347	5.116189	0.083107
26	3.346524	0.234587	6.001921	0.066142
27	2.480966	0.067237	5.285306	0.100981
28	2.553843	0.064714	3.555829	0.134795
29	2.59001	0.063801	4.465617	0.337832
30	2.438901	0.049756	4.385918	0.066093
31	2.407794	0.062234	4.562361	0.072002
32	2.473784	0.047436	4.88678	0.130988
33	2.571524	0.0693	3.885266	0.106337
34	2.643826	0.054931	6.323078	0.029145
35	2.395346	0.059704	3.946711	0.109733
36	2.377416	0.067215	3.851701	0.225861
37	2.331764	0.233278	4.328008	0.062881
38	2.911485	0.158204	5.008348	0.061806
39	2.435332	0.05302	4.7988	0.099037
40	2.625304	0.10091	5.222201	0.107889
41	2.579438	0.06043	4.597132	0.093014
42	2.449535	0.093704	3.621094	0.340702
43	3.12364	0.09824	6.171375	0.050468
44	2.387275	0.102265	3.716104	0.26066
45	2.71298	0.081607	5.430215	0.040959
46	3.51013	0.103697	5.960941	0.042183
47	2.645889	0.042967	5.001818	0.109572
48	2.529708	0.07082	5.119251	0.057114
49	3.188779	0.158325	6.126624	0.05178

Table 6: Robust Values for Reference Data Sets

Test Material	Irradiated Test Material Reference Data Set					Unirradiated Test Material Reference Data Set				
	Mean	Std Dev	A15 Mean	H15 Mean	H15 Std Dev	Mean	Std Dev	A15 Mean	H15 Mean	H15 Std Dev
1	5.346	0.059	5.343	5.343	0.052	2.461	0.068	2.458	2.459	0.074
2	4.535	0.080	4.535	4.534	0.089	2.472	0.077	2.472	2.472	0.088
3	7.357	0.052	7.354	7.354	0.045	2.351	0.085	2.356	2.355	0.088
4	7.577	0.148	7.598	7.600	0.106	3.136	0.141	3.149	3.141	0.150
5	4.259	0.129	4.234	4.243	0.113	2.409	0.090	2.409	2.409	0.102
6	5.407	0.058	5.402	5.402	0.050	2.939	0.105	2.941	2.941	0.109
7	5.661	0.067	5.661	5.661	0.076	2.530	0.114	2.530	2.530	0.129
8	5.529	0.074	5.528	5.531	0.078	2.503	0.073	2.512	2.513	0.052
9	4.802	0.127	4.802	4.800	0.139	2.410	0.062	2.402	2.407	0.062
10	4.203	0.183	4.202	4.198	0.198	2.532	0.040	2.530	2.532	0.045
11	4.473	0.073	4.464	4.468	0.068	2.476	0.051	2.480	2.482	0.042
12	3.084	0.229	2.990	3.047	0.158	2.403	0.102	2.415	2.415	0.085
13	5.558	0.094	5.552	5.552	0.089	2.442	0.102	2.424	2.425	0.062
14	7.615	0.093	7.611	7.615	0.103	2.450	0.063	2.459	2.459	0.049
15	4.822	0.294	4.788	4.813	0.314	3.054	0.284	3.029	3.033	0.267
16	4.402	0.081	4.400	4.400	0.086	2.397	0.117	2.397	2.397	0.132
17	7.760	0.049	7.762	7.761	0.053	2.440	0.075	2.440	2.439	0.084
18	7.146	0.030	7.148	7.148	0.022	2.612	0.122	2.609	2.609	0.119
19	5.116	0.111	5.113	5.113	0.115	2.521	0.164	2.477	2.511	0.165
20	3.307	0.163	3.300	3.307	0.185	2.328	0.092	2.328	2.328	0.104
21	5.484	0.137	5.481	5.483	0.131	2.867	0.243	2.814	2.821	0.143
22	5.035	0.070	5.036	5.035	0.079	2.485	0.070	2.468	2.485	0.079
23	4.834	0.031	4.832	4.832	0.025	2.451	0.067	2.455	2.450	0.072
24	4.076	0.101	4.069	4.074	0.109	2.452	0.075	2.453	2.453	0.083
25	5.116	0.083	5.108	5.113	0.087	2.790	0.126	2.770	2.781	0.125
26	6.002	0.066	5.999	5.999	0.069	3.347	0.235	3.367	3.367	0.143
27	5.285	0.101	5.270	5.283	0.109	2.481	0.067	2.481	2.481	0.076
28	3.556	0.135	3.543	3.554	0.149	2.554	0.065	2.553	2.552	0.070
29	4.466	0.338	4.374	4.391	0.131	2.590	0.064	2.591	2.592	0.047
30	4.386	0.066	4.381	4.389	0.069	2.439	0.050	2.444	2.444	0.043
31	4.562	0.072	4.561	4.561	0.079	2.408	0.062	2.415	2.416	0.046
32	4.887	0.131	4.860	4.862	0.077	2.474	0.047	2.475	2.473	0.052
33	3.885	0.106	3.884	3.873	0.083	2.572	0.069	2.572	2.573	0.075
34	6.323	0.029	6.321	6.321	0.027	2.644	0.055	2.642	2.642	0.059
35	3.947	0.110	3.943	3.944	0.119	2.395	0.060	2.398	2.398	0.059
36	3.852	0.226	3.817	3.816	0.160	2.377	0.067	2.377	2.377	0.076
37	4.328	0.063	4.325	4.327	0.066	2.332	0.233	2.360	2.362	0.187
38	5.008	0.062	5.009	5.010	0.062	2.911	0.158	2.911	2.911	0.179
39	4.799	0.099	4.797	4.799	0.112	2.435	0.053	2.435	2.436	0.059
40	5.222	0.108	5.216	5.215	0.106	2.625	0.101	2.625	2.628	0.108
41	4.597	0.093	4.597	4.597	0.105	2.579	0.060	2.573	2.579	0.067
42	3.621	0.341	3.527	3.593	0.320	2.450	0.094	2.453	2.454	0.095
43	6.171	0.050	6.171	6.171	0.056	3.124	0.098	3.124	3.124	0.111
44	3.716	0.261	3.685	3.685	0.129	2.387	0.102	2.397	2.394	0.100
45	5.430	0.041	5.425	5.424	0.031	2.713	0.082	2.697	2.701	0.038
46	5.961	0.042	5.961	5.961	0.048	3.510	0.104	3.506	3.507	0.110
47	5.002	0.110	4.977	4.998	0.110	2.646	0.043	2.648	2.648	0.041
48	5.119	0.057	5.119	5.121	0.062	2.530	0.071	2.537	2.537	0.061
49	6.127	0.052	6.120	6.127	0.059	3.189	0.158	3.182	3.182	0.110

Table 7: Participants Mean Data from the Study Irradiated Paprika Reference Standard

Lab	Irradiated Paprika Standard		
	Mean	Std Dev	Std Error
1	49428	27901	8823
2	43634	11849	3748
3	59671	18734	5924
4	38751	8138	2573
5	76244	22731	7188
6	74243	38032	12027
8	80248	38781	12264
9	44081	8018	2536
10	67160	25450	8048
11	73264	1054	8561
13	63768	17704	5599
14	66338	26670	8434
15	35034	7328	2317
16	63630	16818	5318
17	70375	20254	6405
18	67992	26210	8288
19	60682	4681	4681
20	43988	9771	3090
21	40542	11262	3561
22	36954	12028	3804
23	90857	31692	10022
24	51040	13725	4340
25	49957	8760	2770
26	64840	20736	6557
27	33527	8652	2736
28	78373	48917	15469
29	52276	13013	4115
30	47100	13979	4421
31	45372	29013	9175
32	38970	17080	5401

Table 8: Unirradiated Test Materials: z-Scores for Participants 1-11

Test Material	Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Lab 8	Lab 9	Lab 10	Lab 11
1	2.30	0.90	1.57	5.36	2.76	3.18	31.13	2.62	2.21	1.71
2	0.00	1.25	-0.66	3.52	0.53	0.65	22.65	2.04	0.42	0.12
3	20.23	6.49	1.35	2.84	8.52	6.58	12.90	4.56	1.50	14.62
4	0.02	-0.10	-0.81	-2.69	0.29	0.42	2.13	-2.44	0.58	2.30
5	5.27	3.60	-0.56	2.56	2.58	5.20	12.29	8.07	0.82	6.84
6	-1.09	0.03	-1.77	-0.58	3.05	1.17	7.17	1.83	1.77	3.13
7	1.08	0.39	0.70	2.93	1.08	3.25	4.77	4.01	-0.38	3.96
8	0.88	0.87	0.59	4.05	2.38	3.80	3.13	1.39	2.15	7.57
9	1.44	3.86	-0.20	0.77	2.14	4.34	1.75	1.15	2.24	6.56
10	-0.14	2.82	-1.81	4.42	1.00	4.82	0.27	0.88	3.81	8.86
11	2.82	1.14	2.89	4.19	0.81	2.55	-2.88	0.97	4.26	8.87
12	0.10	1.42	1.18	3.75	2.52	2.06	2.12	2.88	2.53	4.49
13	2.02	0.92	1.29	1.78	0.38	2.46	1.79	2.23	1.78	4.25
14	25.00	9.13	2.00	4.63	1.08	2.35	27.88	-10.83	2.95	7.49
15	-0.66	-1.03	-1.02	-1.17	-0.48	-0.02	0.15	-2.23	-0.91	0.08
16	1.62	0.09	0.58	-5.28	5.54	6.73	1.58	2.82	1.01	1.62
17	8.23	2.44	3.78	7.18	2.45	1.90	19.15	-3.01	3.15	6.88
18	6.15	-0.22	0.63	-1.30	1.12	12.34	8.90	0.31	0.23	11.38
19	1.67	0.54	1.33	0.38	0.56	1.59	4.76	1.71	-0.63	5.07
20	4.42	0.87	0.35	1.79	-0.46	5.09	11.95	0.65	1.69	9.23
21	0.32	0.18	0.31	0.42	-0.80	-0.26	2.21	-2.01	-0.02	2.24
22	3.70	4.52	2.93	-0.38	3.86	5.66	0.83	-4.58	1.04	10.48
23	5.16	0.75	1.92	1.41	0.30	8.48	16.35	10.40	2.14	11.54
24	2.50	1.29	0.43	1.36	2.21	3.93	3.88	6.00	0.22	9.83
25	0.62	-0.73	2.14	2.00	2.48	0.26	1.99	1.75	-0.33	1.92
26	-0.57	-1.77	-0.14	-1.52	1.24	-0.20	2.41	-0.13	2.52	2.99
27	1.12	3.20	1.83	0.40	-0.19	0.98	3.16	0.54	0.58	5.22
28	1.65	0.71	-1.03	1.20	1.86	2.85	6.41	-0.11	-4.58	4.51
29	-0.45	0.99	1.51	1.58	1.32	2.10	1.80	0.00	0.79	4.14
30	0.07	1.49	0.62	2.88	4.87	4.11	9.94	-1.04	-3.64	7.33
31	1.63	2.54	1.86	-0.16	-0.13	3.14	-2.69	2.71	3.16	2.05
32	1.48	4.28	3.47	0.97	4.26	2.66	4.51	2.64	1.61	5.11
33	0.47	0.70	-2.84	1.05	2.64	3.51	3.18	1.99	0.61	2.94
34	19.85	0.34	3.62	3.60	2.47	3.85	4.78	3.20	-1.10	4.01
35	-0.89	3.07	2.39	3.80	4.01	4.43	1.58	4.07	1.93	7.01
36	0.99	0.83	1.50	2.66	3.06	3.84	2.89	1.57	3.15	4.26
37	1.31	1.31	-0.52	1.57	-1.50	1.00	1.27	-0.08	0.90	1.73
38	-0.88	-1.45	-0.75	2.95	5.58	-0.14	0.80	-0.68	-0.86	1.49
39	-0.80	2.42	1.49	2.44	-0.01	2.81	4.07	3.08	1.98	7.44
40	0.40	-0.27	-0.58	0.01	0.47	1.66	0.89	-1.33	0.12	3.67
41	2.93	-0.05	-0.24	0.86	1.30	0.16	2.36	2.12	-1.55	5.34
42	2.06	0.78	-1.40	0.12	1.01	0.25	2.13	2.75	0.49	-0.06
43	0.98	-0.63	1.06	0.17	5.13	4.17	3.51	1.42	-0.49	1.85
44	3.29	0.22	-2.04	-0.58	1.88	1.83	1.95	2.06	0.12	3.61
45	2.36	-0.38	1.05	-0.20	1.73	0.35	1.93	1.05	6.15	2.90
46	0.59	0.19	1.03	-0.35	1.69	1.19	2.72	-1.14	-1.27	0.30
47	2.24	-0.20	2.99	2.67	4.56	3.81	4.82	1.34	-3.79	4.12
48	2.08	3.07	-1.01	3.22	1.55	4.51	5.29	-2.27	-0.76	5.55
49	0.68	3.65	0.27	0.68	1.84	1.48	0.75	-3.73	-0.66	0.40

Table 9: Unirradiated Test Materials: z-Scores for Participants 13-23

Test Material	Lab 13	Lab 14	Lab 15	Lab 16	Lab 17	Lab 18	Lab 19	Lab 20	Lab 21	Lab 22	Lab 23
1	1.49	0.73	0.83	0.45	4.57	3.68	5.67	0.47	4.71	0.57	3.46
2	0.28	0.99	-0.61	-0.11	1.53	1.52	-0.11	0.65	0.51	0.59	0.24
3	1.53	3.41	2.20	3.02	14.33	11.25	2.87	2.39	3.58	9.78	15.85
4	0.33	-1.60	-4.42	-0.49	1.08	4.54	0.45	0.93	-0.65	-0.52	0.16
5	0.11	-2.06	1.44	-0.64	2.03	6.88	0.93	1.27	1.55	1.59	3.66
6	0.82	2.93	-4.02	-1.86	0.08	4.24	4.81	0.81	-1.38	2.69	3.55
7	1.12	3.79	-1.07	0.01	3.98	5.31	0.08	1.57	0.53	-1.27	2.50
8	-0.09	3.16	-0.56	-0.44	1.04	6.35	2.04	-2.82	1.77	0.42	2.24
9	-1.66	2.90	2.57	1.24	5.67	7.55	1.95	0.98	2.70	0.15	0.94
10	0.64	2.31	-2.16	-4.45	4.96	3.53	3.25	-1.85	0.70	-0.37	3.49
11	2.27	-1.11	0.68	0.86	0.94	4.19	-2.34	1.17	-0.57	0.33	1.22
12	1.46	1.25	-0.58	-0.05	1.65	-1.90	0.26	0.89	-0.28	1.16	2.68
13	1.28	1.40	0.83	1.07	1.61	0.03	1.26	-0.30	0.51	0.95	2.18
14	1.51	4.72	2.85	1.06	3.21	9.63	-5.25	0.57	1.76	-2.85	2.26
15	0.03	-1.34	-2.56	-1.35	3.14	0.35	-0.32	-0.48	-1.46	-1.27	0.58
16	0.97	0.95	-1.13	1.72	1.38	3.63	0.03	1.44	-0.47	0.52	2.17
17	3.43	-0.35	3.81	1.44	3.06	9.87	2.72	1.14	1.90	2.47	4.74
18	-0.05	1.67	-2.86	-1.12	1.66	2.41	3.11	-1.56	-0.68	11.16	2.25
19	0.61	0.23	0.31	1.69	2.77	7.60	1.20	0.33	0.49	2.33	2.72
20	3.01	3.49	1.56	3.59	3.03	18.96	0.76	-0.27	0.53	1.73	3.97
21	-0.60	-0.56	-1.02	0.89	0.04	2.76	0.25	-0.16	-0.61	-0.70	0.89
22	0.87	1.39	2.20	0.46	-0.52	19.60	0.54	0.94	1.19	4.95	2.72
23	-3.60	2.27	1.37	-0.46	2.27	13.28	-0.29	-0.46	0.58	0.56	3.66
24	1.06	0.47	-1.46	0.87	3.17	9.63	2.17	0.49	2.25	1.04	3.48
25	0.18	0.26	-1.39	1.72	-0.22	1.40	1.01	-0.51	-0.43	-1.35	3.13
26	0.37	-0.21	-1.07	0.22	0.33	1.75	0.00	-0.28	-0.73	1.94	2.15
27	-0.98	2.02	-3.01	-0.06	3.95	9.58	1.57	-0.88	-0.50	1.67	1.49
28	1.32	1.46	-7.11	-2.46	0.19	8.71	-0.51	1.28	1.07	-1.28	1.59
29	0.00	1.71	-7.26	-0.38	2.87	9.71	1.29	-0.18	0.76	-1.33	0.67
30	0.83	4.67	-0.18	1.36	3.71	14.11	-0.02	-0.48	-1.25	-0.35	-0.55
31	1.84	2.62	-1.02	1.21	3.83	8.73	0.33	1.48	3.46	0.40	2.15
32	4.06	3.24	-4.76	-1.42	7.21	13.03	3.06	0.80	-2.17	3.15	4.45
33	1.57	2.99	-2.12	-6.90	4.24	11.34	3.02	-0.73	2.36	-0.92	1.25
34	0.55	0.91	-2.62	0.60	1.19	8.13	0.70	0.58	1.07	1.71	2.46
35	3.33	3.62	-5.93	-0.79	2.49	8.58	2.86	1.12	-2.27	0.89	3.53
36	1.98	0.41	2.27	0.56	0.56	8.41	2.44	0.90	2.46	0.33	4.13
37	1.00	1.00	0.45	0.01	2.63	3.15	0.71	-0.30	0.51	7.83	1.03
38	-0.71	-0.22	-1.45	-0.57	1.16	0.95	-1.25	0.39	-0.15	-0.63	0.48
39	1.84	5.12	0.98	0.28	3.54	8.53	2.87	2.35	0.48	1.57	3.19
40	1.36	-1.37	-0.70	0.62	4.83	4.33	0.06	-1.45	0.15	-0.74	3.78
41	-1.74	-2.83	-3.86	-2.53	2.57	8.32	4.65	0.81	1.86	1.41	5.13
42	0.25	1.24	-3.88	0.37	1.71	5.99	-0.16	0.11	1.02	-0.96	3.51
43	-0.30	0.73	-1.96	1.98	0.68	2.89	0.08	0.21	0.33	-0.68	8.25
44	-1.17	0.12	-3.08	1.45	0.78	3.87	1.33	1.41	1.50	0.79	4.17
45	0.49	0.47	-2.80	-3.51	-0.27	2.53	0.24	-0.07	-1.21	-1.45	0.90
46	1.18	1.44	-3.59	0.21	-0.75	0.47	0.71	-0.26	0.75	-0.22	4.68
47	-0.58	1.59	-4.38	3.70	-5.85	10.61	10.16	1.59	7.73	-1.67	14.50
48	-0.52	-3.35	-0.76	0.29	2.34	7.96	0.64	-0.10	0.59	0.83	6.12
49	-0.60	0.12	-0.86	1.61	2.05	1.32	1.55	-1.16	0.22	0.07	2.39

Table 10: Unirradiated Test Materials: z-Scores for Labs 24-32

Test Material	Lab 24	Lab 25	Lab 26	Lab 27	Lab 28	Lab 29	Lab 30	Lab 31	Lab 32
1	2.43	0.69	1.96	-0.04	2.16	18.52	1.26	1.35	2.37
2	1.13	-0.68	-1.58	-0.01	2.00	4.07	1.18	2.09	0.24
3	2.56	2.05	2.81	3.66	5.37	26.73	8.89	8.66	1.36
4	-1.80	0.14	1.83	-0.20	1.98	7.90	0.05	-2.64	-1.36
5	1.33	1.54	1.02	0.73	0.46	12.36	0.24	2.99	1.96
6	-0.91	0.97	1.40	0.98	0.99	3.58	-0.57	2.28	1.13
7	0.65	0.46	0.85	1.11	1.86	12.65	0.63	3.02	1.49
8	-0.48	-0.42	1.07	0.02	1.43	7.38	-0.70	10.13	0.85
9	-1.66	3.97	4.40	-0.29	6.62	16.09	1.10	0.42	0.15
10	4.61	-1.08	3.60	-3.22	4.88	5.59	-1.26	2.16	1.37
11	1.49	0.76	1.37	-0.18	5.05	4.45	0.27	1.37	1.44
12	-1.33	1.00	1.12	0.43	2.19	6.07	1.11	0.67	-0.14
13	1.50	1.85	1.75	0.71	1.15	1.91	0.38	0.83	1.56
14	4.67	4.53	-6.08	2.19	2.28	23.56	2.10	-0.58	3.69
15	-0.41	-0.39	-0.22	-1.65	0.89	1.21	-1.27	-0.85	-1.02
16	1.50	-1.74	-0.07	1.49	2.17	2.79	-0.06	-0.06	0.81
17	10.78	0.54	16.64	0.48	2.37	39.90	-0.56	0.76	1.79
18	7.10	-1.01	0.92	4.12	0.43	22.58	5.23	7.84	1.03
19	4.93	0.45	4.07	0.38	1.28	8.07	0.74	0.42	0.51
20	7.14	0.14	0.70	1.72	3.61	27.62	2.67	8.66	2.03
21	-0.34	8.18	0.39	0.43	0.57	4.33	2.99	3.32	-0.20
22	1.62	0.48	1.23	-0.47	-0.01	14.51	0.27	3.80	0.05
23	2.29	1.46	-0.03	1.24	3.99	17.88	0.24	7.00	2.08
24	1.61	-0.04	2.55	1.29	4.04	13.37	0.16	6.84	2.67
25	0.33	3.92	3.80	-0.04	3.50	5.50	-1.15	1.12	-0.21
26	-1.50	-0.03	3.53	-0.65	0.41	3.17	0.73	0.13	-0.02
27	10.29	0.18	-0.60	-0.71	3.32	13.25	-0.96	14.72	1.37
28	-2.12	1.04	-2.25	-1.32	1.40	12.45	0.75	2.16	1.57
29	3.13	-1.46	0.54	-5.10	2.00	11.08	-0.51	1.95	0.71
30	0.74	2.67	-2.90	-3.50	1.76	14.31	-0.62	-1.40	2.24
31	1.65	0.58	1.32	0.38	0.27	13.74	0.80	3.87	2.33
32	3.88	1.22	1.59	-2.48	2.66	23.83	0.16	4.32	3.88
33	1.11	-0.84	-1.20	1.78	4.09	8.40	-0.80	0.23	1.15
34	1.42	1.14	1.48	0.01	2.64	9.92	0.46	2.70	-0.06
35	2.61	1.56	1.12	-0.47	1.91	13.74	2.06	5.73	4.11
36	0.12	2.08	2.55	-1.37	4.10	11.39	0.17	3.64	1.96
37	0.53	0.75	0.46	0.28	2.02	4.42	0.33	1.11	1.57
38	-0.72	0.47	1.10	-0.53	0.41	2.68	-0.72	-1.37	-1.42
39	0.13	2.77	2.17	1.59	1.42	13.87	2.53	2.12	4.07
40	-2.07	-0.12	0.71	-0.42	-0.10	6.59	-0.04	-0.55	0.44
41	-1.37	-2.19	-1.81	0.27	-0.19	10.82	-1.43	-3.73	1.98
42	-0.44	0.71	1.09	-0.80	0.86	7.28	-0.46	1.29	0.14
43	-1.67	4.22	4.79	1.71	6.81	4.63	-0.14	-0.62	0.92
44	-0.23	1.46	1.96	0.89	1.48	9.78	0.95	1.41	-0.36
45	1.41	0.05	0.45	-1.10	0.70	6.10	1.22	-0.76	-0.32
46	-3.11	0.26	-1.10	-1.16	1.19	1.02	-1.35	-1.63	-1.13
47	0.91	-0.15	-0.29	-0.22	-1.59	14.24	-2.69	-0.45	-0.87
48	1.48	-0.18	-0.72	-2.84	12.21	9.50	-0.31	6.32	0.85
49	-1.84	2.17	0.30	-1.04	0.51	0.99	0.63	-0.92	0.87

Table 11: Irradiated Test Materials: z-Scores for Labs 1-11

Test Material	Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Lab 8	Lab 9	Lab 10	Lab 11
1	-1.79	3.87	14.17	-5.06	3.80	3.51	1.92	-2.01	-0.01	0.14
2	-2.12	-0.05	0.81	-2.85	2.16	1.49	8.24	-2.17	-1.08	-0.47
3	-3.15	-27.36	-5.24	-4.40	-6.79	-5.92	-7.09	-15.28	-6.47	-18.46
4	-10.53	-5.82	-3.15	-6.13	-7.59	-3.39	-5.17	-7.00	-6.30	-6.03
5	-0.39	-0.18	-2.04	-3.67	0.35	0.14	-0.52	2.23	-0.54	0.12
6	-1.15	0.31	7.49	-1.74	8.11	3.22	11.15	7.95	3.24	6.08
7	-2.35	-3.48	0.64	-3.29	1.49	0.51	1.58	-1.07	-0.59	0.58
8	-1.13	-1.99	0.38	-1.48	2.14	0.91	2.56	0.29	-1.26	-4.05
9	-3.27	-2.69	-0.82	-1.60	1.86	2.55	-0.69	-2.42	-1.59	-2.34
10	-0.23	-1.36	2.29	-0.79	2.21	1.49	0.21	0.37	0.73	-1.10
11	-3.46	0.32	1.87	-1.78	2.90	1.06	2.37	-1.36	0.10	0.27
12	-0.05	-0.14	1.06	-0.49	1.12	0.31	1.28	1.40	0.82	2.88
13	-4.14	-2.34	-1.90	17.72	1.73	0.87	2.31	0.68	-0.53	-3.73
14	-6.53	-4.61	-5.96	-5.29	-10.61	-6.59	-5.01	-4.37	-32.88	-5.35
15	-1.19	-0.10	0.30	-2.50	-0.25	-0.76	0.35	-0.71	-1.76	-0.71
16	-0.65	-1.81	1.79	-4.16	2.90	-0.07	3.61	0.35	-0.86	-0.12
17	-11.61	-31.80	-43.83	-11.31	-12.38	-16.46	-12.12	-11.87	-19.58	-13.11
18	1.35	-5.19	-6.19	-8.46	-3.31	-4.01	-28.02	-5.93	-13.43	1.40
19	-2.31	0.58	-0.34	-2.10	-0.18	0.78	1.83	2.15	-2.41	-2.22
20	-0.71	-1.24	-0.06	-1.85	0.62	2.16	1.90	-1.23	-2.29	0.76
21	-0.66	-0.99	-1.02	-1.21	1.53	-0.21	1.97	1.07	-0.65	-0.57
22	-1.84	-4.72	-0.08	0.33	2.07	0.23	0.58	-1.47	-1.64	-1.79
23	-9.75	-8.57	-7.27	-15.20	1.66	-0.45	2.96	-6.56	-4.87	-3.10
24	-1.71	6.71	1.24	-1.23	1.63	-0.52	0.08	-2.24	-0.33	-0.76
25	-1.07	-1.53	0.52	0.78	3.06	1.54	1.62	1.22	-2.45	-1.14
26	-1.53	-1.79	-0.27	1.21	-0.16	0.71	0.32	-2.74	-2.66	0.73
27	-0.60	-3.39	-0.35	-1.98	2.91	0.55	-0.63	-0.88	0.90	1.47
28	3.22	-1.69	0.28	1.84	4.22	1.25	2.02	0.96	0.19	3.64
29	-0.63	0.08	0.33	-1.40	0.09	-0.05	0.61	0.30	-0.38	-0.51
30	0.51	0.12	1.86	-1.32	4.69	2.22	2.39	-1.55	2.18	1.72
31	0.61	-2.69	-0.10	-3.27	3.86	0.83	1.95	-1.98	0.26	-0.28
32	-1.24	0.89	-0.17	-4.30	1.33	1.16	0.26	-1.66	-0.54	-1.40
33	-0.97	-1.55	1.23	-3.72	3.30	1.36	2.08	-1.03	1.04	1.58
34	-4.56	-6.71	1.14	-5.25	5.89	3.22	3.13	10.94	-1.22	-3.08
35	-1.62	-1.23	1.40	-0.32	8.15	-0.27	1.66	1.14	-0.02	-0.82
36	1.11	-0.43	-0.60	-1.96	0.21	-0.59	-0.47	-0.06	-1.38	8.29
37	-2.66	-0.06	2.82	-2.86	0.88	-2.34	1.16	-0.81	-2.14	0.66
38	0.85	-1.26	1.65	-1.69	3.50	-0.09	0.80	-3.56	-0.02	-1.56
39	2.07	-1.56	0.73	-3.89	4.23	5.37	2.63	-0.10	-1.19	-0.36
40	-0.40	-0.84	1.18	-0.26	2.99	0.28	1.13	-0.01	-1.80	-0.04
41	0.72	-2.50	0.38	-1.43	0.22	0.66	1.82	0.01	-0.70	2.24
42	-0.80	-0.51	-0.84	0.03	0.02	0.01	0.06	-0.30	0.11	-0.41
43	-1.50	-4.07	1.44	-0.45	2.23	1.90	1.32	-0.29	-0.31	-1.32
44	-0.72	-1.48	-0.77	0.19	0.74	-0.97	1.79	-0.95	-0.16	0.45
45	-2.69	-5.81	2.02	-3.14	7.04	-0.77	4.59	-0.68	2.68	-0.73
46	-4.18	-4.09	-0.40	-1.49	3.13	2.12	1.96	-2.48	-3.31	0.64
47	-0.63	0.84	0.73	0.39	1.88	-0.33	1.21	-0.58	-0.10	-0.02
48	0.41	-2.45	-0.48	1.25	8.01	1.37	0.36	-0.16	0.53	0.28
49	-5.04	-6.43	-3.75	-4.73	-0.21	-1.49	0.53	-4.89	0.02	-1.58

Table 12: Irradiated Test Materials: z-Scores for Labs 13-23

Test Material	Lab 13	Lab 14	Lab 15	Lab 16	Lab 17	Lab 18	Lab 19	Lab 20	Lab 21	Lab 22	Lab 23
1	-0.20	2.94	-3.74	1.47	-1.35	0.44	2.35	-1.14	-1.98	-2.28	2.75
2	0.57	0.17	-3.18	-0.38	-0.03	-1.70	-0.18	-1.72	-0.07	-2.69	3.42
3	-38.88	-8.73	-10.83	-2.67	-3.71	-4.05	-3.08	-16.19	-9.67	-35.58	-9.94
4	-5.79	-3.63	-3.49	-4.65	-12.18	-3.04	-3.86	-4.18	-5.85	-6.11	-3.23
5	-0.43	-1.80	-2.93	-0.19	0.19	-1.39	-0.99	3.42	0.52	-1.84	0.78
6	-1.66	6.06	-2.07	1.48	7.67	5.43	-3.45	1.31	0.51	-1.11	0.91
7	-1.69	-1.53	-4.99	0.37	-0.98	-0.23	-0.57	-0.01	-0.61	-2.27	1.01
8	0.32	-0.83	-3.56	0.01	-0.44	-2.60	-0.22	0.51	-3.15	-2.27	1.46
9	-0.69	-1.65	-0.62	4.36	-1.69	-2.34	1.89	-1.76	-1.48	-3.26	-0.97
10	0.05	-0.09	-1.07	0.36	0.87	-0.62	0.26	0.25	0.15	0.26	5.04
11	-28.92	0.13	-1.94	0.61	-0.19	-3.01	0.18	-0.74	-1.56	-3.13	6.81
12	0.29	0.46	-0.78	-0.16	-0.34	-0.38	-0.14	0.14	0.76	-0.83	0.24
13	0.19	-2.57	-2.29	-0.39	-0.68	-4.22	-1.40	-0.95	-2.20	-0.41	1.07
14	-13.29	-4.21	-9.56	-7.81	-14.40	-6.77	-12.59	-8.17	-5.28	-10.32	-8.00
15	-1.04	1.42	-1.69	0.59	-0.36	-1.56	-1.19	-0.02	-1.31	-2.01	-0.52
16	0.94	-0.23	-4.49	1.31	2.30	-2.67	-0.54	-0.75	-1.89	-1.38	2.09
17	-23.58	-11.72	-20.10	-16.04	-32.75	-15.55	-23.70	-26.43	-11.94	-23.82	-12.03
18	-0.02	-1.49	0.58	-1.62	-9.54	1.32	32.55	2.37	-30.03	0.51	2.12
19	-1.69	-1.82	-3.48	1.48	-1.18	-2.68	-0.96	-0.93	-2.46	-22.84	0.46
20	-0.38	-0.02	-4.86	-3.64	-0.41	3.39	-0.39	-1.62	0.38	-0.71	0.83
21	-1.45	-0.92	-2.56	-0.25	-0.99	-1.54	0.25	-0.06	0.45	-0.53	0.85
22	-0.66	-1.58	-1.95	0.46	-3.48	-2.93	-1.31	-0.31	-2.98	-1.62	1.02
23	-5.32	-9.00	-13.77	-0.63	-8.44	-14.38	-3.81	-3.65	-11.61	-4.34	2.20
24	-2.27	-0.14	-2.72	-0.93	-1.60	-1.99	-2.71	0.32	-0.19	-1.57	0.97
25	0.11	0.58	-0.14	1.18	0.19	0.35	-0.77	-0.44	1.12	-2.64	2.37
26	1.20	0.78	-5.91	2.59	-2.43	-9.32	-3.04	-0.57	0.70	-1.74	3.33
27	-0.58	1.38	-2.42	-0.53	-0.60	-0.73	-1.57	-1.48	-2.90	-1.05	2.23
28	0.75	0.22	-2.12	-0.56	0.79	0.06	2.05	-0.21	-0.93	1.04	2.18
29	0.20	0.07	-1.09	2.17	-0.06	-0.25	-0.69	0.25	-0.15	-0.11	0.25
30	2.73	2.50	-4.61	3.16	1.72	0.80	0.15	2.19	1.84	0.10	5.30
31	1.05	0.74	-3.26	-0.26	0.81	-0.82	-0.54	0.01	-1.71	-2.99	1.11
32	0.21	0.79	-3.87	-0.02	0.95	-0.46	-1.05	0.03	-0.74	-1.14	0.48
33	1.29	-0.69	-7.22	-0.94	0.86	-1.01	1.64	0.82	0.88	-1.01	4.34
34	-0.44	-1.31	-6.41	1.39	-1.41	-7.45	-3.45	0.91	-2.18	-3.01	4.21
35	-0.51	0.60	-2.80	7.18	0.16	-1.34	-1.16	0.85	3.08	1.97	2.39
36	-0.88	0.04	-2.12	-0.78	0.38	-1.40	-1.36	-0.62	-0.37	-0.74	2.60
37	-0.52	0.08	-2.78	1.60	-0.19	-1.22	-1.58	-1.12	-1.98	-0.03	2.16
38	2.66	0.23	-3.70	3.85	2.06	0.69	1.11	-2.43	0.14	-0.88	7.84
39	-1.21	0.15	-1.96	-0.32	1.41	0.62	-0.60	1.66	-0.76	0.22	-0.15
40	0.20	0.64	-4.40	0.47	0.42	-1.45	-1.35	0.49	-1.48	1.30	0.90
41	-0.22	-2.21	-5.36	-0.86	-0.26	-1.72	-0.83	-0.31	-0.63	0.06	0.33
42	-0.58	-0.87	-1.96	-0.47	-0.24	-0.03	-0.24	0.17	-0.74	-0.96	-0.10
43	-0.15	0.05	-6.54	-0.30	-0.11	-10.26	-4.78	-0.61	-1.77	-0.69	1.76
44	-0.73	-0.46	-0.10	0.84	-0.59	-0.69	-0.05	-0.75	1.39	-0.66	-0.16
45	0.09	-2.90	-4.02	0.22	1.33	-1.58	-5.06	0.36	-3.11	-1.23	1.99
46	0.05	0.30	-11.07	3.42	0.06	-3.06	-5.96	-0.30	-2.72	-1.12	3.63
47	-1.67	0.01	-2.61	0.23	0.10	0.79	-1.05	-0.16	-1.61	-1.12	0.93
48	-1.40	3.86	-8.33	3.98	-3.64	-3.77	-2.63	-0.40	5.17	-0.35	1.72
49	-1.98	-0.59	-11.99	-3.44	-2.48	-14.58	-7.01	-3.37	-5.06	-2.89	0.48

Table 13: Irradiated Test Materials: z-Scores for Labs 24-32

Test Material	Lab 24	Lab 25	Lab 26	Lab 27	Lab 28	Lab 29	Lab 30	Lab 31	Lab 32
1	-3.22	1.73	1.05	-3.37	-0.59	1.89	-2.87	-3.38	-2.32
2	-1.09	-0.26	0.69	-3.84	0.00	-1.26	-2.08	-2.51	-1.96
3	-18.29	-5.24	-16.76	-5.97	-3.94	-3.72	-12.95	-10.94	-2.75
4	-2.85	-4.35	-7.14	-7.69	-3.00	-7.91	-2.81	-2.39	-7.31
5	0.03	1.53	-0.02	-0.38	-0.43	-1.05	-1.39	-1.72	2.56
6	-0.96	1.10	2.56	-0.05	8.02	2.64	-1.17	1.77	-1.66
7	-2.06	0.35	0.79	-3.51	2.08	0.15	-2.39	-2.29	-3.56
8	-4.69	0.23	0.65	-2.56	0.40	-1.22	-3.07	-2.74	-1.93
9	-0.27	-1.42	-0.75	-3.25	-0.28	-2.61	-3.58	-2.34	-1.30
10	-2.01	0.34	0.70	-0.60	-0.50	-0.07	0.24	-1.33	0.92
11	-1.15	-0.07	0.64	-3.22	0.38	-1.15	-0.72	-2.77	-3.61
12	-1.09	0.75	0.73	-1.04	1.27	4.32	0.37	0.28	-0.63
13	-1.45	-0.77	-0.27	-1.55	1.37	-1.23	-3.03	-3.87	-2.78
14	-5.44	-6.78	-13.53	-12.66	-7.40	-13.33	-6.36	-7.03	-9.05
15	-0.47	-1.80	-0.83	-1.22	-1.26	-1.31	-1.11	-0.37	0.60
16	-0.53	2.25	-4.42	-3.11	0.77	-0.53	-3.45	-2.46	-3.72
17	-28.71	-27.28	-13.68	-14.89	-22.41	-12.79	-18.51	-24.42	-13.10
18	-38.51	-8.05	-5.32	-17.74	1.68	-18.59	-1.19	-46.38	-4.07
19	-1.83	0.33	-1.93	-2.27	0.20	-2.02	-3.00	-3.47	-3.63
20	-0.15	-0.97	0.20	-1.33	-0.69	11.57	-2.07	1.79	-1.22
21	-1.69	-0.19	-1.17	-2.61	1.05	-2.03	-0.56	-1.94	-0.66
22	-2.87	0.07	-0.67	-3.74	-1.26	-1.79	-2.28	-4.93	-4.59
23	-2.35	-2.87	2.01	-5.65	-0.84	-3.83	-10.59	-6.79	-7.84
24	-1.47	-0.09	-1.55	-3.14	-0.93	-0.42	-1.75	-1.68	-2.60
25	1.80	0.59	0.10	-1.68	1.31	-1.65	-0.71	-2.16	-1.77
26	0.46	-0.59	0.70	-3.21	2.25	-1.59	-2.98	-3.18	0.29
27	-1.59	-0.18	-0.66	-3.60	-0.63	-1.32	-3.02	-2.44	-3.39
28	0.00	-0.13	2.47	1.67	0.05	1.62	-0.27	0.07	0.16
29	-0.74	-0.07	0.25	0.03	-0.59	-0.13	-1.01	-0.92	-0.54
30	0.33	1.55	2.40	0.22	0.01	1.12	-1.56	-2.05	-0.46
31	-0.60	-1.29	1.38	-4.22	-0.31	-2.24	-2.07	-3.36	-2.41
32	-2.69	0.75	-1.13	-0.51	-0.20	0.22	-0.27	-0.37	-2.52
33	-2.31	1.02	0.49	-0.20	4.22	0.31	-1.17	1.02	-0.68
34	-9.79	0.77	-1.86	-6.44	0.13	-2.53	-4.92	-7.70	-8.39
35	2.14	1.22	-0.53	2.81	0.23	1.94	-2.62	-4.18	3.18
36	-1.76	0.14	2.09	-1.81	-1.01	-0.76	0.71	-1.31	-1.92
37	-1.38	0.09	0.05	-3.11	1.86	0.37	-2.06	-3.23	-4.06
38	1.18	0.59	1.40	-3.08	2.51	1.87	-1.96	-2.26	-5.33
39	0.57	-0.49	0.08	-3.90	0.65	-5.54	0.86	-1.06	0.35
40	-1.55	-0.44	0.74	-1.42	0.80	-0.20	-3.22	-2.76	-1.57
41	-2.74	1.53	-2.80	-1.29	1.28	-1.94	-3.51	-2.87	-3.36
42	-0.53	0.02	0.00	-1.08	-0.97	-0.14	-1.43	-0.11	-1.41
43	-0.49	0.01	0.42	-3.71	0.83	-3.60	-3.67	-6.19	-4.46
44	-0.44	1.69	-0.98	-0.98	-0.83	0.41	-0.67	-2.03	-1.40
45	-1.85	0.61	1.56	-5.76	0.40	0.37	-7.29	-6.43	-6.87
46	-1.89	0.38	0.63	-4.44	1.80	-5.99	-3.71	-9.50	-5.22
47	-0.78	-0.33	-0.76	-1.55	-1.30	-0.28	-2.37	-3.87	0.11
48	-8.12	0.58	0.56	-1.45	0.01	1.08	-1.94	-6.63	-1.03
49	-4.63	-2.30	-2.65	-5.56	0.30	-4.66	-4.42	-12.07	-5.07

Table 14: Qualitative Results by Laboratory

Laboratory	Irradiated			Unirradiated		
	Neg	Int	Pos	Neg	Int	Pos
1	0	4	45	34	12	3
2	0	5	44	40	8	1
3	0	5	44	42	7	0
4	0	5	44	39	10	0
5	0	3	46	37	11	1
6	0	4	45	32	16	1
8	0	3	46	22	20	7
9	0	5	44	40	9	0
10	0	6	43	41	7	1
11	0	2	47	16	31	2
12	0	3	46	49	0	0
13	1	6	42	42	7	0
14	0	5	44	41	8	0
15	1	7	41	45	4	0
16	1	4	44	42	7	0
17	0	5	44	34	14	1
18	0	5	44	8	36	5
19	0	4	45	36	13	0
20	0	5	44	41	8	0
21	0	4	45	42	7	0
22	1	6	42	39	7	3
23	0	4	45	32	14	3
24	1	6	42	38	11	0
25	0	4	45	39	9	1
26	0	4	45	37	11	1
27	0	5	44	41	8	0
28	0	6	43	37	11	1
29	0	2	47	5	33	11
30	0	6	43	40	9	0
31	0	7	42	33	16	0
32	0	6	43	43	6	0
Total	5	146	1368	1107	370	42
Percent	0.33	9.61	90.06	72.88	24.36	2.76

Table 15: Qualitative Results by Test Material

Test Material	Irradiated			Unirradiated		
	Neg	Int	Pos	Neg	Int	Pos
1	0	0	31	28	1	2
2	0	0	31	30	0	1
3	0	0	31	18	11	2
4	0	0	31	5	24	2
5	0	0	31	24	7	0
6	0	0	31	7	24	0
7	0	0	31	21	9	1
8	0	0	31	27	4	0
9	0	0	31	29	2	0
10	0	0	31	30	1	0
11	1	0	30	30	1	0
12	1	28	2	29	2	0
13	0	0	31	30	1	0
14	0	0	31	25	3	3
15	0	0	31	15	15	1
16	0	0	31	29	2	0
17	0	0	31	23	6	2
18	0	0	31	18	8	5
19	1	0	30	22	7	2
20	2	27	2	25	4	2
21	0	0	31	12	17	2
22	0	0	31	27	3	1
23	0	0	31	24	7	0
24	0	0	31	26	5	0
25	0	0	31	15	16	0
26	0	0	31	1	22	8
27	0	0	31	27	4	0
28	0	19	12	27	4	0
29	0	0	31	28	3	0
30	0	0	31	28	3	0
31	0	0	31	29	2	0
32	0	0	31	29	2	0
33	0	3	28	27	4	0
34	0	0	31	25	5	1
35	0	3	28	29	2	0
36	0	14	17	29	2	0
37	0	0	31	27	3	1
38	0	0	31	16	14	1
39	0	0	31	29	2	0
40	0	0	31	26	5	0
41	0	0	31	26	5	0
42	0	30	1	29	2	0
43	0	0	31	1	28	2
44	0	22	9	30	1	0
45	0	0	31	24	7	0
46	0	0	31	1	28	2
47	0	0	31	25	6	0
48	0	0	31	23	8	0
49	0	0	31	2	28	1
Total	5	146	1368	1107	370	42
Percent	0.3	9.7	90.0	72.8	24.4	2.8

Table 16: Qualitative Results for the SUERC Reference Data Set

Test Material	Irradiated			Unirradiated		
	Neg	Int	Pos	Neg	Int	Pos
1	0	0	10	10	0	0
2	0	0	10	10	0	0
3	0	0	10	10	0	0
4	0	0	10	0	10	0
5	0	0	10	10	0	0
6	0	0	10	2	8	0
7	0	0	10	10	0	0
8	0	0	10	10	0	0
9	0	0	10	10	0	0
10	0	0	10	10	0	0
11	0	0	10	10	0	0
12	0	10	0	10	0	0
13	0	0	10	10	0	0
14	0	0	10	10	0	0
15	0	0	10	2	8	0
16	0	0	10	10	0	0
17	0	0	10	10	0	0
18	0	0	10	10	0	0
19	0	0	10	10	0	0
20	0	10	0	10	0	0
21	0	0	10	6	4	0
22	0	0	10	10	0	0
23	0	0	10	10	0	0
24	0	0	10	10	0	0
25	0	0	10	8	2	0
26	0	0	10	1	8	1
27	0	0	10	10	0	0
28	0	8	2	10	0	0
29	0	0	10	10	0	0
30	0	0	10	10	0	0
31	0	0	10	10	0	0
32	0	0	10	10	0	0
33	0	0	10	10	0	0
34	0	0	10	10	0	0
35	0	0	10	10	0	0
36	0	2	8	10	0	0
37	0	0	10	10	0	0
38	0	0	10	3	7	0
39	0	0	10	10	0	0
40	0	0	10	10	0	0
41	0	0	10	10	0	0
42	0	7	3	10	0	0
43	0	0	10	10	0	0
44	0	5	5	0	10	0
45	0	0	10	10	0	0
46	0	0	10	9	1	0
47	0	0	10	0	10	0
48	0	0	10	10	0	0
49	0	0	10	0	10	0
Total	0	42	448	411	78	1
Percent	0	8.57	91.43	83.88	15.92	0.20

Table 17: Comparison Between Qualitative Results for Participants and the SUERC Reference Data Set

	Irradiated Test Materials		Unirradiated Test Materials	
	Neg	Pos / Int	Neg / Int	Pos
All Participants				
Total	5	1514	1477	42
Percent	0.3	99.7	97.2	2.8
Reference Set				
Total	0	490	489	1
Percent	0	100	99.8	0.2

Table 18: Summary of Participants Results from Paprika Reference Standard, Pooled z-Scores, and Qualitative Results

			Pooled z-scores ¹						Qualitative results					
Paprika ²			Unirradiated			Irradiated			Unirradiated			Irradiated		
Lab	Rel sens.	Error	Mean z	S(z)	$\Sigma z/\sqrt{n}$ ³	Mean z	S(z)	$\Sigma z/\sqrt{n}$	% Neg	% Int	% Pos	% Neg	% Int	% Pos
1	0.79	0.15	2.78	5.27	19.47	-1.85	2.91	-12.96	69.4	24.5	6.1	0.0	8.2	91.8
2	0.70	0.08	1.36	2.02	9.50	-2.91	6.16	-20.40	81.6	16.3	2.0	0.0	10.2	89.8
3	0.95	0.12	0.68	1.55	4.75	-0.73	7.05	-5.13	85.7	14.3	0.0	0.0	10.2	89.8
4	0.62	0.06	1.51	2.21	10.57	-2.17	4.22	-15.18	79.6	20.4	0.0	0.0	10.2	89.8
5	1.22	0.15	1.97	1.93	13.79	1.42	4.02	9.91	75.5	22.4	2.0	0.0	6.1	93.9
6	1.18	0.21	2.92	2.43	20.41	-0.03	3.21	-0.22	65.3	32.7	2.0	0.0	8.2	91.8
8	1.28	0.22	5.50	7.14	38.48	0.42	5.32	2.94	44.9	40.8	14.3	0.0	6.1	93.9
9	0.70	0.07	1.04	3.24	7.31	-1.21	3.92	-8.48	81.6	18.4	0.0	0.0	10.2	89.8
10	1.07	0.15	0.81	2.01	5.66	-2.14	5.80	-14.95	83.7	14.3	2.0	0.0	12.2	87.8
11	1.17	0.16	4.88	3.37	34.14	-0.88	3.98	-6.18	32.7	63.3	4.1	0.0	4.1	95.9
13	1.02	0.12	0.66	1.39	4.62	-2.57	7.73	-17.99	85.7	14.3	0.0	2.0	12.2	85.7
14	1.06	0.16	1.20	1.91	8.40	-0.75	2.93	-5.26	83.7	16.3	0.0	0.0	10.2	89.8
15	0.56	0.06	-1.26	2.54	-8.84	-4.34	3.90	-30.41	91.8	8.2	0.0	2.0	14.3	83.7
16	1.01	0.12	0.10	1.88	0.71	-0.06	3.32	-0.44	85.7	14.3	0.0	2.0	8.2	89.8
17	1.12	0.14	2.30	2.71	16.07	-1.72	5.76	-12.06	69.4	28.6	2.0	0.0	10.2	89.8
18	1.08	0.16	6.52	4.70	45.61	-2.47	4.19	-17.28	16.3	73.5	10.2	0.0	10.2	89.8
19	0.97	0.11	1.29	2.23	9.06	-1.29	6.39	-9.06	73.5	26.5	0.0	0.0	8.2	91.8
20	0.70	0.07	0.30	1.05	2.11	-1.33	4.65	-9.33	83.7	16.3	0.0	0.0	10.2	89.8
21	0.65	0.08	0.75	1.77	5.26	-2.16	5.14	-15.15	85.7	14.3	0.0	0.0	8.2	91.8
22	0.59	0.08	0.96	2.67	6.72	-3.06	6.73	-21.40	79.6	14.3	6.1	2.0	12.2	85.7
23	1.45	0.20	3.19	3.00	22.31	1.05	3.46	7.35	65.3	28.6	6.1	0.0	8.2	91.8
24	0.81	0.09	1.33	2.96	9.29	-3.28	7.15	-22.93	77.6	22.4	0.0	2.0	12.2	85.7
25	0.80	0.08	0.94	1.81	6.59	-0.93	4.35	-6.53	79.6	18.4	2.0	0.0	8.2	91.8
26	1.03	0.13	1.22	2.97	8.54	-1.10	3.98	-7.72	75.5	22.4	2.0	0.0	8.2	91.8
27	0.53	0.06	-0.04	1.66	-0.27	-3.26	3.72	-22.81	83.7	16.3	0.0	0.0	10.2	89.8
28	1.25	0.27	2.28	2.28	15.94	-0.28	3.84	-1.93	75.5	22.4	2.0	0.0	12.2	87.8
29	0.83	0.09	10.94	7.98	76.55	-1.62	4.51	-11.36	10.2	67.3	22.4	0.0	4.1	95.9
30	0.75	0.09	0.50	1.81	3.53	-2.89	3.40	-20.23	81.6	18.4	0.0	0.0	12.2	87.8
31	0.72	0.16	2.28	3.57	15.98	-4.44	7.43	-31.07	67.3	32.7	0.0	0.0	14.3	85.7
32	0.62	0.10	1.05	1.35	7.37	-2.73	3.02	-19.14	87.8	12.2	0.0	0.0	12.2	87.8
Reference data set									81.6	18.4	0.0	0.0	8.2	91.8

- z-Scores were evaluated using log transformed PSL intensity data, relative to mean and standard deviations from log transformed reference data, and pooled across all 49 test materials. The use of single laboratory reference values facilitates identification of outlying values in participants data sets at this stage of the study.
- Relative sensitivities are the mean and standard deviation of participants paprika standard results expressed as a fraction of the corresponding values from the reference set.
- Thompson, M., et al, 2006, The International Harmonised Protocol For The Proficiency Testing Of Analytical Chemistry Laboratories, IUPAC Technical Report, in press

Figure 1: Reference Data for All Test Materials

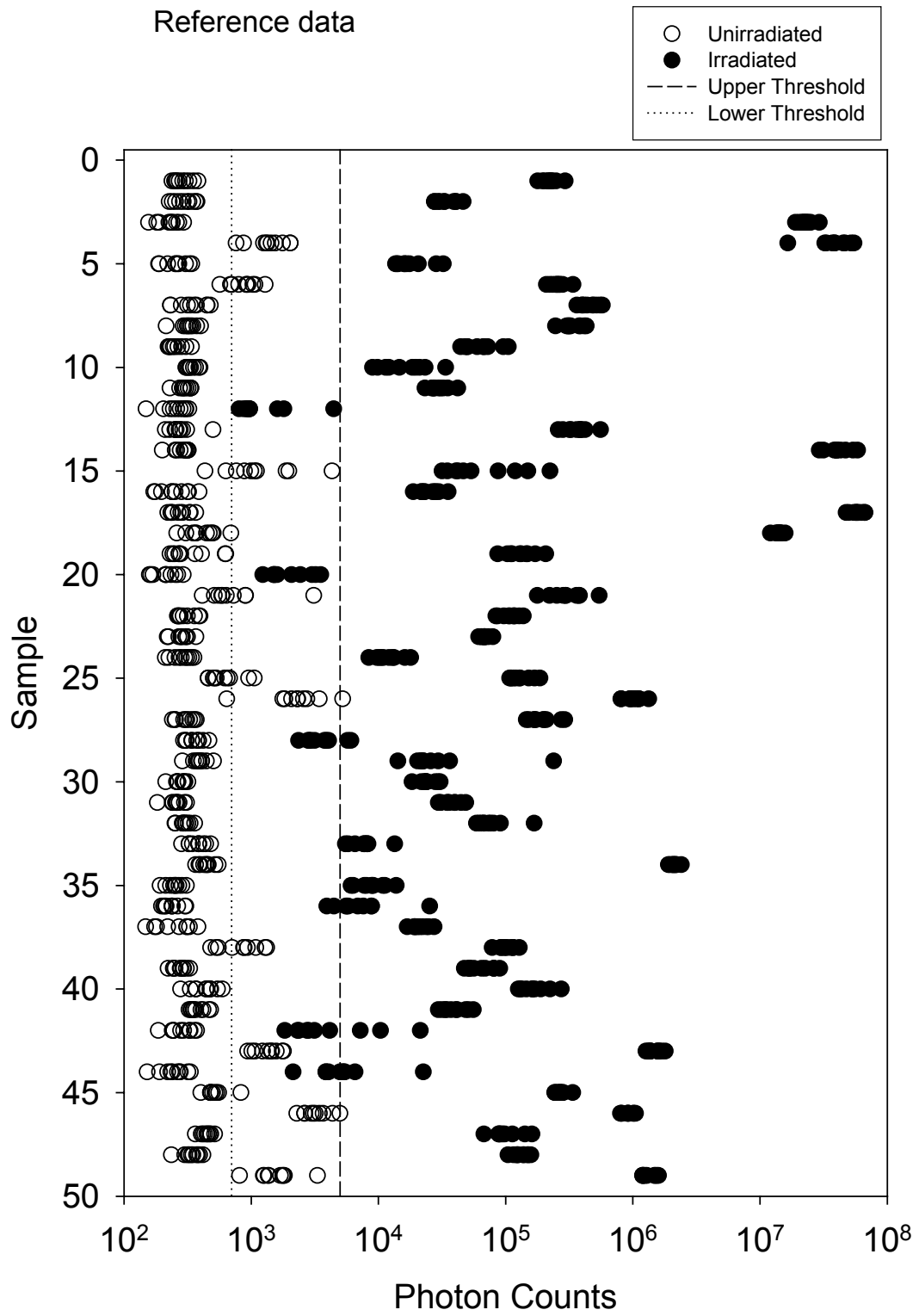


Figure 2: Histogram of Homogeneity Testing Data Sets

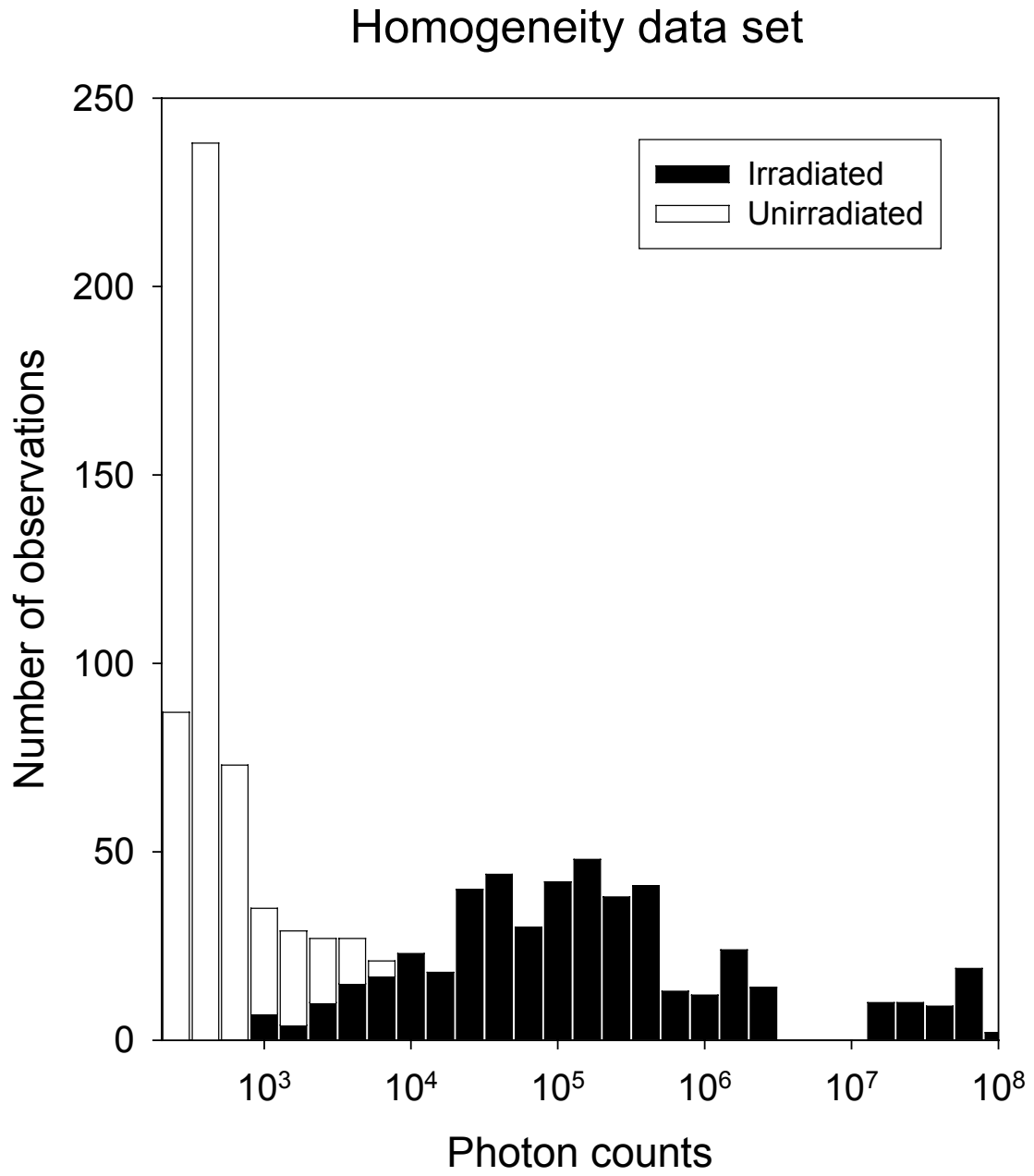


Figure 3: Simulated Calibrated PSL Plot for Reference Data

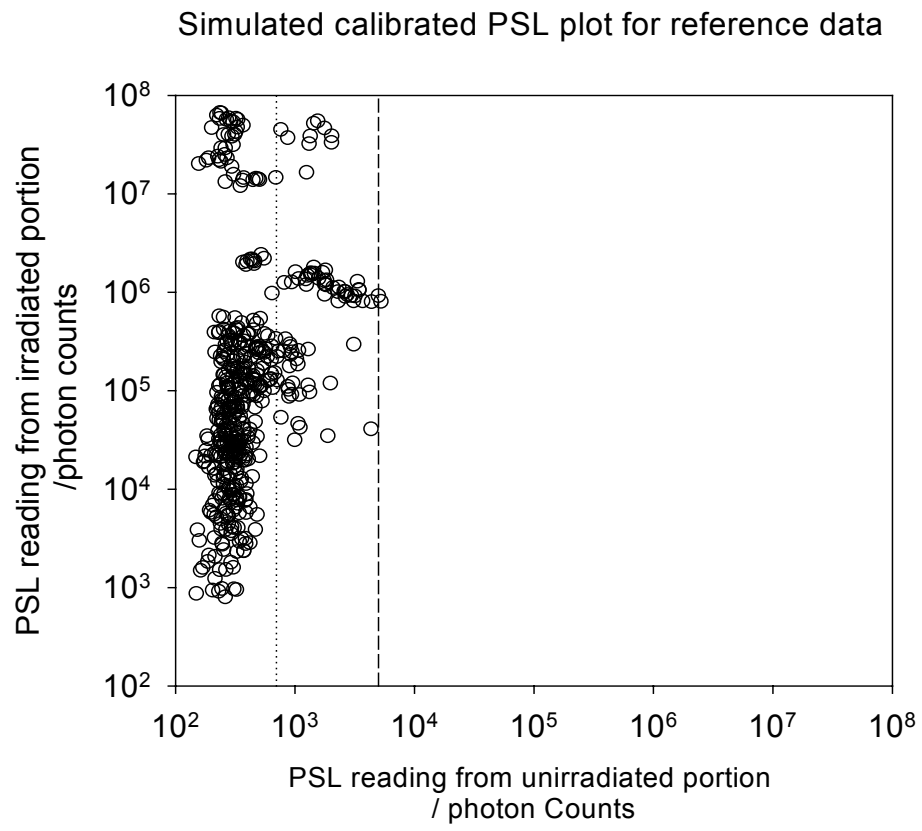


Figure 4: Arithmetic Mean of Log Transformed Reference Data vs. Robust Mean

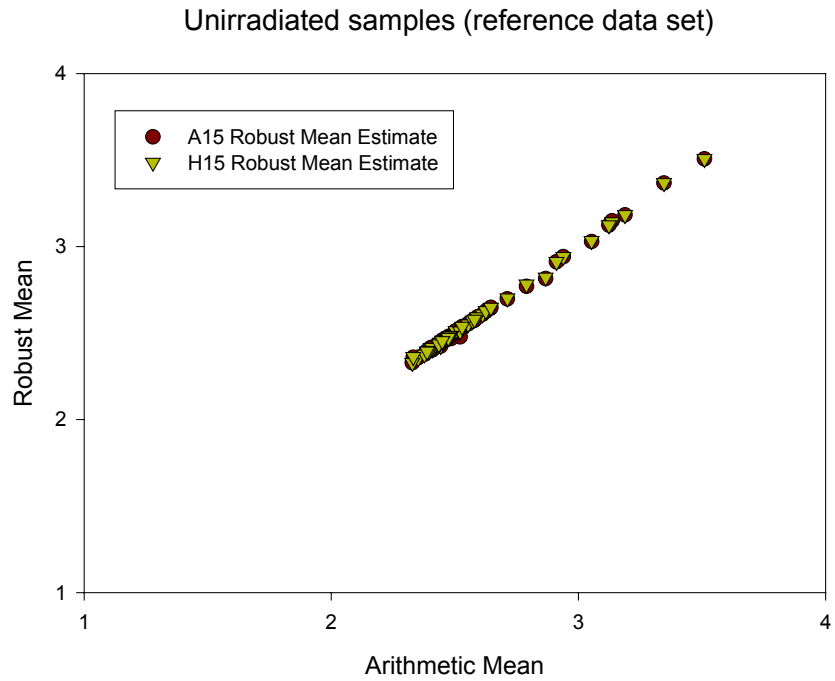
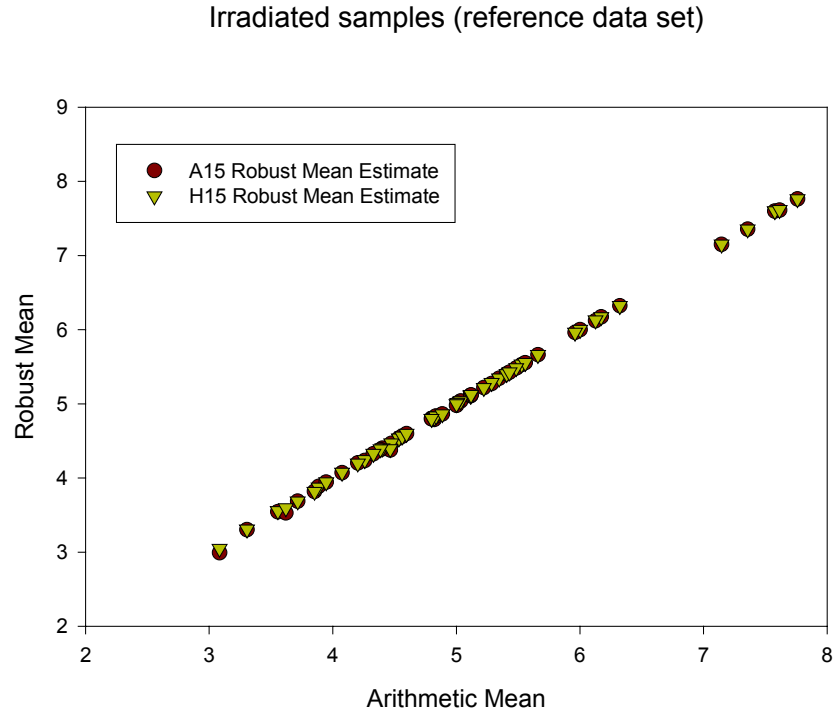


Figure 5: Standard Deviations of Log Transformed Reference Data vs. Robust Standard Deviation

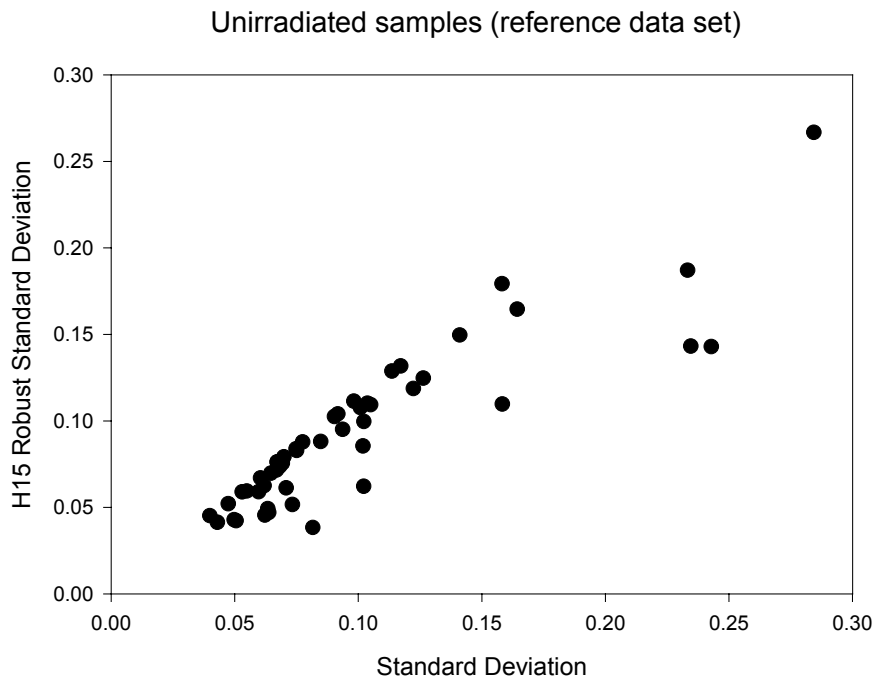
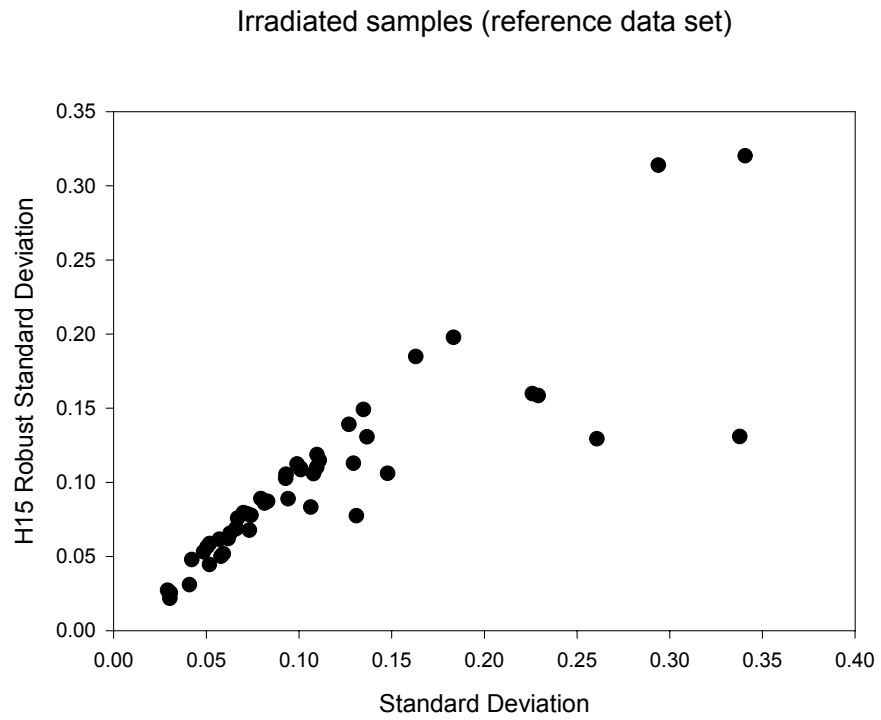


Figure 6: Histogram of all Participant Data

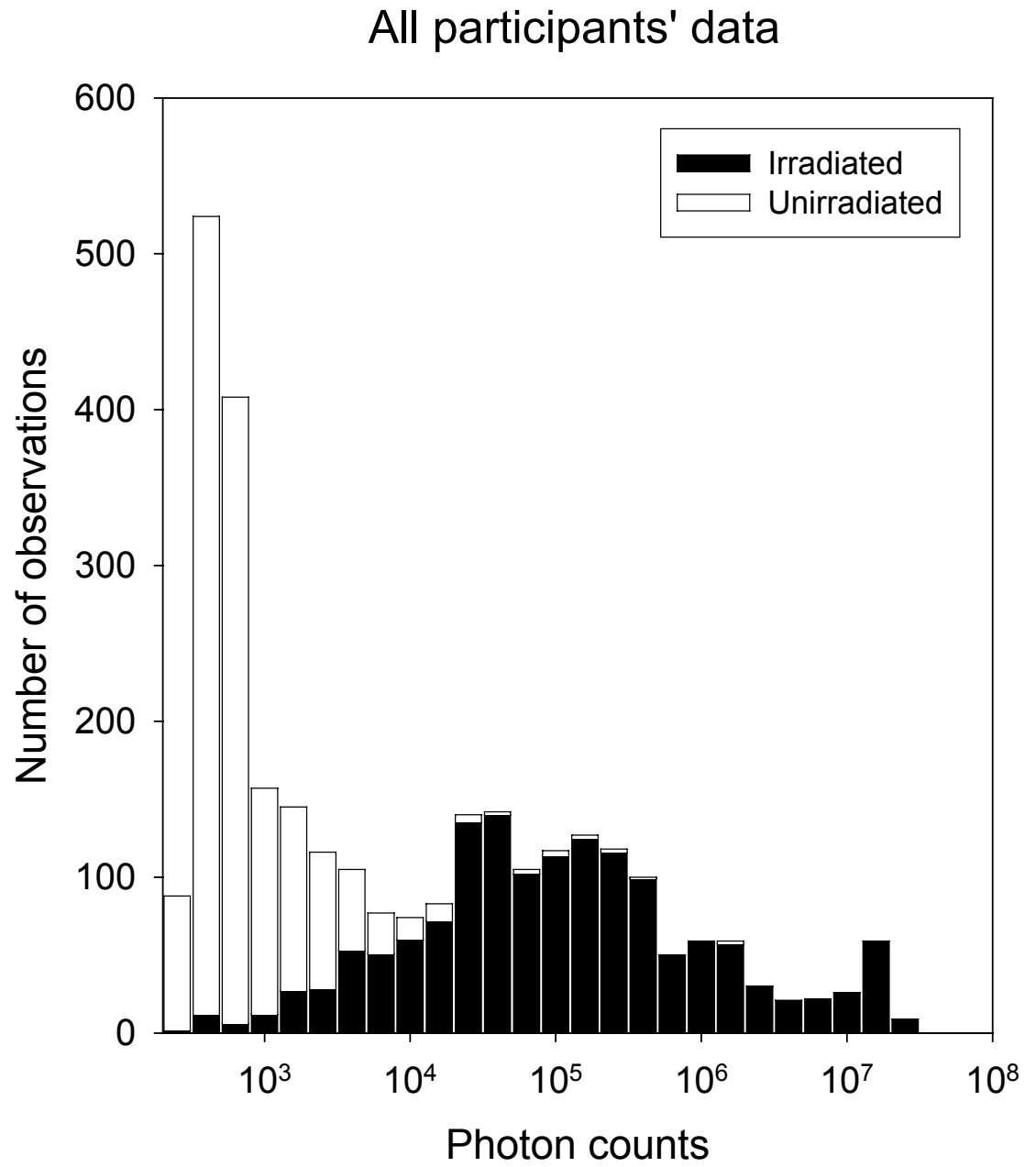


Figure 7: Participant Data for All Test Materials

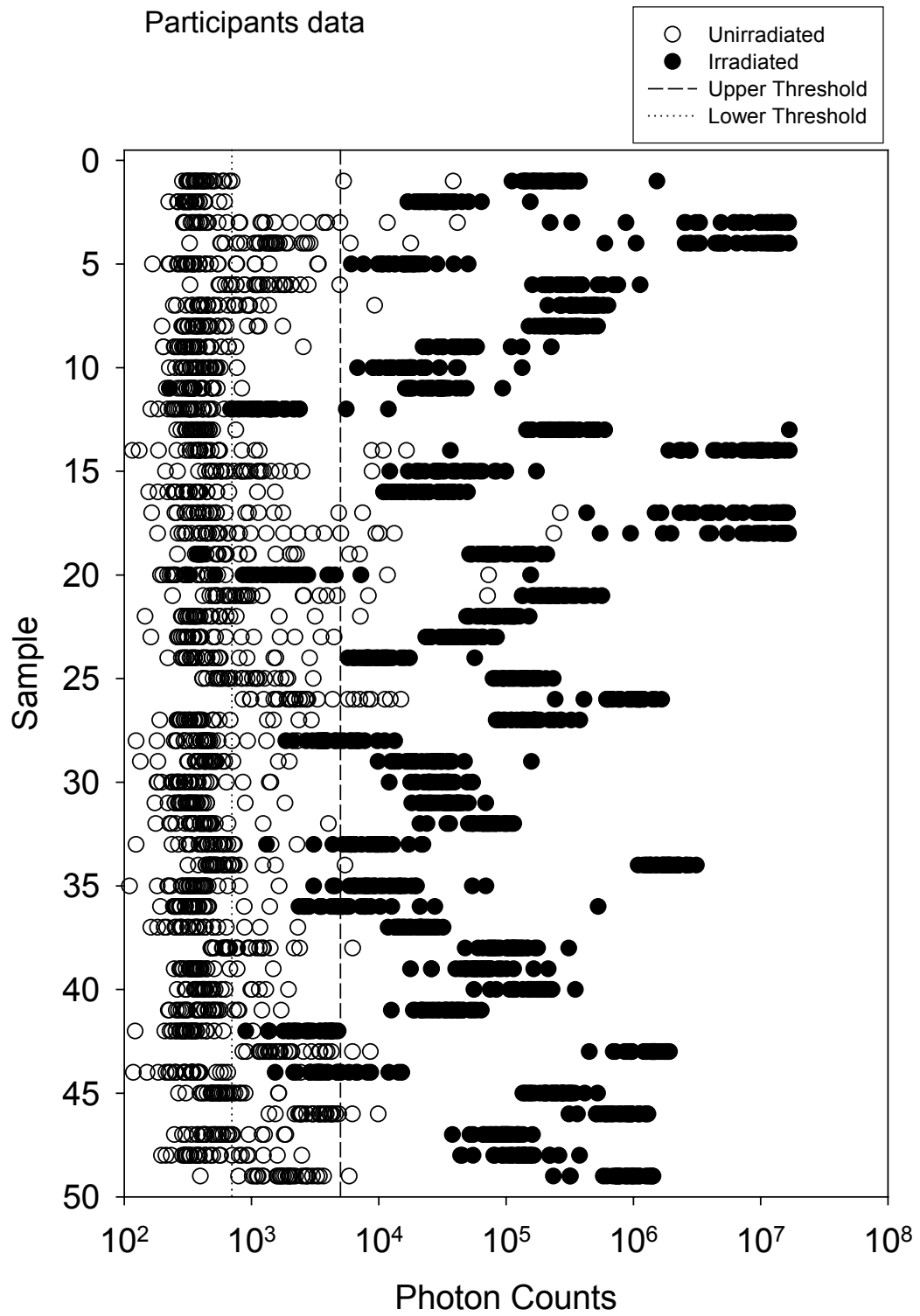


Figure 8: Participants Data From Irradiated Test Materials Arranged by Laboratory

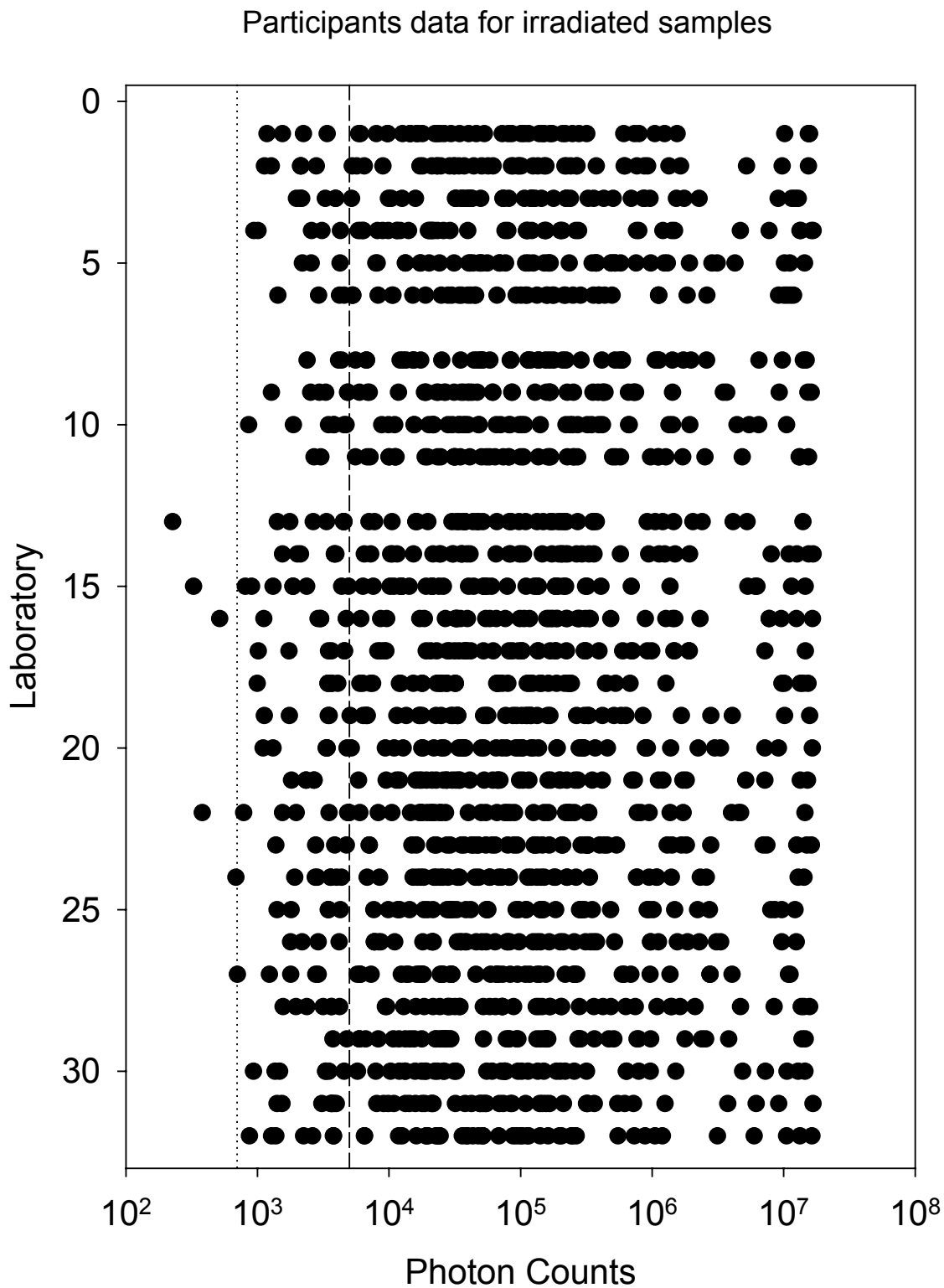


Figure 9: Participants Data from Unirradiated Test Materials Arranged by Laboratory

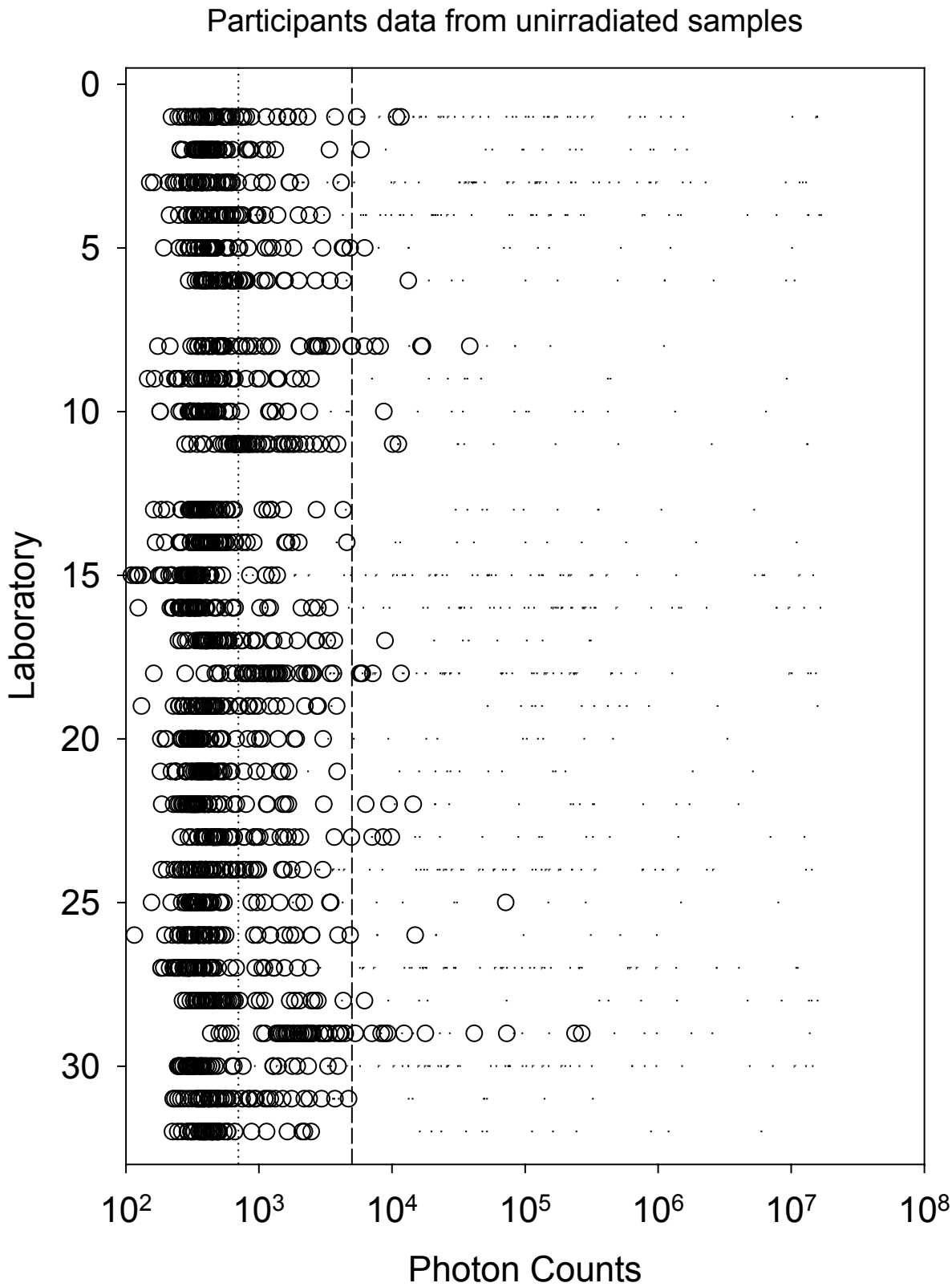


Figure 10: z-Scores for Participant Irradiated Test Materials

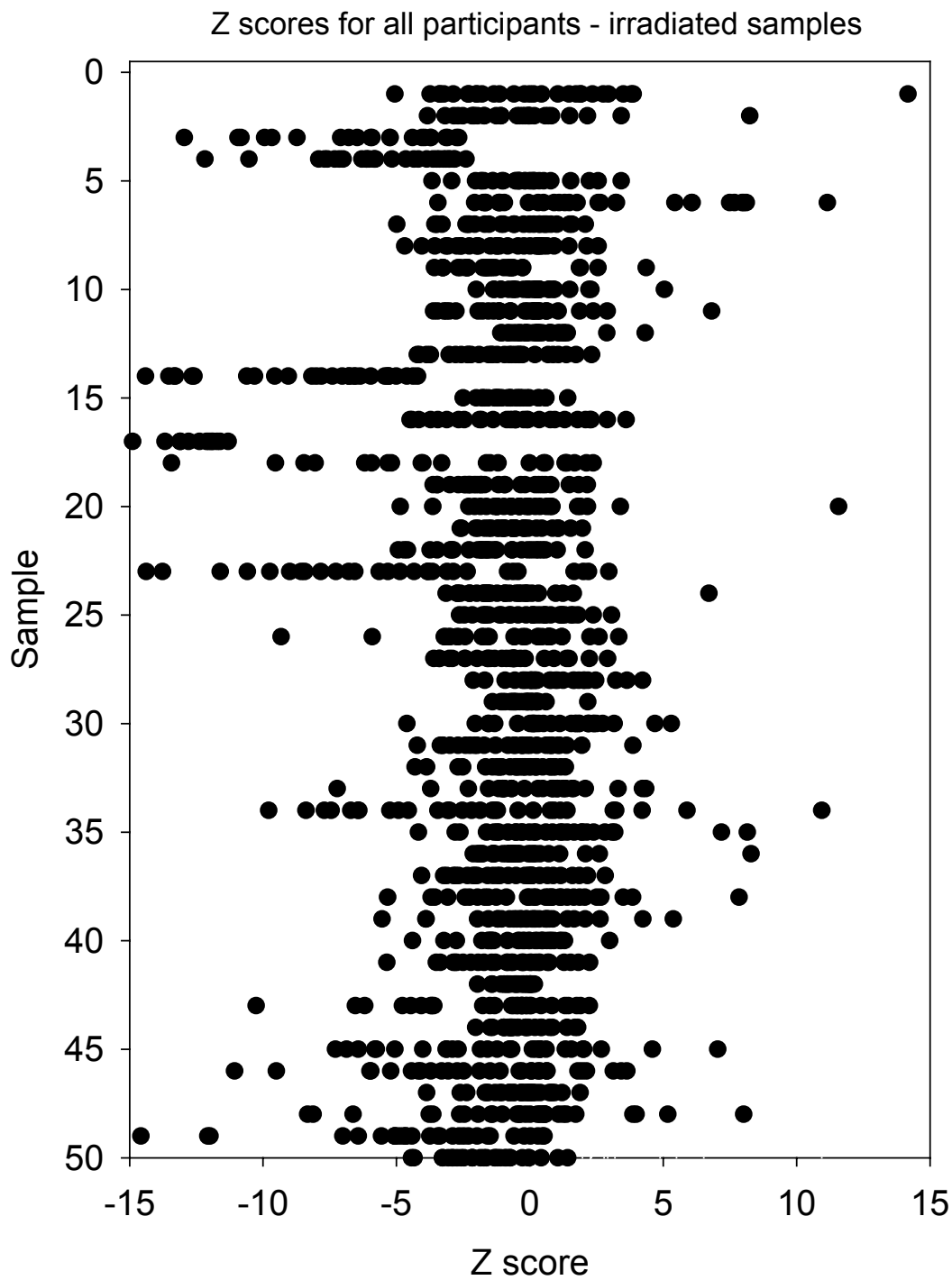


Figure 11: z-Scores for Irradiated Test Materials Arranged by Laboratory

Participants data for irradiated samples

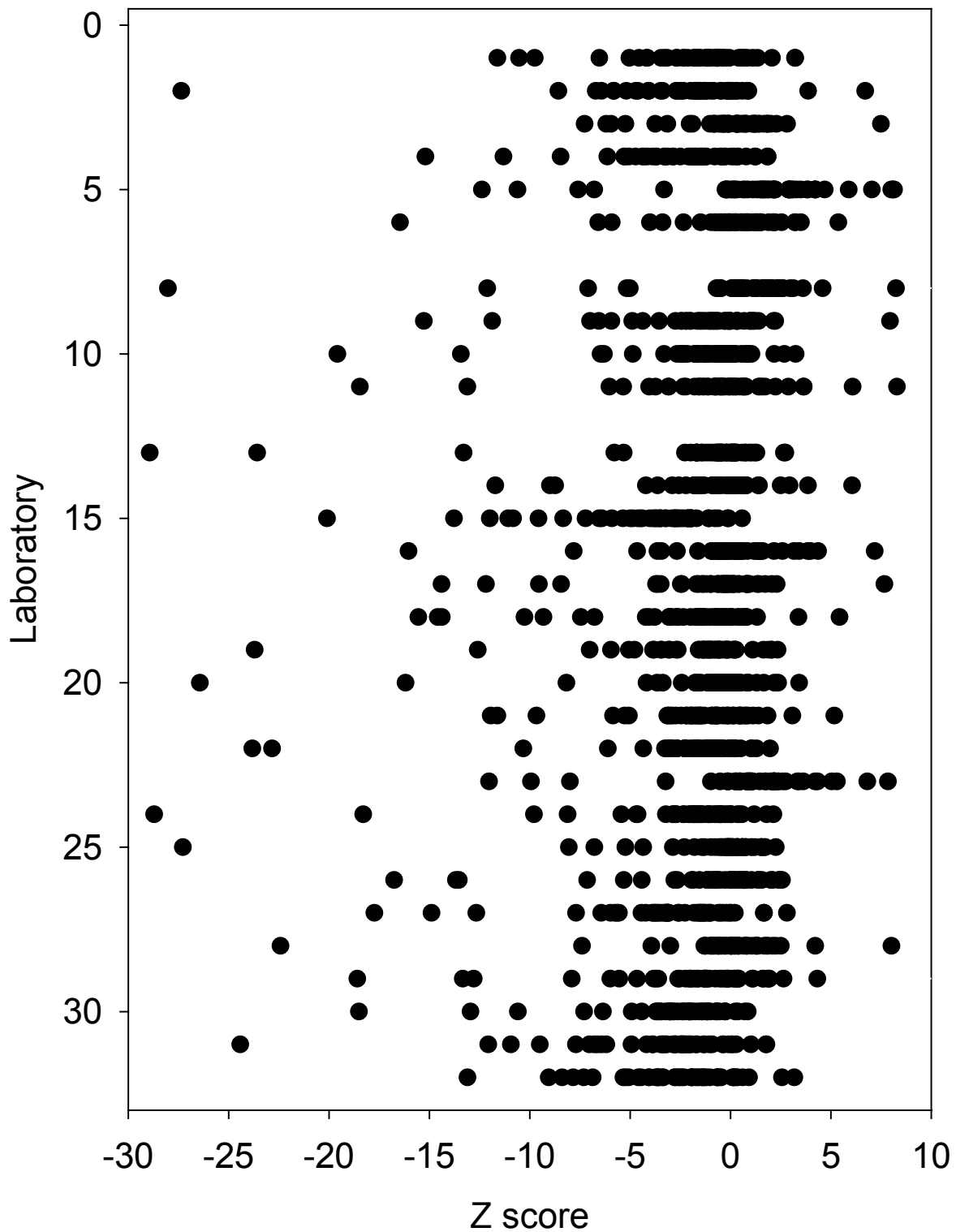


Figure 12: z-Scores for Participant Unirradiated Test Materials

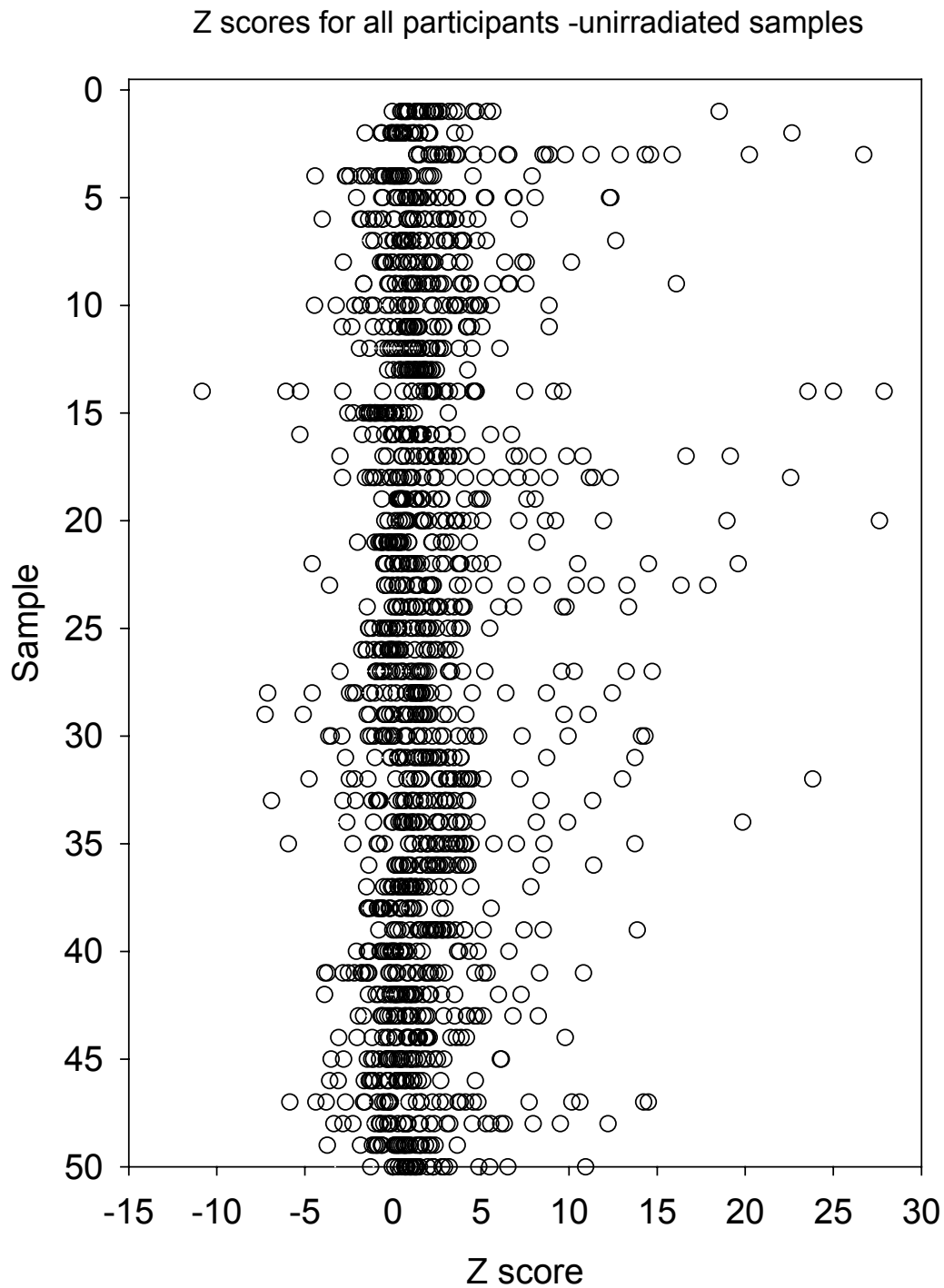


Figure 13: z-Scores for Unirradiated Test Materials Arranged by Laboratory

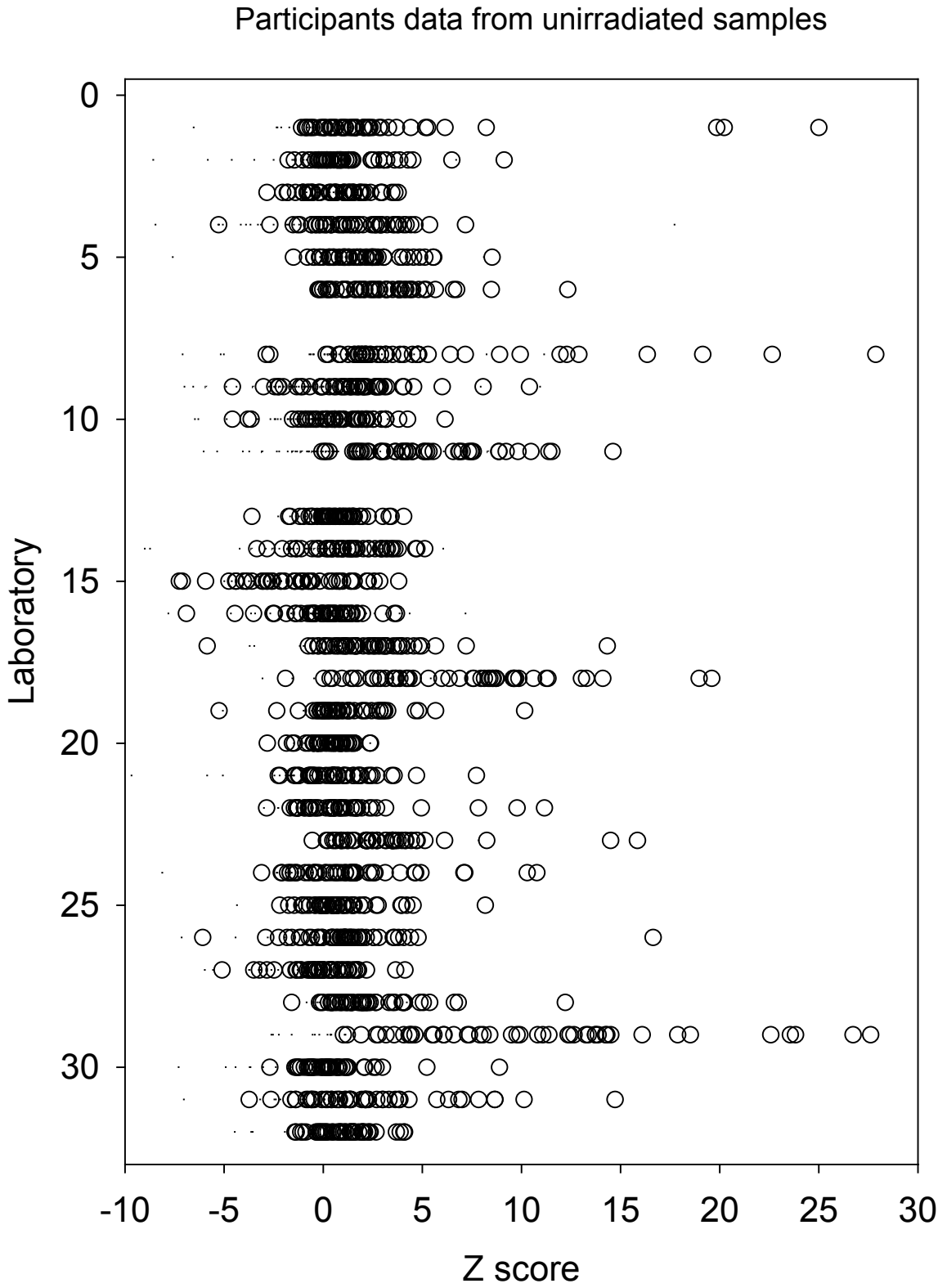


Figure 14: z-Score Contour Plot for Irradiated Test Materials

Irradiated Samples

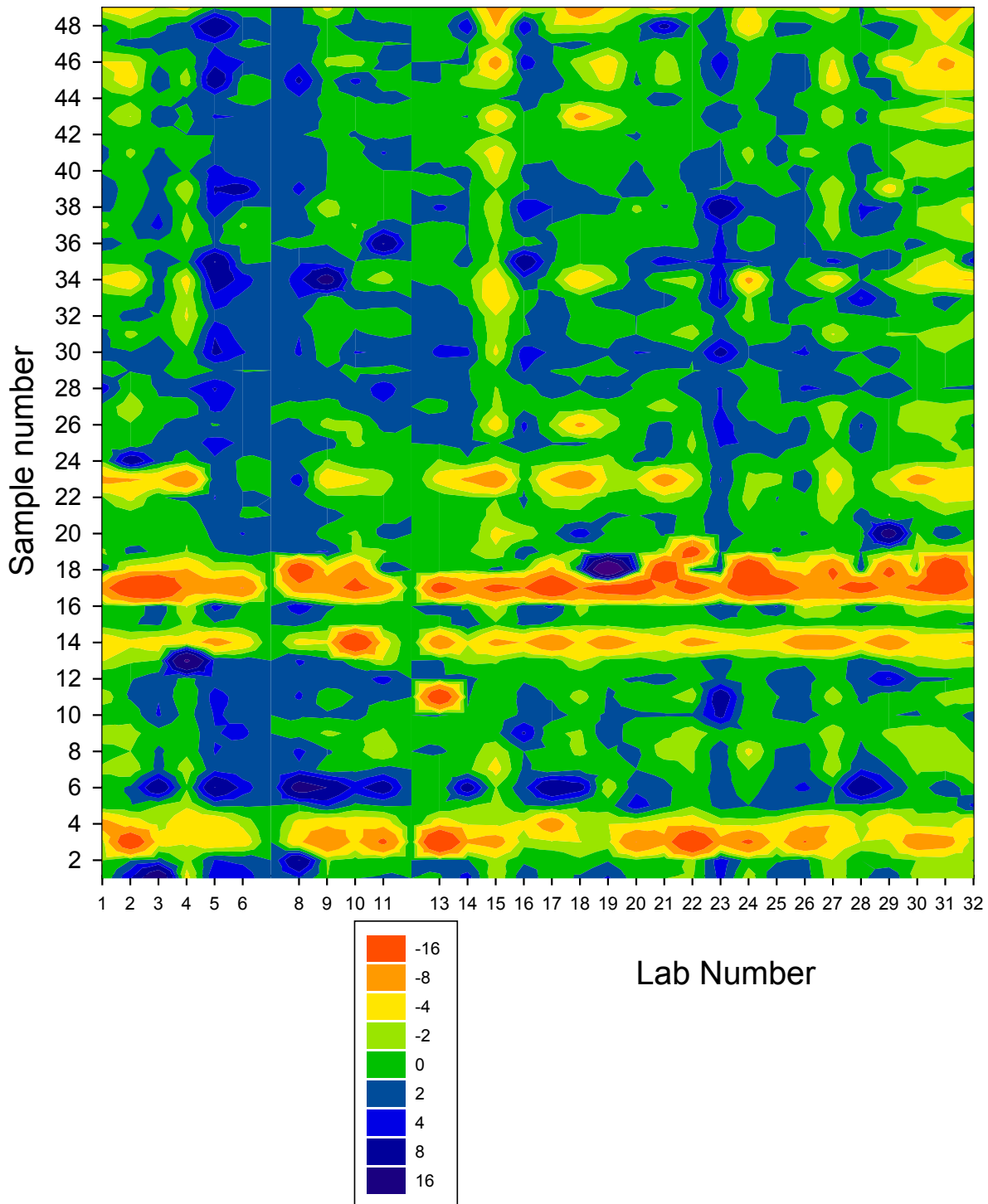


Figure 15: z-Score Contour Plot for Unirradiated Test Materials

Unirradiated Samples

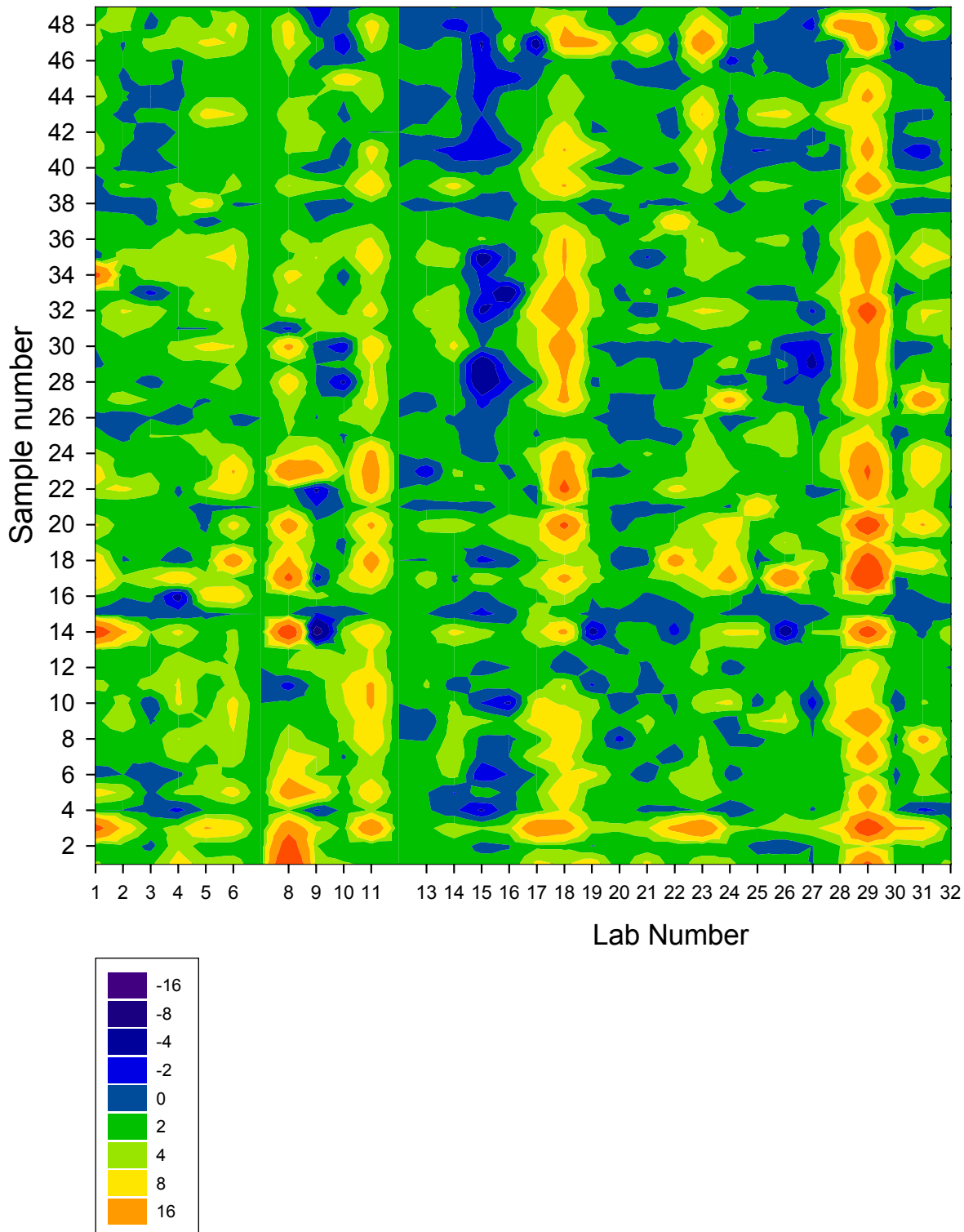
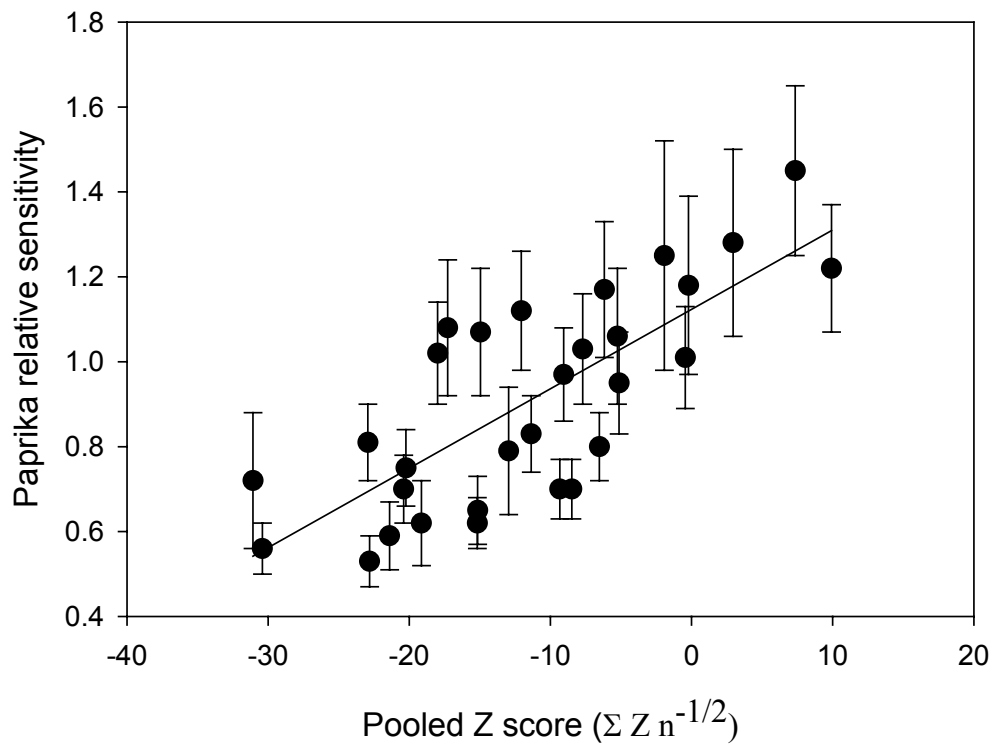


Figure 16: Pooled z-Scores for Irradiated Test Materials in Comparison With the Relative Sensitivities of Each Laboratory Based on the Paprika Standard



Intercept : 1.123
Slope : 0.0187
 r^2 : 0.58

Figure 17: Pooled z-Scores for Irradiated Test Materials in Comparison with Qualitative Outcomes

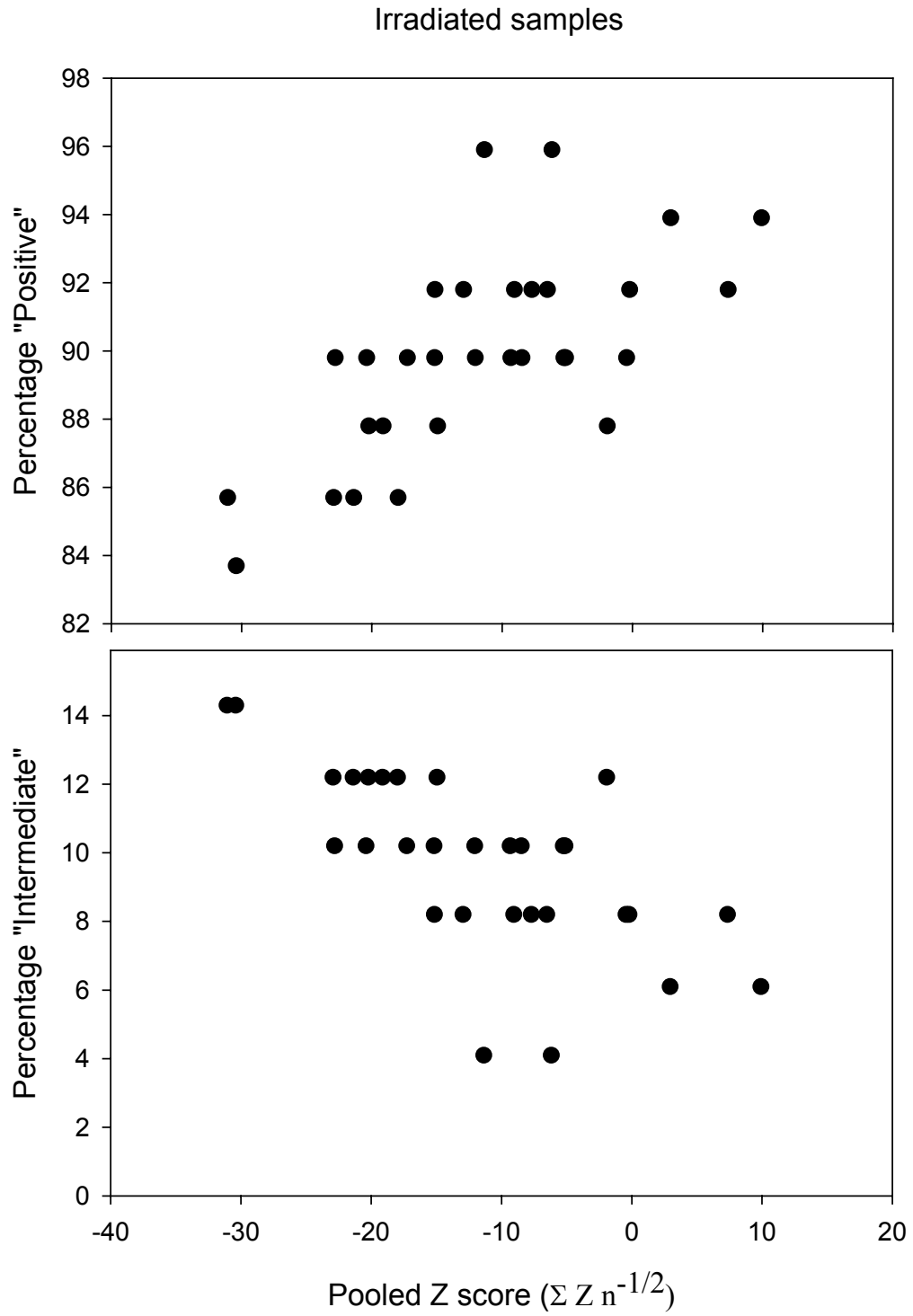
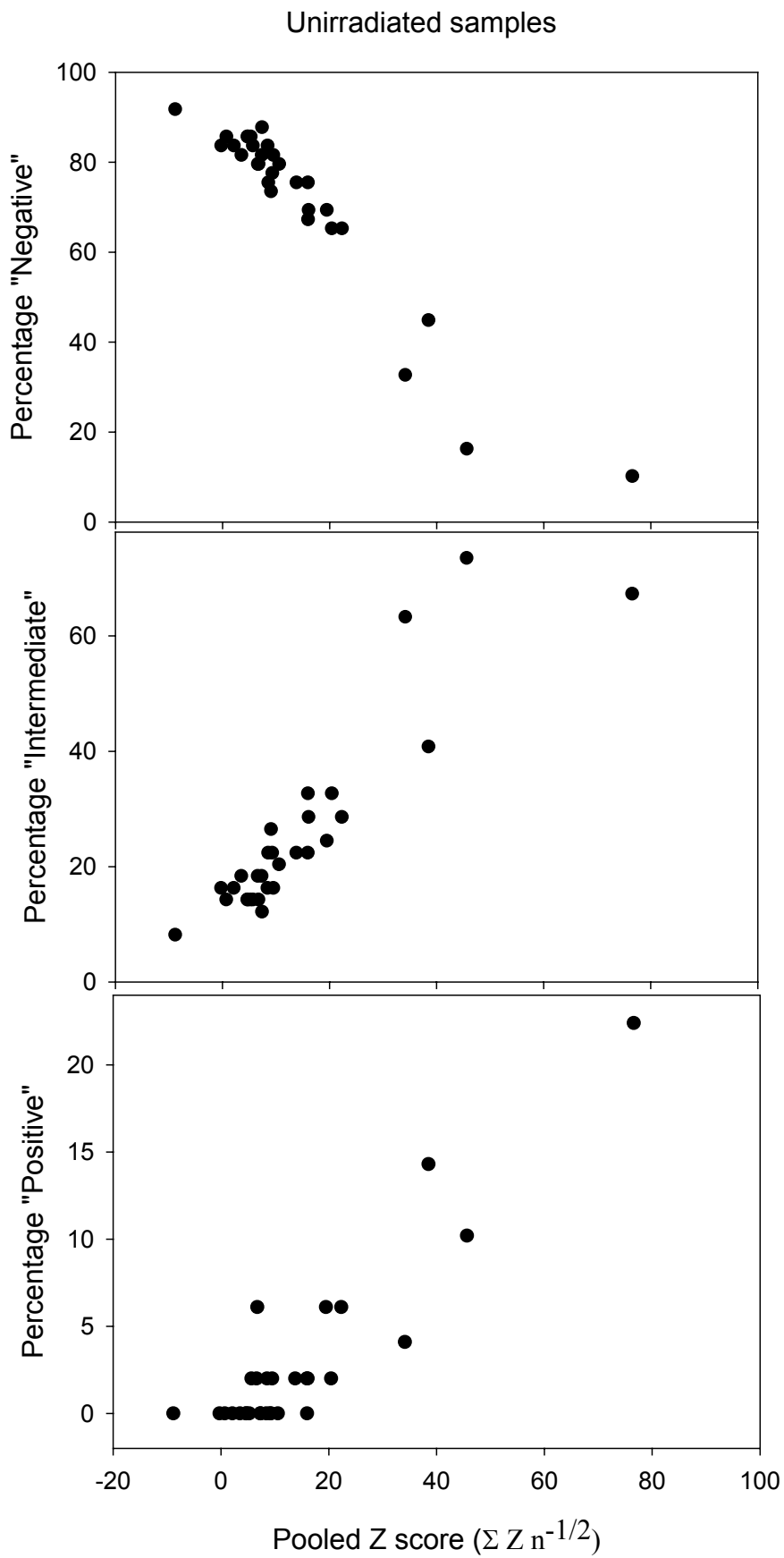


Figure 18: Pooled z-Scores for Unirradiated Test Materials in Comparison with Qualitative Outcome



APPENDIX A: TEST SAMPLE DISTRIBUTION AND STUDY PROTOCOL

**PLEASE FAX YOUR REPLY TO LORNA CARMICHAEL / SAFFRON FISK AT
44 1355229898**

LABORATORY :

We have received the Proficiency test materials on _____ (date)

Were the test materials in good condition on arrival ? _____

Any other comments :

List of items in package

Instructions

Standard irradiated paprika (2 pots) + spatula

6 packs of Petri dishes

Spatula

Disk – for summary and PSL data files plus Excel spreadsheet for results

Test materials

INSTRUCTIONS FOR PARTICIPANTS

Thank you for agreeing to participate in the FSA Proficiency Scheme.

Please answer the following questions:

1. Do you work in daylight or dark room conditions?
2. Do you run standard irradiated and unirradiated paprika at the start and end of each run?
3. How often do you run an empty chamber test?
4. Do you dispense the test materials as you are doing the run or do you dispense all the test materials prior to starting?

Test material analysis:

Set up your PSL system in your usual manner

To dispense a test material, place one level spatula of the material evenly into a new Petri dish

Run the paprika standard provided in 10 separately dispensed aliquots (portions)

Run each of the test test materials 1-98, one aliquot (portion) per test material, in numerical order

Please return the data in the following format entered into the Excel spreadsheet on your disk:

The 10 irradiated paprika standard results (terminal counts and classification)

The test test material results in the numbered sequence of 1 to 98. (If you wish to run further aliquots of certain test test materials please only run these after the 98 test test materials.)

Remember to ensure that you have saved the summary file and individual PSL files onto the disk

Please also e-mail us with your results and keep a back-up copy for yourselves

APPENDIX B – RAW DATA

Table 19: Unirradiated Reference Test Material Raw Data

Test Material	PSL Terminal Counts										Mean	Std Dev	CV (%)
1	249	304	324	254	381	271	261	352	238	289	292.3	47.5	16.25
2	347	239	254	374	314	367	324	292	273	226	301.0	52.7	17.52
3	294	258	269	189	156	240	240	225	181	231	228.3	42.4	18.56
4	760	1432	869	1339	1249	2022	1548	1762	2024	1311	1431.6	427.7	29.87
5	220	341	187	255	264	254	327	269	189	305	261.1	52.9	20.26
6	913	1287	944	798	1069	688	1030	705	567	920	892.1	211.2	23.67
7	357	232	449	449	371	231	477	315	282	332	349.5	88.5	25.32
8	292	314	373	318	400	347	337	214	303	328	322.6	50.1	15.52
9	243	307	230	339	265	232	226	222	283	250	259.7	39.0	15.01
10	351	395	306	330	365	388	315	308	334	324	341.6	32.1	9.38
11	336	292	287	307	335	297	230	274	320	333	301.1	33.1	11.00
12	244	307	304	291	260	276	149	230	204	323	258.8	53.7	20.74
13	277	311	253	289	257	500	251	229	271	211	284.9	80.8	28.36
14	320	260	319	200	276	303	253	296	303	313	284.3	37.8	13.31
15	1060	887	763	1974	433	633	4319	1878	993	1098	1403.8	1137.4	81.02
16	283	171	389	238	315	321	238	252	176	197	258	69.8	27.06
17	266	235	221	366	233	242	289	328	331	279	279	49.1	17.61
18	445	348	364	491	371	306	503	690	469	260	424.7	123.4	29.05
19	271	279	624	630	250	407	242	230	269	362	356.4	152.9	42.90
20	214	253	292	158	264	169	214	162	234	211	217.1	45.1	20.76
21	724	898	554	512	412	638	904	3095	592	586	891.5	790.1	88.63
22	264	276	274	314	358	291	395	263	268	387	309	52.0	16.84
23	306	288	224	282	279	305	269	367	219	315	285.4	43.3	15.16
24	271	211	323	282	355	311	301	251	225	339	286.9	47.8	16.67
25	458	503	459	617	955	1057	519	649	675	531	642.3	207.1	32.25
26	2300	1769	2734	2074	3425	2575	5230	641	2327	1839	2491.4	1204.0	48.33
27	304	240	312	251	370	346	329	359	294	254	305.9	46.31	15.14
28	342	384	419	309	340	373	466	293	386	304	361.6	54.8	15.16
29	444	381	406	386	408	351	288	368	391	505	392.8	56.9	14.49
30	301	293	258	213	318	265	300	289	261	265	276.3	30.2	10.91
31	271	239	242	254	259	310	183	261	263	298	258	34.6	13.41
32	292	359	251	306	330	254	318	287	303	293	299.3	32.6	10.88
33	419	438	324	384	387	388	283	480	344	324	377.1	59.5	15.79
34	437	423	454	365	520	550	459	396	388	444	443.6	57.3	12.91
35	309	192	285	231	251	269	245	213	257	254	250.6	33.7	13.47
36	301	210	204	214	197	306	237	264	240	238	241.1	38.5	15.99
37	327	220	311	180	381	62	148	313	271	174	238.7	98.5	41.25
38	870	1322	528	933	881	1284	551	707	480	1087	864.3	302.6	35.01
39	222	252	245	294	329	309	291	281	276	244	274.3	33.2	12.10
40	365	592	473	370	448	481	331	439	544	278	432.1	97.1	22.46
41	480	355	348	403	366	324	418	335	339	463	383.1	55.2	14.42
42	326	186	294	372	245	330	239	357	246	278	287.3	59.2	20.62
43	1433	1008	1576	1229	936	1752	1449	1350	1071	1793	1359.7	299.2	22.00
44	190	240	220	277	273	318	233	332	152	263	249.8	55.0	22.03
45	830	481	478	480	479	520	554	535	402	496	525.5	114.6	21.81
46	4983	3433	3678	2631	3084	4363	2635	2281	2966	3180	3323.4	831.2	25.01
47	417	481	446	404	430	515	461	364	450	476	444.4	43.05	9.69
48	236	347	338	417	300	380	317	393	325	372	342.5	52.2	15.24
49	1823	1698	1376	1789	1246	3322	1355	1267	809	1763	1644.8	669.9	40.73

Ref No	Terminal Counts									
SP8511	216737	201998	216402	249127	194733	232091	293047	229116	225601	179122
SP8512	30212	27475	27706	40380	32795	46379	29621	33130	40935	39099
SP8513	18955666	25010966	23110531	23193340	20250646	29170850	21359931	24083188	21905175	22126777
SP8514	45033231	51921235	37081451	38454796	16513772	33290988	54903307	46519985	38783848	32248300
SP8515	14303	20625	32340	13965	17571	16018	16042	13631	16670	28453
SP8516	280909	263933	247302	253574	256056	339122	209570	221921	267821	233893
SP8517	490365	575034	414727	519275	362878	397819	482354	551713	400913	436373
SP8518	301627	324268	319347	429968	378670	309643	310716	246625	386343	414597
SP8519	67666	66837	59741	104853	44319	50038	72206	95866	48024	50050
SP8520	12080	8973	9865	33675	19693	11386	21069	18453	23285	14582
SP8521	23228	35155	30822	26208	26962	27569	32236	42083	29737	27277
SP8522	974	969	1604	1808	803	4446	871	917	940	953
SP8523	362184	383462	421097	326817	259263	282610	556439	387035	317634	393034
SP8524	58397493	29209382	42922241	47044927	39997024	53767166	39933268	38336389	31426986	40021719
SP8525	46574	87314	53546	118968	223182	149556	40841	34812	31638	42343
SP8526	22795	18792	26669	29939	27708	23240	35304	28511	21650	21913
SP8527	56899745	66951680	62839725	49722640	58247189	66127918	54629697	47462377	56809922	59263725
SP8528	13837501	12077577	13726644	14223850	14579187	15772092	13912078	14648709	14353557	13273251
SP8529	109571	103358	132566	206282	145386	170976	86597	112104	128985	148799
SP8530	1234	2433	3519	3004	1523	1595	2073	1494	1517	3213
SP8531	252387	177475	380534	543278	375878	284216	298378	296181	360930	221590
SP8532	83838	107500	105910	86341	96745	115363	128168	137740	118985	116230
SP8533	79369	68382	67819	64340	67535	69214	61435	73002	64974	68592
SP8534	17899	16126	10961	9723	12931	10534	10163	13247	12122	8405
SP8535	128276	109547	116067	129779	120042	185870	111229	107580	152079	168917
SP8536	811287	949692	946616	1113243	1065261	1019692	807112	978180	1124393	1335027
SP8537	200690	197309	167092	208723	169113	152192	173285	273488	291423	145234
SP8538	2939	3158	2856	4062	5722	2357	3887	3765	2798	6082
SP8539	29604	21570	20251	238703	36326	22424	14184	25808	22634	21748
SP8540	18345	23779	29508	23342	30503	23599	28042	21708	22864	24020
SP8541	29604	30990	48589	39871	39949	44510	34830	36158	34921	30244
SP8542	67906	67317	80464	76203	64295	58977	61914	73634	167252	91011
SP8543	6552	13417	7756	7637	7837	5788	8119	5509	8277	8146
SP8544	2168996	2173573	1949021	2022524	2411060	2203852	2073099	2071933	1904046	2106571
SP8545	8817	6092	7762	9125	11270	10836	8065	13798	6337	8948
SP8546	8799	5544	6877	7633	5796	25298	4468	5659	3924	8828
SP8547	27429	22301	23940	24797	19646	20311	21206	16833	19186	19205
SP8548	110492	96848	78254	91927	102771	114220	99647	128088	115099	91297
SP8549	52271	47366	51311	89858	69137	56245	64698	51889	80631	80954
SP8571	161220	126033	273782	223850	130525	145614	170022	133904	189300	163454
SP8572	34281	31607	55809	33647	41451	37267	40630	29597	51058	48508
SP8573	2315	1838	4145	2371	2824	7190	21333	3140	2748	10399
SP8574	1798499	1611967	1385842	1360503	1269731	1317848	1559748	1571571	1373571	1679774
SP8575	2132	4980	5223	5334	5450	6558	22551	4061	3862	3875
SP8576	336975	270905	260542	265951	278991	267938	244932	251136	283783	242933
SP8577	920757	1050015	814564	1015339	815534	800924	907300	1013302	925485	915466
SP8578	95062	161036	141984	88833	98449	112983	67523	88844	91857	88109
SP8579	115694	104280	138503	121709	138838	150386	124168	125141	158064	149367
SP8580	1189133	1592854	1553944	1206142	1196838	1290494	1496934	1479676	1254800	1211325

Table 20: Irradiated Reference Test Material Raw Data

Table 21: Supplementary Homogeneity Data - Unirradiated Test Materials

Ref No	Terminal Counts									
	SP8522	236	277	213	183	254	290	272	192	273
SP8525	2984	665	679	780	481	1325	935	1022	5064	508
SP8531	532	1278	550	1029	709	448	607	471	436	961
SP8536	1458	5368	2352	3339	3702	2144	1809	2681	2020	2638
SP8539	495	433	469	414	342	336	417	372	290	425
SP8542	316	366	340	438	381	313	429	391	359	386
SP8546	214	267	208	244	284	260	233	248	210	268
SP8573	410	277	287	300	264	179	232	371	322	226
SP8575	263	209	291	228	167	261	247	273	240	285
SP8577	3498	4735	4607	3787	3172	2702	4173	3349	3522	3332

Table 22: Supplementary Homogeneity Data - Irradiated Test Materials

Ref No	Terminal Counts									
	SP8522	1985	1042	1301	1003	752	6600	1076	1024	1102
SP8525	61837	59467	108320	38958	53329	176986	145611	19090	98613	38082
SP8531	357949	444193	276333	315398	388305	481483	339611	261437	353339	281874
SP8536	181687	964676	240165	799702	993358	344960	247071	69776	210241	30097
SP8539	42040	30358	42243	37719	30496	28752	24496	20942	27662	21442
SP8542	37758	61156	66528	84994	70139	54134	57948	59274	82270	83298
SP8546	4909	4721	4827	7765	3460	5435	5201	3018	3510	4477
SP8573	2038	12435	2352	6858	4936	2561	5239	5813	3891	2244
SP8575	3965	6456	4554	3674	6906	3404	8424	4879	3070	3452
SP8577	919835	933200	897793	557815	799801	819928	772714	962409	799667	853290

Table 23: Linear Summary Statistics for the Supplementary Homogeneity Data Sets

Test Material	Unirradiated Test Materials			Irradiated Test Materials		
	Mean	Std Dev	CV (%)	Mean	Std Dev	CV (%)
12	243.2	37.1	15.2	1666.0	1767.5	106.1
15	1444.3	1466.8	101.6	80029.3	51070.7	63.8
21	702.1	289.7	41.3	349992.2	72202.1	20.6
26	2751.1	1142.0	41.5	408173.3	366899.2	89.9
29	399.3	63.5	15.9	30615.0	7772.0	25.4
32	371.9	42.3	11.4	65749.9	14957.1	22.7
36	243.6	26.8	11.0	4732.3	1336.2	28.2
42	286.8	68.8	24.0	4836.7	3157.8	65.3
44	246.4	37.7	15.3	4878.4	1796.3	36.8
46	3687.7	643.7	17.5	831645.2	115789.0	13.9

APPENDIX C – PARTICIPANT RAW DATA

Table 24: Raw Data Returned By Laboratory 1

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	173872	Positive	2	415	Negative
SP8512	3	23245	Positive	4	297	Negative
SP8513	5	15646778	Positive	6	11653	Positive
SP8514	7	1048391	Positive	8	1376	Intermediate
SP8515	9	16185	Positive	10	767	Intermediate
SP8516	11	218936	Positive	12	668	Negative
SP8517	13	319086	Positive	14	450	Negative
SP8518	15	278554	Positive	16	370	Negative
SP8519	17	24367	Positive	18	316	Negative
SP8520	19	14455	Positive	20	336	Negative
SP8521	21	16586	Positive	22	416	Negative
SP8522	23	1180	Intermediate	24	259	Negative
SP8523	25	147382	Positive	26	446	Negative
SP8524	27	10201958	Positive	28	10819	Positive
SP8525	29	29590	Positive	30	736	Intermediate
SP8526	31	22345	Positive	32	387	Negative
SP8527	33	15718841	Positive	34	1136	Intermediate
SP8528	35	15394226	Positive	36	2318	Intermediate
SP8529	37	72391	Positive	38	625	Negative
SP8530	39	1550	Intermediate	40	542	Negative
SP8531	41	248001	Positive	42	880	Intermediate
SP8532	43	80523	Positive	44	554	Negative
SP8533	45	34381	Positive	46	626	Negative
SP8534	47	8012	Positive	48	436	Negative
SP8535	49	106423	Positive	50	739	Intermediate
SP8536	51	795914	Positive	52	1631	Intermediate
SP8537	53	167635	Positive	54	360	Negative
SP8538	55	9761	Positive	56	458	Negative
SP8539	57	17955	Positive	58	364	Negative
SP8540	59	26261	Positive	60	277	Negative
SP8541	61	40384	Positive	62	323	Negative
SP8542	63	53041	Positive	64	350	Negative
SP8543	65	6054	Positive	66	402	Negative
SP8544	67	1549903	Positive	68	5421	Negative
SP8545	69	5876	Positive	70	220	Negative
SP8546	71	12628	Positive	72	278	Negative
SP8547	73	14482	Positive	74	435	Negative
SP8548	75	115087	Positive	76	591	Negative
SP8549	77	100935	Positive	78	247	Negative
SP8571	79	151165	Positive	80	463	Negative
SP8572	81	46122	Positive	82	571	Negative
SP8573	83	2234	Intermediate	84	439	Negative
SP8574	85	1245722	Positive	86	1659	Intermediate
SP8575	87	3383	Intermediate	88	529	Negative
SP8576	89	209026	Positive	90	804	Intermediate
SP8577	91	609031	Positive	92	3725	Intermediate
SP8578	93	85765	Positive	94	552	Negative
SP8579	95	138831	Positive	96	475	Negative
SP8580	97	734064	Positive	98	1981	Intermediate
Mean Value		1346704	Mean Value		1226.979592	
Std Deviation		3956051	Std Deviation		2281.970644	
Std Error		565150	Std Error		325.99	

Table 25: Raw Data Returned By Laboratory 2

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	375934	Positive	2	333	Negative
SP8512	3	33950	Positive	4	371	Negative
SP8513	5	874940	Positive	6	797	Intermediate
SP8514	7	5215679	Positive	8	1327	Intermediate
SP8515	9	17194	Positive	10	542	Negative
SP8516	11	266016	Positive	12	875	Intermediate
SP8517	13	268287	Positive	14	376	Negative
SP8518	15	240525	Positive	16	369	Negative
SP8519	17	28863	Positive	18	446	Negative
SP8520	19	8971	Positive	20	441	Negative
SP8521	21	31380	Positive	22	342	Negative
SP8522	23	1130	Intermediate	24	353	Negative
SP8523	25	217306	Positive	26	344	Negative
SP8524	27	15410743	Positive	28	1067	Intermediate
SP8525	29	61813	Positive	30	576	Negative
SP8526	31	17988	Positive	32	256	Negative
SP8527	33	1646223	Positive	34	419	Negative
SP8528	35	9748448	Positive	36	385	Negative
SP8529	37	151324	Positive	38	407	Negative
SP8530	39	1272	Intermediate	40	256	Negative
SP8531	41	223488	Positive	42	814	Intermediate
SP8532	43	50644	Positive	44	632	Negative
SP8533	45	37359	Positive	46	317	Negative
SP8534	47	56652	Positive	48	354	Negative
SP8535	49	97477	Positive	50	499	Negative
SP8536	51	764665	Positive	52	854	Intermediate
SP8537	53	87704	Positive	54	497	Negative
SP8538	55	2127	Intermediate	56	398	Negative
SP8539	57	31191	Positive	58	450	Negative
SP8540	59	24771	Positive	60	326	Negative
SP8541	61	23375	Positive	62	368	Negative
SP8542	63	100915	Positive	64	475	Negative
SP8543	65	5253	Positive	66	417	Negative
SP8544	67	1340988	Positive	68	460	Negative
SP8545	69	6481	Positive	70	379	Negative
SP8546	71	5686	Positive	72	271	Negative
SP8547	73	21112	Positive	74	433	Negative
SP8548	75	85234	Positive	76	481	Negative
SP8549	77	44079	Positive	78	366	Negative
SP8571	79	135320	Positive	80	396	Negative
SP8572	81	23165	Positive	82	377	Negative
SP8573	83	2795	Intermediate	84	333	Negative
SP8574	85	924516	Positive	86	1154	Intermediate
SP8575	87	2143	Intermediate	88	257	Negative
SP8576	89	155612	Positive	90	481	Negative
SP8577	91	614262	Positive	92	3386	Intermediate
SP8578	93	124120	Positive	94	434	Negative
SP8579	95	95382	Positive	96	559	Negative
SP8580	97	621861	Positive	98	5850	Positive
Mean Value		822987	Mean Value		659.1837	
Std Deviation		2640231	Std Deviation		892.7729	
Std Error		377175.8	Std Error		127.539	

Table 26: Raw Data Returned By Laboratory 3

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	1529198	Positive	2	370	Negative
SP8512	3	39710	Positive	4	264	Negative
SP8513	5	12203043	Positive	6	292	Negative*
SP8514	7	12939098	Positive	8	1053	Intermediate
SP8515	9	9883	Positive	10	228	Negative
SP8516	11	694400	Positive	12	566	Negative
SP8517	13	505608	Positive	14	407	Negative*
SP8518	15	360222	Positive	16	352	Negative
SP8519	17	49824	Positive	18	250	Negative
SP8520	19	41926	Positive	20	288	Negative
SP8521	21	40782	Negative	22	419	Negative
SP8522	23	2121	Intermediate	24	334	Negative
SP8523	25	239176	Positive	26	375	Negative
SP8524	27	11529846	Positive	28	377	Negative
SP8525	29	81504	Positive	30	580	Negative
SP8526	31	35284	Positive	32	292	Negative
SP8527	33	429189	Positive	34	528	Negative
SP8528	35	9085441	Positive	36	489	Negative
SP8529	37	119629	Positive	38	549	Negative
SP8530	39	1977	Intermediate	40	229	Negative
SP8531	41	221302	Positive	42	875	Intermediate
SP8532	43	106996	Positive	44	489	Negative
SP8533	45	40927	Positive	46	380	Negative
SP8534	47	15896	Positive	48	305	Negative
SP8535	49	144384	Positive	50	1150	Intermediate
SP8536	51	964692	Positive	52	2054	Intermediate
SP8537	53	177980	Positive	54	402	Negative
SP8538	55	3925	Intermediate	56	307	Negative
SP8539	57	37688	Positive	58	486	Negative
SP8540	59	32271	Positive	60	295	Negative
SP8541	61	35925	Positive	62	334	Negative
SP8542	63	73263	Positive	64	435	Negative
SP8543	65	10381	Positive	66	237	Negative*
SP8544	67	2271294	Positive	68	696	Negative
SP8545	69	12588	Positive	70	345	Negative
SP8546	71	5194	Positive	72	301	Negative
SP8547	73	32008	Positive	74	162	Negative
SP8548	75	128965	Positive	76	620	Negative
SP8549	77	74309	Positive	78	327	Negative
SP8571	79	223781	Positive	80	369	Negative
SP8572	81	42896	Positive	82	367	Negative
SP8573	83	2169	Intermediate	84	208	Negative
SP8574	85	1753614	Positive	86	1689	Intermediate
SP8575	87	3271	Intermediate	88	151	Negative
SP8576	89	325801	Positive	90	629	Negative*
SP8577	91	878828	Positive	92	4138	Intermediate
SP8578	93	120701	Positive	94	595	Negative
SP8579	95	123594	Positive	96	287	Negative
SP8580	97	856237	Positive	98	1705	Intermediate
Mean Value		1197117	Mean Value		583.3	
Std Deviation		3149333	Std Deviation		651.7	
Std Error		449904.8	Std Error		93.0962	

Table 27: Raw Data Returned By Laboratory 4

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	111329	Positive	2	671	Negative
SP8512	3	20338	Positive	4	556	Negative
SP8513	5	13474518	Positive	6	391	Negative
SP8514	7	4692728	Positive	8	572	Negative
SP8515	9	6085	Positive	10	436	Negative
SP8516	11	202369	Positive	12	756	Intermediate
SP8517	13	276249	Positive	14	730	Intermediate
SP8518	15	262522	Positive	16	632	Negative
SP8519	17	39719	Positive	18	287	Negative
SP8520	19	11441	Positive	20	511	Negative
SP8521	21	22016	Positive	22	488	Negative
SP8522	23	940	Intermediate	24	610	Negative
SP8523	25	16777172	Positive	26	421	Negative
SP8524	27	13321558	Positive	28	554	Negative
SP8525	29	12199	Positive	30	526	Negative
SP8526	31	11576	Positive	32	60	Negative
SP8527	33	16260781	Positive	34	948	Intermediate
SP8528	35	7756826	Positive	36	284	Negative
SP8529	37	76271	Positive	38	383	Negative
SP8530	39	1010	Intermediate	40	311	Negative
SP8531	41	208287	Positive	42	932	Intermediate
SP8532	43	114277	Positive	44	287	Negative
SP8533	45	23419	Positive	46	351	Negative
SP8534	47	8955	Positive	48	358	Negative
SP8535	49	151621	Positive	50	1104	Intermediate
SP8536	51	1206962	Positive	52	979	Intermediate
SP8537	53	121773	Positive	54	322	Negative
SP8538	55	6366	Positive	56	428	Negative
SP8539	57	9849	Positive	58	491	Negative
SP8540	59	19885	Positive	60	382	Negative
SP8541	61	21226	Positive	62	250	Negative
SP8542	63	21041	Positive	64	331	Negative
SP8543	65	3089	Intermediate	66	441	Negative
SP8544	67	1479659	Positive	68	694	Negative
SP8545	69	8168	Positive	70	419	Negative
SP8546	71	2571	Intermediate	72	360	Negative
SP8547	73	14069	Positive	74	500	Negative
SP8548	75	80133	Positive	76	2389	Intermediate
SP8549	77	25903	Positive	78	367	Negative
SP8571	79	156444	Positive	80	423	Negative
SP8572	81	29122	Positive	82	428	Negative
SP8573	83	4271	Intermediate	84	289	Negative
SP8574	85	1408612	Positive	86	1381	Intermediate
SP8575	87	5831	Positive	88	213	Negative
SP8576	89	200171	Positive	90	497	Negative
SP8577	91	790494	Positive	92	2977	Intermediate
SP8578	93	110929	Positive	94	576	Negative
SP8579	95	155188	Positive	96	572	Negative
SP8580	97	761660	Positive	98	1980	Intermediate
Mean Value		1642605	Mean Value		629.551	
Std Deviation		4238076	Std Deviation		536.9638	
Std Error		605439.5	Std Error		76.7091	

Table 28: Raw Data Returned By Laboratory 5

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	372155	Positive	2	446	Negative
SP8512	3	50839	Positive	4	326	Negative
SP8513	5	10147711	Positive	6	1185	Intermediate
SP8514	7	2849208	Positive	8	1504	Intermediate
SP8515	9	20161	Positive	10	438	Negative
SP8516	11	754327	Positive	12	1816	Intermediate
SP8517	13	576870	Positive	14	450	Negative
SP8518	15	486872	Positive	16	476	Negative
SP8519	17	109288	Positive	18	349	Negative
SP8520	19	40504	Positive	20	373	Negative
SP8521	21	48492	Positive	22	329	Negative
SP8522	23	2194	Intermediate	24	457	Negative
SP8523	25	524728	Positive	26	303	Negative
SP8524	27	4270648	Positive	28	330	Negative
SP8525	29	55844	Positive	30	827	Intermediate
SP8526	31	43467	Positive	32	1113	Intermediate
SP8527	33	14420856	Positive	34	420	Negative
SP8528	35	11118563	Positive	36	561	Negative
SP8529	37	124749	Positive	38	410	Negative
SP8530	39	2557	Intermediate	40	193	Negative
SP8531	41	494180	Positive	42	471	Negative
SP8532	43	151376	Positive	44	568	Negative
SP8533	45	76804	Positive	46	296	Negative
SP8534	47	17412	Positive	48	415	Negative
SP8535	49	234701	Positive	50	1268	Intermediate
SP8536	51	979860	Positive	52	4345	Intermediate
SP8537	53	379744	Positive	54	294	Negative
SP8538	55	13333	Positive	56	472	Negative
SP8539	57	31213	Positive	58	472	Negative
SP8540	59	49618	Positive	60	480	Negative
SP8541	61	69224	Positive	62	251	Negative
SP8542	63	114918	Positive	64	474	Negative
SP8543	65	17224	Positive	66	568	Negative
SP8544	67	3124411	Positive	68	602	Negative
SP8545	69	69422	Positive	70	431	Negative
SP8546	71	7932	Positive	72	383	Negative
SP8547	73	24177	Positive	74	96	Negative
SP8548	75	167816	Positive	76	6227	Positive
SP8549	77	165179	Positive	78	272	Negative
SP8571	79	350587	Positive	80	471	Negative
SP8572	81	41421	Positive	82	455	Negative
SP8573	83	4245	Intermediate	84	350	Negative
SP8574	85	1922031	Positive	86	4246	Intermediate
SP8575	87	8120	Positive	88	380	Negative
SP8576	89	522973	Positive	90	715	Intermediate
SP8577	91	1239224	Positive	92	4849	Intermediate
SP8578	93	161271	Positive	94	695	Negative
SP8579	95	377534	Positive	96	436	Negative
SP8580	97	1305918	Positive	98	3016	Intermediate
Mean Value		1186569	Mean Value		944.9796	
Std Deviation		2930793	Std Deviation		1309.158	
Std Error		418684.7	Std Error		187.0225	

Table 29: Raw Data Returned By Laboratory 6

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	357807	Positive	2	476	Negative
SP8512	3	44986	Positive	4	333	Negative
SP8513	5	11242797	Positive	6	812	Intermediate
SP8514	7	11911916	Positive	8	1568	Intermediate
SP8515	9	18924	Positive	10	756	Intermediate
SP8516	11	392248	Positive	12	1154	Intermediate
SP8517	13	495775	Positive	14	794	Intermediate
SP8518	15	394632	Positive	16	605	Negative
SP8519	17	133424	Positive	18	478	Negative
SP8520	19	29963	Positive	20	530	Negative
SP8521	21	35528	Positive	22	403	Negative
SP8522	23	1428	Intermediate	24	410	Negative
SP8523	25	436263	Positive	26	494	Negative
SP8524	27	10083906	Positive	28	397	Negative
SP8525	29	39654	Positive	30	1114	Intermediate
SP8526	31	24925	Positive	32	1534	Intermediate
SP8527	33	9142795	Positive	34	382	Negative
SP8528	35	10583384	Positive	36	13244	Positive
SP8529	37	159398	Positive	38	607	Negative
SP8530	39	4562	Intermediate	40	624	Negative
SP8531	41	285800	Positive	42	637	Negative
SP8532	43	112564	Positive	44	759	Intermediate
SP8533	45	66163	Positive	46	1044	Intermediate
SP8534	47	10561	Positive	48	559	Negative
SP8535	49	175478	Positive	50	666	Negative
SP8536	51	1119617	Positive	52	1996	Intermediate
SP8537	53	219288	Positive	54	352	Negative
SP8538	55	5301	Positive	56	547	Negative
SP8539	57	28103	Positive	58	530	Negative
SP8540	59	34108	Positive	60	440	Negative
SP8541	61	41865	Positive	62	401	Negative
SP8542	63	109295	Positive	64	398	Negative
SP8543	65	10707	Positive	66	653	Negative
SP8544	67	2612064	Positive	68	717	Intermediate
SP8545	69	8256	Positive	70	457	Negative
SP8546	71	5234	Positive	72	432	Negative
SP8547	73	15162	Positive	74	368	Negative
SP8548	75	100666	Positive	76	775	Intermediate
SP8549	77	214316	Positive	78	384	Negative
SP8571	79	178904	Positive	80	620	Negative
SP8572	81	45528	Positive	82	388	Negative
SP8573	83	4196	Intermediate	84	297	Negative
SP8574	85	1849720	Positive	86	3411	Intermediate
SP8575	87	2913	Intermediate	88	375	Negative
SP8576	89	250512	Positive	90	551	Negative
SP8577	91	1122876	Positive	92	4301	Intermediate
SP8578	93	92302	Positive	94	645	Negative
SP8579	95	157556	Positive	96	707	Intermediate
SP8580	97	1119995	Positive	98	2650	Intermediate
Mean Value		1337416	Mean Value		1077.041	
Std Deviation		3205626	Std Deviation		1936.732	
Std Error		457946.5	Std Error		276.676	

Table 30: Raw Data Returned By Laboratory 8

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	288077	Positive	2	38356	Positive
SP8512	3	154757	Positive	4	16889	Positive
SP8513	5	9786746	Positive	6	2787	Intermediate
SP8514	7	6496772	Positive	8	2735	Intermediate
SP8515	9	15528	Positive	10	3310	Intermediate
SP8516	11	1131220	Positive	12	4929	Intermediate
SP8517	13	584554	Positive	14	1181	Intermediate
SP8518	15	523036	Positive	16	541	Negative
SP8519	17	51746	Positive	18	330	Negative
SP8520	19	17418	Positive	20	349	Negative
SP8521	21	44371	Positive	22	214	Negative
SP8522	23	2384	Intermediate	24	416	Negative
SP8523	25	595670	Positive	26	422	Negative
SP8524	27	14135723	Positive	28	16470	Positive
SP8525	29	84231	Positive	30	1249	Intermediate
SP8526	31	49655	Positive	32	383	Negative
SP8527	33	14847952	Positive	34	7466	Positive
SP8528	35	1974962	Positive	36	5020	Positive
SP8529	37	208615	Positive	38	2014	Intermediate
SP8530	39	4132	Intermediate	40	2657	Intermediate
SP8531	41	566707	Positive	42	2540	Intermediate
SP8532	43	119036	Positive	44	349	Negative
SP8533	45	84123	Positive	46	3518	Intermediate
SP8534	47	12141	Positive	48	554	Negative
SP8535	49	178304	Positive	50	1099	Intermediate
SP8536	51	1053997	Positive	52	8146	Positive
SP8537	53	166511	Positive	54	494	Negative
SP8538	55	6732	Positive	56	931	Intermediate
SP8539	57	47098	Positive	58	507	Negative
SP8540	59	34998	Positive	60	858	Intermediate
SP8541	61	50449	Positive	62	174	Negative
SP8542	63	83438	Positive	64	487	Negative
SP8543	65	12782	Positive	66	619	Negative
SP8544	67	2595785	Positive	68	806	Intermediate
SP8545	69	13458	Positive	70	309	Negative
SP8546	71	5562	Positive	72	373	Negative
SP8547	73	25169	Positive	74	424	Negative
SP8548	75	114238	Positive	76	1090	Intermediate
SP8549	77	114664	Positive	78	448	Negative
SP8571	79	221056	Positive	80	519	Negative
SP8572	81	58462	Positive	82	527	Negative
SP8573	83	4369	Intermediate	84	446	Negative
SP8574	85	1729454	Positive	86	2944	Intermediate
SP8575	87	15186	Positive	88	386	Negative
SP8576	89	415159	Positive	90	742	Intermediate
SP8577	91	1105652	Positive	92	6195	Positive
SP8578	93	136256	Positive	94	713	Intermediate
SP8579	95	138013	Positive	96	802	Intermediate
SP8580	97	1425823	Positive	98	2030	Intermediate
Mean Value		1255759	Mean Value		2994.857	
Std Deviation		3234305	Std Deviation		6259.265	
Std Error		462043.5	Std Error		894.1807	

Table 31: Raw Data Returned By Laboratory 9

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	168,825	Positive	2	436	Negative
SP8512	3	23,028	Positive	4	427	Negative
SP8513	5	3,691,116	Positive	6	547	Negative
SP8514	7	3,479,230	Positive	8	619	Negative
SP8515	9	35,267	Positive	10	1,375	Intermediate
SP8516	11	737,904	Positive	12	1,355	Intermediate
SP8517	13	388,724	Positive	14	968	Intermediate
SP8518	15	354,663	Positive	16	403	Negative
SP8519	17	31,237	Positive	18	303	Negative
SP8520	19	18,630	Positive	20	369	Negative
SP8521	21	23,635	Positive	22	335	Negative
SP8522	23	2,537	Intermediate	24	497	Negative
SP8523	25	418,596	Positive	26	468	Negative
SP8524	27	16,197,415	Positive	28	58	Negative
SP8525	29	40,979	Positive	30	262	Negative
SP8526	31	26,935	Positive	32	535	Negative
SP8527	33	15,280,521	Positive	34	164	Negative
SP8528	35	9,255,990	Positive	36	447	Negative
SP8529	37	226,337	Positive	38	635	Negative
SP8530	39	1,277	Intermediate	40	244	Negative
SP8531	41	427,534	Positive	42	240	Negative
SP8532	43	85,520	Positive	44	146	Negative
SP8533	45	43,027	Positive	46	1,404	Intermediate
SP8534	47	7,080	Positive	48	799	Intermediate
SP8535	49	165,097	Positive	50	1,027	Intermediate
SP8536	51	661,421	Positive	52	2,068	Intermediate
SP8537	53	157,220	Positive	54	329	Negative
SP8538	55	4,847	Intermediate	56	352	Negative
SP8539	57	36,820	Positive	58	389	Negative
SP8540	59	19,213	Positive	60	244	Negative
SP8541	61	26,286	Positive	62	377	Negative
SP8542	63	46,689	Positive	64	397	Negative
SP8543	65	5,969	Positive	66	512	Negative
SP8544	67	4,384,551	Positive	68	660	Negative
SP8545	69	11,790	Positive	70	435	Negative
SP8546	71	6,891	Positive	72	304	Negative
SP8547	73	18,916	Positive	74	206	Negative
SP8548	75	61,396	Positive	76	637	Negative
SP8549	77	61,518	Positive	78	397	Negative
SP8571	79	166,350	Positive	80	310	Negative
SP8572	81	39,607	Positive	82	510	Negative
SP8573	83	3,303	Intermediate	84	510	Negative
SP8574	85	1,435,090	Positive	86	1,832	Intermediate
SP8575	87	2,949	Intermediate	88	396	Negative
SP8576	89	252,459	Positive	90	629	Negative
SP8577	91	718,110	Positive	92	2,464	Intermediate
SP8578	93	86,711	Positive	94	505	Negative
SP8579	95	128,798	Positive	96	234	Negative
SP8580	97	747,508	Positive	98	396	Negative
Mean Value		1,228,888	Mean Value		595	
Std Deviation		3408039.274	Std Deviation		495.7547	
Std Error		486862.75	Std Error		70.8221	

Table 32: Raw Data Returned By Laboratory 10

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	221515	Positive	2	409	Negative
SP8512	3	28119	Intermediate	4	320	Negative
SP8513	5	10541068	Positive	6	301	Negative
SP8514	7	4427903	Positive	8	1653	Intermediate
SP8515	9	15454	Positive	10	304	Negative
SP8516	11	393509	Positive	12	1335	Intermediate
SP8517	13	418676	Positive	14	307	Negative
SP8518	15	272375	Positive	16	458	Negative
SP8519	17	39825	Positive	18	354	Negative
SP8520	19	21739	Positive	20	483	Negative
SP8521	21	30247	Positive	22	492	Negative
SP8522	23	1875	Intermediate	24	458	Negative
SP8523	25	321763	Positive	26	421	Negative
SP8524	27	36535	Positive	28	433	Negative
SP8525	29	20105	Positive	30	622	Negative
SP8526	31	21503	Positive	32	328	Negative
SP8527	33	6455198	Positive	34	474	Negative
SP8528	35	5477290	Positive	36	437	Negative
SP8529	37	70412	Positive	38	262	Negative
SP8530	39	857	Intermediate	40	304	Negative
SP8531	41	248508	Positive	42	729	Intermediate
SP8532	43	83255	Positive	44	361	Negative
SP8533	45	48471	Positive	46	393	Negative
SP8534	47	11027	Positive	48	294	Negative
SP8535	49	81713	Positive	50	560	Negative
SP8536	51	670215	Positive	52	8681	Positive
SP8537	53	237783	Positive	54	331	Negative
SP8538	55	3809	Intermediate	56	181	Negative
SP8539	57	21781	Positive	58	437	Negative
SP8540	59	33873	Positive	60	181	Negative
SP8541	61	38122	Positive	62	402	Negative
SP8542	63	65512	Positive	64	355	Negative
SP8543	65	9908	Positive	66	411	Negative
SP8544	67	1938234	Positive	68	383	Negative
SP8545	69	8810	Positive	70	324	Negative
SP8546	71	3466	Intermediate	72	388	Negative
SP8547	73	15616	Positive	74	348	Negative
SP8548	75	101714	Positive	76	596	Negative
SP8549	77	48022	Positive	78	347	Negative
SP8571	79	106702	Positive	80	434	Negative
SP8572	81	34077	Positive	82	306	Negative
SP8573	83	4555	Intermediate	84	313	Negative
SP8574	85	1430517	Positive	86	1189	Intermediate
SP8575	87	4719	Intermediate	88	251	Negative
SP8576	89	346698	Positive	90	1639	Intermediate
SP8577	91	662768	Positive	92	2391	Intermediate
SP8578	93	97804	Positive	94	304	Negative
SP8579	95	141183	Positive	96	299	Negative
SP8580	97	1341250	Positive	98	1216	Intermediate
Mean Value		748083.3	Mean Value		697.9388	
Std Deviation		1959723	Std Deviation		1241.36	
Std Error		279960.4	Std Error		177.3371	

Table 33: Raw Data Returned By Laboratory 11

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	226321	Positive	2	378	Negative
SP8512	3	31450	Positive	4	303	Negative
SP8513	5	2526234	Positive	6	3901	Intermediate
SP8514	7	4852305	Positive	8	2892	Intermediate
SP8515	9	18801	Positive	10	1063	Intermediate
SP8516	11	575281	Positive	12	1854	Intermediate
SP8517	13	500815	Positive	14	955	Intermediate
SP8518	15	169061	Positive	16	1144	Intermediate
SP8519	17	32007	Positive	18	656	Negative
SP8520	19	10034	Positive	20	769	Intermediate
SP8521	21	31114	Positive	22	841	Intermediate
SP8522	23	5556	Positive	24	725	Intermediate
SP8523	25	161093	Positive	26	753	Intermediate
SP8524	27	13142379	Positive	28	841	Intermediate
SP8525	29	41146	Positive	30	1194	Intermediate
SP8526	31	24671	Positive	32	387	Negative
SP8527	33	13298298	Positive	34	901	Intermediate
SP8528	35	15447554	Positive	36	10112	Positive
SP8529	37	73968	Positive	38	2261	Intermediate
SP8530	39	2692	Intermediate	40	1498	Intermediate
SP8531	41	255326	Positive	42	2583	Intermediate
SP8532	43	81179	Positive	44	1651	Intermediate
SP8533	45	54894	Positive	46	1676	Intermediate
SP8534	47	9985	Positive	48	1551	Intermediate
SP8535	49	104987	Positive	50	1077	Intermediate
SP8536	51	1122440	Positive	52	11157	Positive
SP8537	53	271768	Positive	54	679	Negative
SP8538	55	11145	Positive	56	701	Intermediate
SP8539	57	19628	Positive	58	715	Intermediate
SP8540	59	31578	Positive	60	636	Negative
SP8541	61	34856	Positive	62	343	Negative
SP8542	63	50491	Positive	64	520	Negative
SP8543	65	11308	Positive	66	596	Negative
SP8544	67	1710767	Positive	68	731	Intermediate
SP8545	69	7183	Positive	70	651	Negative
SP8546	71	529039	Positive	72	461	Negative
SP8547	73	23405	Positive	74	544	Negative
SP8548	75	81607	Positive	76	1405	Intermediate
SP8549	77	57936	Positive	78	676	Negative
SP8571	79	165167	Positive	80	990	Intermediate
SP8572	81	63841	Positive	82	798	Intermediate
SP8573	83	3032	Intermediate	84	278	Negative
SP8574	85	1273298	Positive	86	2020	Intermediate
SP8575	87	6810	Positive	88	571	Negative
SP8576	89	251366	Positive	90	890	Intermediate
SP8577	91	972548	Positive	92	3478	Intermediate
SP8578	93	99789	Positive	94	665	Negative
SP8579	95	136491	Positive	96	837	Intermediate
SP8580	97	1108605	Positive	98	1787	Intermediate
Mean Value		1218801	Mean Value		1512.143	
Std Deviation		3399119	Std Deviation		2062.422	
Std Error		48558.5	Std Error		294.6317	

Table 34: Raw Data Returned By Laboratory 12 (Stand Alone Mode)

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1		Positive	2		Negative
SP8512	3		Positive	4		Negative
SP8513	5		Positive	6		Negative
SP8514	7		Positive	8		Negative
SP8515	9		Positive	10		Negative
SP8516	11		Positive	12		Negative
SP8517	13		Positive	14		Negative
SP8518	15		Positive	16		Negative
SP8519	17		Positive	18		Negative
SP8520	19		Positive	20		Negative
SP8521	21		Positive	22		Negative
SP8522	23		Intermediate	24		Negative
SP8523	25		Positive	26		Negative
SP8524	27		Positive	28		Negative
SP8525	29		Positive	30		Negative
SP8526	31		Positive	32		Negative
SP8527	33		Positive	34		Negative
SP8528	35		Positive	36		Negative
SP8529	37		Positive	38		Negative
SP8530	39		Intermediate	40		Negative
SP8531	41		Positive	42		Negative
SP8532	43		Positive	44		Negative
SP8533	45		Positive	46		Negative
SP8534	47		Positive	48		Negative
SP8535	49		Positive	50		Negative
SP8536	51		Positive	52		Negative
SP8537	53		Positive	54		Negative
SP8538	55		Positive	56		Negative
SP8539	57		Positive	58		Negative
SP8540	59		Positive	60		Negative
SP8541	61		Positive	62		Negative
SP8542	63		Positive	64		Negative
SP8543	65		Positive	66		Negative
SP8544	67		Positive	68		Negative
SP8545	69		Positive	70		Negative
SP8546	71		Positive	72		Negative
SP8547	73		Positive	74		Negative
SP8548	75		Positive	76		Negative
SP8549	77		Positive	78		Negative
SP8571	79		Positive	80		Negative
SP8572	81		Positive	82		Negative
SP8573	83		Positive	84		Negative
SP8574	85		Positive	86		Negative
SP8575	87		Intermediate	88		Negative
SP8576	89		Positive	90		Negative
SP8577	91		Positive	92		Negative
SP8578	93		Positive	94		Negative
SP8579	95		Positive	96		Negative
SP8580	97		Positive	98		Negative
Mean Value						
Std Deviation						

Table 35: Raw Data Returned By Laboratory 13

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	215983	Positive	2	365	Negative
SP8512	3	37982	Positive	4	312	Negative
SP8513	5	222036	Positive*	6	303	Negative
SP8514	7	5268481	Positive	8	1525	Intermediate
SP8515	9	15953	Positive	10	262	Negative
SP8516	11	204571	Positive	12	1059	Intermediate
SP8517	13	353247	Positive	14	455	Negative
SP8518	15	356576	Positive	16	314	Negative
SP8519	17	51754	Positive	18	203	Negative
SP8520	19	16293	Positive	20	361	Negative
SP8521	21	226	Negative	22	390	Negative
SP8522	23	1415	Intermediate	24	356	Negative
SP8523	25	376022	Positive	26	374	Negative
SP8524	27	2404816	Positive	28	351	Negative
SP8525	29	32721	Positive	30	1152	Intermediate
SP8526	31	30113	Positive	32	324	Negative
SP8527	33	4126357	Positive	34	497	Negative
SP8528	35	13988844	Positive	36	404	Negative
SP8529	37	84806	Positive	38	418	Negative
SP8530	39	1756	Intermediate	40	402	Negative
SP8531	41	193586	Positive	42	527	Negative
SP8532	43	97481	Positive	44	351	Negative
SP8533	45	46970	Positive	46	162	Negative
SP8534	47	7032	Positive	48	340	Negative
SP8535	49	133520	Positive	50	650	Negative
SP8536	51	1205453	Positive	52	2705	Intermediate
SP8537	53	168431	Positive	54	260	Negative
SP8538	55	4535	Intermediate	56	436	Negative
SP8539	57	34171	Positive	58	389	Negative
SP8540	59	36818	Positive	60	302	Negative
SP8541	61	43445	Positive	62	333	Negative
SP8542	63	82206	Positive	64	464	Negative
SP8543	65	10520	Positive	66	479	Negative
SP8544	67	2042685	Positive	68	472	Negative
SP8545	69	7770	Positive	70	393	Negative
SP8546	71	4503	Intermediate	72	324	Negative
SP8547	73	19725	Positive	74	368	Negative
SP8548	75	148788	Positive	76	629	Negative
SP8549	77	47748	Positive	78	341	Negative
SP8571	79	175391	Positive	80	579	Negative
SP8572	81	37737	Positive	82	298	Negative
SP8573	83	2650	Intermediate	84	297	Negative
SP8574	85	1457369	Positive	86	1243	Intermediate
SP8575	87	3347	Intermediate	88	185	Negative
SP8576	89	271710	Positive	90	566	Negative
SP8577	91	918623	Positive	92	4288	Intermediate
SP8578	93	65969	Positive	94	418	Negative
SP8579	95	109498	Positive	96	311	Negative
SP8580	97	1056895	Positive	98	1242	Intermediate
Mean Value		739276.1	Mean Value		595.4898	
Std Deviation		2188912	Std Deviation		688.3036	
Std Error		312701.7	Std Error		98.3291	

Table 36: Raw Data Returned By Laboratory 14

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	331082	Positive	2	324	Negative
SP8512	3	35309	Positive	4	354	Negative
SP8513	5	8045996	Positive	6	437	Negative
SP8514	7	10964782	Positive	8	813	Intermediate
SP8515	9	10624	Positive	10	167	Negative
SP8516	11	573475	Positive	12	1767	Intermediate
SP8517	13	362138	Positive	14	914	Intermediate
SP8518	15	292950	Positive	16	543	Negative
SP8519	17	39088	Positive	18	389	Negative
SP8520	19	15359	Positive	20	421	Negative
SP8521	21	30376	Positive	22	263	Negative
SP8522	23	1546	Intermediate	24	339	Negative
SP8523	25	206795	Positive	26	385	Negative
SP8524	27	16770399	Positive	28	561	Negative
SP8525	29	172859	Positive	30	470	Negative
SP8526	31	24180	Positive	32	323	Negative
SP8527	33	15527882	Positive	34	259	Negative
SP8528	35	12623787	Positive	36	655	Negative
SP8529	37	82044	Positive	38	362	Negative
SP8530	39	2013	Intermediate	40	445	Negative
SP8531	41	228168	Positive	42	540	Negative
SP8532	43	83973	Positive	44	382	Negative
SP8533	45	36235	Positive	46	401	Negative
SP8534	47	11518	Positive	48	307	Negative
SP8535	49	146065	Positive	50	666	Negative
SP8536	51	1130268	Positive	52	1988	Intermediate
SP8537	53	266040	Positive	54	414	Negative
SP8538	55	3845	Intermediate	56	445	Negative
SP8539	57	30798	Positive	58	500	Negative
SP8540	59	35564	Positive	60	469	Negative
SP8541	61	41245	Positive	62	372	Negative
SP8542	63	97754	Positive	64	424	Negative
SP8543	65	6483	Positive	66	601	Negative
SP8544	67	1927080	Positive	68	494	Negative
SP8545	69	10299	Positive	70	409	Negative
SP8546	71	7262	Positive	72	254	Negative
SP8547	73	21523	Positive	74	368	Negative
SP8548	75	105382	Positive	76	754	Intermediate
SP8549	77	65085	Positive	78	509	Negative
SP8571	79	195692	Positive	80	307	Negative
SP8572	81	24641	Positive	82	256	Negative
SP8573	83	2120	Intermediate	84	368	Negative
SP8574	85	1493221	Positive	86	1569	Intermediate
SP8575	87	3941	Intermediate	88	251	Negative
SP8576	89	204757	Positive	90	564	Negative
SP8577	91	941415	Positive	92	4567	Intermediate
SP8578	93	100652	Positive	94	518	Negative
SP8579	95	218632	Positive	96	196	Negative
SP8580	97	1247683	Positive	98	1613	Intermediate
Mean Value		1526531	Mean Value		626.4694	
Std Deviation		3987547	Std Deviation		695.3395	
Std Error		569649.6	Std Error		99.3342	

Table 37: Raw Data Returned By Laboratory 15

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	133322	Positive	2	329	Negative
SP8512	3	19124	Positive	4	266	Negative
SP8513	5	6265076	Positive	6	345	Negative
SP8514	7	11491559	Positive	8	326	Negative
SP8515	9	7582	Positive	10	346	Negative
SP8516	11	193633	Positive	12	329	Negative
SP8517	13	212581	Positive	14	256	Negative
SP8518	15	183895	Positive	16	290	Negative
SP8519	17	52822	Positive	18	371	Negative
SP8520	19	10166	Positive	20	279	Negative
SP8521	21	21414	Positive	22	324	Negative
SP8522	23	806	Intermediate	24	221	Negative
SP8523	25	219906	Positive	26	337	Negative
SP8524	27	5340398	Positive	28	427	Negative
SP8525	29	21131	Positive	30	211	Negative
SP8526	31	10888	Positive	32	184	Negative
SP8527	33	6084311	Positive	34	531	Negative
SP8528	35	14587722	Positive	36	183	Negative
SP8529	37	53643	Positive	38	374	Negative
SP8530	39	327	Negative	40	296	Negative
SP8531	41	136444	Positive	42	417	Negative
SP8532	43	79181	Positive	44	435	Negative
SP8533	45	25893	Positive	46	349	Negative
SP8534	47	6335	Positive	48	220	Negative
SP8535	49	127260	Positive	50	412	Negative
SP8536	51	408641	Positive	52	1248	Intermediate
SP8537	53	109969	Positive	54	190	Negative
SP8538	55	1864	Intermediate	56	124	Negative
SP8539	57	12495	Positive	58	134	Negative
SP8540	59	12055	Positive	60	269	Negative
SP8541	61	21275	Positive	62	221	Negative
SP8542	63	23949	Positive	64	177	Negative
SP8543	65	1312	Intermediate	66	266	Negative
SP8544	67	1368538	Positive	68	316	Negative
SP8545	69	4358	Intermediate	70	110	Negative
SP8546	71	2360	Intermediate	72	339	Negative
SP8547	73	14227	Positive	74	274	Negative
SP8548	75	60210	Positive	76	481	Negative
SP8549	77	40240	Positive	78	307	Negative
SP8571	79	55932	Positive	80	359	Negative
SP8572	81	12553	Positive	82	222	Negative
SP8573	83	900	Intermediate	84	122	Negative
SP8574	85	693932	Positive	86	854	Intermediate
SP8575	87	4910	Intermediate	88	118	Negative
SP8576	89	184325	Positive	90	305	Negative
SP8577	91	311871	Positive	92	1372	Intermediate
SP8578	93	52043	Positive	94	287	Negative
SP8579	95	43990	Positive	96	299	Negative
SP8580	97	320536	Positive	98	1128	Intermediate
Mean Value		1000978	Mean Value		358.7755	
Std Deviation		2899589	Std Deviation		262.116	
Std Error		414226.9	Std Error		37.4451	

Table 38: Raw Data Returned By Laboratory 16

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	270920	Positive	2	310	Negative
SP8512	3	31951	Positive	4	291	Negative
SP8513	5	16562629	Positive	6	405	Negative
SP8514	7	7747899	Positive	8	1167	Intermediate
SP8515	9	17154	Positive	10	224	Negative
SP8516	11	311247	Positive	12	554	Negative
SP8517	13	485011	Positive	14	340	Negative
SP8518	15	338352	Positive	16	296	Negative
SP8519	17	226520	Positive	18	307	Negative
SP8520	19	18576	Positive	20	226	Negative
SP8521	21	32976	Positive	22	331	Negative
SP8522	23	1116	Intermediate	24	250	Negative
SP8523	25	331592	Positive	26	356	Negative
SP8524	27	7767615	Positive	28	329	Negative
SP8525	29	98816	Positive	30	468	Negative
SP8526	31	32260	Positive	32	397	Negative
SP8527	33	9581683	Positive	34	353	Negative
SP8528	35	12511067	Positive	36	299	Negative
SP8529	37	190743	Positive	38	630	Negative
SP8530	39	516	Negative	40	454	Negative
SP8531	41	282423	Positive	42	1213	Intermediate
SP8532	43	116826	Positive	44	329	Negative
SP8533	45	65362	Positive	46	263	Negative
SP8534	47	9585	Positive	48	329	Negative
SP8535	49	163715	Positive	50	1018	Intermediate
SP8536	51	1489487	Positive	52	2498	Intermediate
SP8537	53	170540	Positive	54	300	Negative
SP8538	55	3020	Intermediate	56	248	Negative
SP8539	57	157965	Positive	58	368	Negative
SP8540	59	39342	Positive	60	321	Negative
SP8541	61	34950	Positive	62	304	Negative
SP8542	63	76540	Positive	64	255	Negative
SP8543	65	6102	Positive	66	124	Negative
SP8544	67	2310497	Positive	68	475	Negative
SP8545	69	54310	Positive	70	223	Negative
SP8546	71	4730	Intermediate	72	260	Negative
SP8547	73	26830	Positive	74	216	Negative
SP8548	75	176416	Positive	76	663	Negative
SP8549	77	58504	Positive	78	282	Negative
SP8571	79	187674	Positive	80	487	Negative
SP8572	81	32893	Positive	82	267	Negative
SP8573	83	2881	Intermediate	84	305	Negative
SP8574	85	1432319	Positive	86	2081	Intermediate
SP8575	87	8633	Positive	88	343	Negative
SP8576	89	274946	Positive	90	267	Negative
SP8577	91	1273565	Positive	92	3406	Intermediate
SP8578	93	106404	Positive	94	638	Negative
SP8579	95	222173	Positive	96	355	Negative
SP8580	97	887878	Positive	98	2774	Intermediate
Mean Value		1351737.8	Mean Value		583.7	
Std Deviation		3435833.0	Std Deviation		685.8	
Std Error		490833.3	Std Error		97.9725	

Table 39: Raw Data Returned By Laboratory 17

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	184722	Positive	2	592	Negative
SP8512	3	34059	Positive	4	390	Negative
SP8513	5	14636032	Positive	6	3687	Intermediate
SP8514	7	597485	Positive	8	1947	Intermediate
SP8515	9	19212	Positive	10	391	Negative
SP8516	11	710849	Positive	12	887	Intermediate
SP8517	13	393972	Positive	14	962	Intermediate
SP8518	15	313443	Positive	16	380	Negative
SP8519	17	38722	Positive	18	578	Negative
SP8520	19	23014	Positive	20	537	Negative
SP8521	21	28778	Positive	22	334	Negative
SP8522	23	1014	Intermediate	24	373	Negative
SP8523	25	311666	Positive	26	405	Negative
SP8524	27	1900156	Positive	28	450	Negative
SP8525	29	52122	Positive	30	8847	Positive
SP8526	31	38867	Positive	32	362	Negative
SP8527	33	1479596	Positive	34	466	Negative
SP8528	35	7190832	Positive	36	654	Negative
SP8529	37	96558	Positive	38	947	Intermediate
SP8530	39	1736	Intermediate	40	404	Negative
SP8531	41	223107	Positive	42	754	Intermediate
SP8532	43	61874	Positive	44	281	Negative
SP8533	45	37705	Positive	46	401	Negative
SP8534	47	8217	Positive	48	490	Negative
SP8535	49	135515	Positive	50	579	Negative
SP8536	51	694195	Positive	52	2661	Intermediate
SP8537	53	167935	Positive	54	558	Negative
SP8538	55	4590	Intermediate	56	368	Negative
SP8539	57	27895	Positive	58	593	Negative
SP8540	59	31590	Positive	60	420	Negative
SP8541	61	41775	Positive	62	443	Negative
SP8542	63	102598	Positive	64	654	Negative
SP8543	65	9469	Positive	66	734	Intermediate
SP8544	67	1914181	Positive	68	512	Negative
SP8545	69	9218	Positive	70	350	Negative
SP8546	71	8642	Positive	72	260	Negative
SP8547	73	20710	Positive	74	881	Intermediate
SP8548	75	136644	Positive	76	1245	Intermediate
SP8549	77	86856	Positive	78	420	Negative
SP8571	79	185010	Positive	80	1295	Intermediate
SP8572	81	37411	Positive	82	543	Negative
SP8573	83	3467	Intermediate	84	407	Negative
SP8574	85	1465623	Positive	86	1551	Intermediate
SP8575	87	3649	Intermediate	88	293	Negative
SP8576	89	305335	Positive	90	491	Negative
SP8577	91	919726	Positive	92	2707	Intermediate
SP8578	93	102945	Positive	94	248	Negative
SP8579	95	81585	Positive	96	496	Negative
SP8580	97	995572	Positive	98	3264	Intermediate
Mean Value		732160.7	Mean Value		969.2245	
Std Deviation		2305515	Std Deviation		1383.892	
Std Error		329359.3	Std Error		197.6988	

Table 40: Raw Data Returned By Laboratory 18

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	235452	Positive	2	515	Negative
SP8512	3	25073	Positive	4	389	Negative
SP8513	5	14052319	Positive	6	2021	Intermediate
SP8514	7	13414218	Positive	8	5978	Positive
SP8515	9	12008	Positive	10	1072	Intermediate
SP8516	11	526861	Positive	12	2427	Intermediate
SP8517	13	442574	Positive	14	1362	Intermediate
SP8518	15	216834	Positive	16	931	Intermediate
SP8519	17	31939	Positive	18	755	Intermediate
SP8520	19	12250	Positive	20	471	Negative
SP8521	21	17886	Positive	22	488	Negative
SP8522	23	996	Intermediate	24	162	Negative
SP8523	25	144577	Positive	26	279	Negative
SP8524	27	9695696	Positive	28	1149	Intermediate
SP8525	29	23118	Positive	30	1426	Intermediate
SP8526	31	15304	Positive	32	665	Negative
SP8527	33	10118897	Positive	34	1507	Intermediate
SP8528	35	15360058	Positive	36	807	Intermediate
SP8529	37	65728	Positive	38	5888	Positive
SP8530	39	7235	Positive	40	11691	Positive
SP8531	41	187832	Positive	42	3440	Intermediate
SP8532	43	67555	Positive	44	7167	Positive
SP8533	45	24805	Positive	46	2192	Intermediate
SP8534	47	7497	Positive	48	1498	Intermediate
SP8535	49	139788	Positive	50	926	Intermediate
SP8536	51	243048	Positive	52	5721	Positive
SP8537	53	162964	Positive	54	1334	Intermediate
SP8538	55	3667	Intermediate	56	1310	Intermediate
SP8539	57	23997	Positive	58	1621	Intermediate
SP8540	59	27479	Positive	60	1383	Intermediate
SP8541	61	31863	Positive	62	893	Intermediate
SP8542	63	67159	Positive	64	1235	Intermediate
SP8543	65	5990	Positive	66	2277	Intermediate
SP8544	67	1276212	Positive	68	1232	Intermediate
SP8545	69	6298	Positive	70	808	Intermediate
SP8546	71	3434	Intermediate	72	877	Intermediate
SP8547	73	17827	Positive	74	1166	Intermediate
SP8548	75	112474	Positive	76	1154	Intermediate
SP8549	77	72495	Positive	78	772	Intermediate
SP8571	79	116213	Positive	80	1153	Intermediate
SP8572	81	27355	Positive	82	1208	Intermediate
SP8573	83	4075	Intermediate	84	1025	Intermediate
SP8574	85	450529	Positive	86	2558	Intermediate
SP8575	87	3445	Intermediate	88	607	Negative
SP8576	89	231922	Positive	90	831	Intermediate
SP8577	91	678755	Positive	92	3623	Intermediate
SP8578	93	122696	Positive	94	1264	Intermediate
SP8579	95	80144	Positive	96	1241	Intermediate
SP8580	97	235242	Positive	98	2496	Intermediate
Mean Value		1405138	Mean Value		1897.9	
Std Deviation		3862763	Std Deviation		2102.8	
Std Error		551823.3	Std Error		300.4034	

Table 41: Raw Data Returned By Laboratory 19

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	305643	Positive	2	704	Negative
SP8512	3	33128	Positive	4	291	Negative
SP8513	5	15767371	Positive	6	393	Negative
SP8514	7	10161864!!!!	Positive	8	1583	Intermediate
SP8515	9	13520	Positive	10	311	Negative
SP8516	11	160970	Positive	12	2785	Intermediate
SP8517	13	419443	Positive	14	346	Negative
SP8518	15	325385	Positive	16	450	Negative
SP8519	17	110031	Positive	18	340	Negative
SP8520	19	17806	Positive	20	459	Negative
SP8521	21	30629	Positive	22	228	Negative
SP8522	23	1126	Intermediate	24	269	Negative
SP8523	25	266484	Positive	26	373	Negative
SP8524	27	2797171!!!!	Positive	28	131	Negative
SP8525	29	29647	Positive	30	919	Negative
SP8526	31	22800	Positive	32	252	Negative
SP8527	33	4071607!!!!	Positive	34	440	Negative
SP8528	35	1.36e+08	Positive	36	984	Negative
SP8529	37	102068	Positive	38	523	Negative
SP8530	39	1748	Intermediate	40	250	Negative
SP8531	41	329963	Positive	42	845	Negative
SP8532	43	87757	Positive	44	333	Negative
SP8533	45	52249	Positive	46	270	Negative
SP8534	47	6349	Positive	48	412	Negative
SP8535	49	112776	Positive	50	828	Negative
SP8536	51	632315	Positive	52	2218	Intermediate
SP8537	53	133825	Positive	54	386	Negative
SP8538	55	6803	Positive	56	332	Negative
SP8539	57	17120	Positive	58	470	Negative
SP8540	59	24869	Positive	60	274	Negative
SP8541	61	33373	Positive	62	268	Negative
SP8542	63	56195	Positive	64	416	Negative
SP8543	65	11471	Positive	66	604	Negative
SP8544	67	1669224	Positive	68	481	Negative
SP8545	69	6598	Positive	70	368	Negative
SP8546	71	3512	Intermediate	72	348	Negative
SP8547	73	16940	Positive	74	315	Negative
SP8548	75	119460	Positive	76	518	Negative
SP8549	77	54885	Positive	78	387	Negative
SP8571	79	119201	Positive	80	428	Negative
SP8572	81	33073	Positive	82	725	Negative
SP8573	83	3454	Intermediate	84	272	Negative
SP8574	85	851739	Positive	86	1353	Intermediate
SP8575	87	5056	Positive	88	334	Negative
SP8576	89	167151	Positive	90	540	Negative
SP8577	91	512159	Positive	92	3837	Intermediate
SP8578	93	77088	Positive	94	1209	Intermediate
SP8579	95	93176	Positive	96	376	Negative
SP8580	97	580027	Positive	98	2722	Intermediate
Mean Value		4448002	Mean Value		691.8367	
Std Deviation		24083551	Std Deviation		743.9986	
Std Error		2881432	Std Error		106.2855	

Table 42: Raw Data Returned By Laboratory 20

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	189865	Positive	2	311	Negative
SP8512	3	25011	Positive	4	333	Negative
SP8513	5	3312575	Positive	6	358	Negative
SP8514	7	9113364	Positive	8	1849	Intermediate
SP8515	9	50288	Positive	10	334	Negative
SP8516	11	304240	Positive	12	1058	Intermediate
SP8517	13	457720	Positive	14	512	Negative
SP8518	15	368745	Positive	16	198	Negative
SP8519	17	37840	Positive	18	296	Negative
SP8520	19	17746	Positive	20	287	Negative
SP8521	21	26231	Positive	22	343	Negative
SP8522	23	1310	Intermediate	24	312	Negative
SP8523	25	293611	Positive	26	258	Negative
SP8524	27	7193044	Positive	28	306	Negative
SP8525	29	65268	Positive	30	825	Intermediate
SP8526	31	21923	Positive	32	368	Negative
SP8527	33	2999501	Positive	34	335	Negative
SP8528	35	16539470	Positive	36	264	Negative
SP8529	37	102894	Positive	38	377	Negative
SP8530	39	1103	Intermediate	40	201	Negative
SP8531	41	299817	Positive	42	673	Negative
SP8532	43	103201	Positive	44	355	Negative
SP8533	45	52812	Positive	46	263	Negative
SP8534	47	12823	Positive	48	308	Negative
SP8535	49	120122	Positive	50	531	Negative
SP8536	51	921374	Positive	52	1904	Intermediate
SP8537	53	136800	Positive	54	264	Negative
SP8538	55	3370	Intermediate	56	433	Negative
SP8539	57	35478	Positive	58	379	Negative
SP8540	59	33943	Positive	60	260	Negative
SP8541	61	36567	Positive	62	316	Negative
SP8542	63	77837	Positive	64	325	Negative
SP8543	65	9382	Positive	66	332	Negative
SP8544	67	2236493	Positive	68	474	Negative
SP8545	69	10962	Positive	70	290	Negative
SP8546	71	5161	Positive	72	274	Negative
SP8547	73	18103	Positive	74	183	Negative
SP8548	75	72178	Positive	76	939	Intermediate
SP8549	77	91819	Positive	78	363	Negative
SP8571	79	188586	Positive	80	301	Negative
SP8572	81	37046	Positive	82	425	Negative
SP8573	83	4790	Intermediate	84	288	Negative
SP8574	85	1381860	Positive	86	1394	Intermediate
SP8575	87	3317	Intermediate	88	340	Negative
SP8576	89	278693	Positive	90	510	Negative
SP8577	91	887745	Positive	92	3040	Intermediate
SP8578	93	96466	Positive	94	518	Negative
SP8579	95	124812	Positive	96	333	Negative
SP8580	97	895509	Positive	98	1013	Intermediate
Mean Value		1006098	Mean Value		533.7347	
Std Deviation		2846598	Std Deviation		525.178	
Std Error		406656.9	Std Error		75.0254	

Table 43: Raw Data Returned By Laboratory 21

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	169384	Positive	2	606	Negative
SP8512	3	33809	Positive	4	325	Negative
SP8513	5	7195335	Positive	6	452	Negative
SP8514	7	5154062	Positive	8	1107	Intermediate
SP8515	9	21180	Positive	10	354	Negative
SP8516	11	273339	Positive	12	623	Negative
SP8517	13	417447	Positive	14	390	Negative
SP8518	15	197236	Positive	16	430	Negative
SP8519	17	41135	Positive	18	378	Negative
SP8520	19	16978	Positive	20	363	Negative
SP8521	21	22850	Positive	22	280	Negative
SP8522	23	1814	Intermediate	24	237	Negative
SP8523	25	224106	Positive	26	312	Negative
SP8524	27	13350796	Positive	28	364	Negative
SP8525	29	27405	Positive	30	435	Negative
SP8526	31	17729	Positive	32	220	Negative
SP8527	33	15155493	Positive	34	382	Negative
SP8528	35	1716766	Positive	36	338	Negative
SP8529	37	69635	Negative	38	400	Negative
SP8530	39	2337	Intermediate	40	238	Negative
SP8531	41	351215	Positive	42	523	Negative
SP8532	43	67080	Positive	44	370	Negative
SP8533	45	30156	Positive	46	309	Negative
SP8534	47	11385	Positive	48	418	Negative
SP8535	49	161797	Positive	50	544	Negative
SP8536	51	1118189	Positive	52	1498	Intermediate
SP8537	53	98208	Positive	54	280	Negative
SP8538	55	2692	Intermediate	56	420	Negative
SP8539	57	25918	Positive	58	435	Negative
SP8540	59	32173	Positive	60	238	Negative
SP8541	61	27506	Positive	62	420	Negative
SP8542	63	61605	Positive	64	235	Negative
SP8543	65	9516	Positive	66	543	Negative
SP8544	67	1817487	Positive	68	504	Negative
SP8545	69	19264	Positive	70	182	Negative
SP8546	71	5861	Positive	72	349	Negative
SP8547	73	15974	Positive	74	282	Negative
SP8548	75	103946	Positive	76	771	Intermediate
SP8549	77	52884	Positive	78	289	Negative
SP8571	79	115467	Positive	80	437	Negative
SP8572	81	34574	Positive	82	492	Negative
SP8573	83	2342	Intermediate	84	351	Negative
SP8574	85	1208430	Positive	86	1434	Intermediate
SP8575	87	11995	Positive	88	347	Negative
SP8576	89	200919	Positive	90	411	Negative
SP8577	91	701497	Positive	92	3868	Intermediate
SP8578	93	66838	Positive	94	951	Intermediate
SP8579	95	259638	Positive	96	373	Negative
SP8580	97	731922	Positive	98	1674	Intermediate
Mean Value		1050108	Mean Value		554.7347	
Std Deviation		30376614	Std Deviation		580.0692	
Std Error		442908.3	Std Error		81.1589	

Table 44: Raw Data Returned By Laboratory 22

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	162580	Positive	2	316	Negative
SP8512	3	20936	Positive	4	330	Negative
SP8513	5	328916	Positive	6	1515	Intermediate
SP8514	7	4710313	Positive	8	1158	Intermediate
SP8515	9	10495	Positive	10	357	Negative
SP8516	11	220011	Positive	12	1665	Intermediate
SP8517	13	323207	Positive	14	243	Negative
SP8518	15	229112	Positive	16	342	Negative
SP8519	17	24441	Positive	18	263	Negative
SP8520	19	17804	Positive	20	329	Negative
SP8521	21	17529	Positive	22	311	Negative
SP8522	23	785	Intermediate	24	332	Negative
SP8523	25	330540	Positive	26	346	Negative
SP8524	27	4537664	Positive	28	186	Negative
SP8525	29	17027	Positive	30	491	Negative
SP8526	31	19501	Positive	32	287	Negative
SP8527	33	4018171	Positive	34	421	Negative
SP8528	35	14523449	Positive	36	9507	Positive
SP8529	37	380	Negative	38	802	Intermediate
SP8530	39	1549	Intermediate	40	307	Negative
SP8531	41	257870	Positive	42	497	Negative
SP8532	43	83515	Positive	44	677	Negative
SP8533	45	50325	Positive	46	308	Negative
SP8534	47	8273	Positive	48	339	Negative
SP8535	49	78906	Positive	50	416	Negative
SP8536	51	770920	Positive	52	6350	Positive
SP8537	53	150992	Positive	54	392	Negative
SP8538	55	4963	Intermediate	56	296	Negative
SP8539	57	26893	Positive	58	320	Negative
SP8540	59	24681	Positive	60	264	Negative
SP8541	61	22246	Positive	62	271	Negative
SP8542	63	54575	Positive	64	420	Negative
SP8543	65	5994	Positive	66	322	Negative
SP8544	67	1719545	Positive	68	547	Negative
SP8545	69	14568	Positive	70	281	Negative
SP8546	71	4848	Intermediate	72	251	Negative
SP8547	73	21204	Positive	74	14419	Positive
SP8548	75	89881	Positive	76	648	Negative
SP8549	77	66175	Positive	78	330	Negative
SP8571	79	230259	Positive	80	355	Negative
SP8572	81	40035	Positive	82	462	Negative
SP8573	83	1968	Positive	84	229	Negative
SP8574	85	1370237	Positive	86	1141	Intermediate
SP8575	87	3494	Intermediate	88	294	Negative
SP8576	89	239878	Positive	90	393	Negative
SP8577	91	819858	Positive	92	3074	Intermediate
SP8578	93	75771	Positive	94	375	Negative
SP8579	95	125682	Positive	96	388	Negative
SP8580	97	948088	Positive	98	1582	Intermediate
Mean Value		751552.1	Mean Value		1125.49	
Std Deviation		2281654	Std Deviation		2509.333	
Std Error		325950.5	Std Error		358.4761	

Table 45: Raw Data Returned By Laboratory 23

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	322719	Positive	2	498	Negative
SP8512	3	64039	Positive	4	310	Negative
SP8513	5	6972440	Positive	6	4956	Intermediate
SP8514	7	12556742	Positive	8	1444	Intermediate
SP8515	9	22917	Positive	10	549	Negative
SP8516	11	288322	Positive	12	2052	Intermediate
SP8517	13	535581	Positive	14	652	Negative
SP8518	15	433269	Positive	16	465	Negative
SP8519	17	47733	Positive	18	294	Negative
SP8520	19	133939	Positive	20	469	Negative
SP8521	21	93852	Positive	22	345	Negative
SP8522	23	1378	Intermediate	24	474	Negative
SP8523	25	455380	Positive	26	463	Negative
SP8524	27	7460743	Positive	28	392	Negative
SP8525	29	46802	Positive	30	1655	Intermediate
SP8526	31	37337	Positive	32	448	Negative
SP8527	33	15012663	Positive	34	623	Negative
SP8528	35	16245372	Positive	36	771	Intermediate
SP8529	37	146804	Positive	38	929	Intermediate
SP8530	39	2769	Intermediate	40	492	Negative
SP8531	41	398432	Positive	42	1213	Intermediate
SP8532	43	127830	Positive	44	473	Negative
SP8533	45	79781	Positive	46	497	Negative
SP8534	47	14931	Positive	48	517	Negative
SP8535	49	205740	Positive	50	1532	Intermediate
SP8536	51	1667544	Positive	52	7090	Positive
SP8537	53	324047	Positive	54	381	Negative
SP8538	55	7076	Positive	56	454	Negative
SP8539	57	35537	Positive	58	429	Negative
SP8540	59	54497	Positive	60	258	Negative
SP8541	61	43857	Positive	62	348	Negative
SP8542	63	88998	Positive	64	484	Negative
SP8543	65	22228	Positive	66	455	Negative
SP8544	67	2791326	Positive	68	601	Negative
SP8545	69	16163	Positive	70	404	Negative
SP8546	71	27531	Positive	72	452	Negative
SP8547	73	29116	Positive	74	373	Negative
SP8548	75	311225	Positive	76	971	Intermediate
SP8549	77	60751	Positive	78	402	Negative
SP8571	79	208604	Positive	80	1015	Intermediate
SP8572	81	42422	Positive	82	775	Intermediate
SP8573	83	3860	Intermediate	84	600	Negative
SP8574	85	1820479	Positive	86	8588	Positive
SP8575	87	4737	Intermediate	88	651	Negative
SP8576	89	324788	Positive	90	612	Negative
SP8577	91	1299955	Positive	92	9896	Positive
SP8578	93	126962	Positive	94	1857	Intermediate
SP8579	95	164902	Positive	96	919	Intermediate
SP8580	97	1416837	Positive	98	3691	Intermediate
Mean Value		1481652	Mean Value		1310.592	
Std Deviation		3716024	Std Deviation		2063.455	
Std Error		530860.6	Std Error		294.7792	

Table 46: Raw Data Returned By Laboratory 24

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	143109	Positive	2	423	Negative
SP8512	3	28073	Positive	4	363	Negative
SP8513	5	2577726	Positive	6	370	Negative
SP8514	7	14292635	Positive	8	763	Intermediate
SP8515	9	18339	Positive	10	338	Negative
SP8516	11	224595	Positive	12	697	Negative
SP8517	13	333660	Positive	14	402	Negative
SP8518	15	151513	Positive	16	294	Negative
SP8519	17	58544	Positive	18	203	Negative
SP8520	19	6812	Positive	20	520	Negative
SP8521	21	24507	Positive	22	356	Negative
SP8522	23	685	Negative	24	185	Negative
SP8523	25	263948	Positive	26	394	Negative
SP8524	27	12879213	Positive	28	557	Negative
SP8525	29	48167	Positive	30	863	Intermediate
SP8526	31	22865	Positive	32	374	Negative
SP8527	33	2325372	Positive	34	1765	Intermediate
SP8528	35	948437	Positive	36	3023	Intermediate
SP8529	37	81816	Positive	38	2142	Intermediate
SP8530	39	1918	Intermediate	40	962	Intermediate
SP8531	41	179208	Positive	42	610	Negative
SP8532	43	68214	Positive	44	396	Negative
SP8533	45	57871	Positive	46	402	Negative
SP8534	47	8473	Positive	48	374	Negative
SP8535	49	184336	Positive	50	678	Negative
SP8536	51	1077160	Positive	52	990	Intermediate
SP8537	53	133167	Positive	54	1488	Intermediate
SP8538	55	3598	Intermediate	56	261	Negative
SP8539	57	16423	Positive	58	616	Negative
SP8540	59	25566	Positive	60	299	Negative
SP8541	61	33046	Positive	62	324	Negative
SP8542	63	34267	Positive	64	455	Negative
SP8543	65	4357	Intermediate	66	445	Negative
SP8544	67	1090715	Positive	68	527	Negative
SP8545	69	15192	Positive	70	356	Negative
SP8546	71	2840	Intermediate	72	243	Negative
SP8547	73	17417	Positive	74	285	Negative
SP8548	75	120501	Positive	76	627	Negative
SP8549	77	71720	Positive	78	277	Negative
SP8571	79	113543	Positive	80	261	Negative
SP8572	81	21995	Positive	82	314	Negative
SP8573	83	2754	Intermediate	84	256	Negative
SP8574	85	1401090	Positive	86	911	Intermediate
SP8575	87	3990	Intermediate	88	231	Negative
SP8576	89	226255	Positive	90	673	Negative
SP8577	91	761026	Positive	92	1539	Intermediate
SP8578	93	82403	Positive	94	484	Negative
SP8579	95	45209	Positive	96	431	Negative
SP8580	97	770456	Positive	98	790	Intermediate
Mean Value		836831.1	Mean Value		623.2041	
Std Deviation		2718590	Std Deviation		539.3701	
Std Error		388370	Std Error		77.0529	

Table 47: Raw Data Returned By Laboratory 25

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	280851	Positive	2	322	Negative
SP8512	3	32660	Positive	4	263	Negative
SP8513	5	12200511	Positive	6	335	Negative
SP8514	7	8582572	Positive	8	1435	Intermediate
SP8515	9	28640	Positive	10	353	Negative
SP8516	11	295845	Positive	12	1098	Intermediate
SP8517	13	483610	Positive	14	383	Negative
SP8518	15	351001	Positive	16	297	Negative
SP8519	17	41820	Positive	18	453	Negative
SP8520	19	18442	Positive	20	308	Negative
SP8521	21	29398	Positive	22	327	Negative
SP8522	23	1801	Intermediate	24	320	Negative
SP8523	25	305706	Positive	26	428	Negative
SP8524	27	9671370	Positive	28	546	Negative
SP8525	29	19661	Positive	30	876	Intermediate
SP8526	31	38489	Positive	32	156	Negative
SP8527	33	2727029	Positive	34	302	Negative
SP8528	35	7982383	Positive	36	308	Negative
SP8529	37	141873	Positive	38	394	Negative
SP8530	39	1410	Intermediate	40	219	Negative
SP8531	41	287458	Positive	42	71581	Positive
SP8532	43	109663	Positive	44	330	Negative
SP8533	45	55815	Positive	46	354	Negative
SP8534	47	11665	Positive	48	281	Negative
SP8535	49	146426	Positive	50	1930	Negative
SP8536	51	918565	Positive	52	2187	Intermediate
SP8537	53	184832	Positive	54	311	Negative
SP8538	55	3455	Intermediate	56	418	Negative
SP8539	57	27608	Positive	58	314	Negative
SP8540	59	30784	Positive	60	373	Negative
SP8541	61	29497	Positive	62	278	Negative
SP8542	63	96518	Positive	64	340	Negative
SP8543	65	9846	Positive	66	326	Negative
SP8544	67	2215881	Positive	68	509	Negative
SP8545	69	12028	Positive	70	308	Negative
SP8546	71	7663	Positive	72	329	Negative
SP8547	73	21560	Positive	74	321	Negative
SP8548	75	110801	Positive	76	969	Intermediate
SP8549	77	56312	Positive	78	382	Negative
SP8571	79	149426	Positive	80	410	Negative
SP8572	81	54909	Positive	82	280	Negative
SP8573	83	4257	Intermediate	84	328	Negative
SP8574	85	1484931	Positive	86	3457	Intermediate
SP8575	87	14324	Positive	88	344	Negative
SP8576	89	285163	Positive	90	521	Negative
SP8577	91	948065	Positive	92	3444	Intermediate
SP8578	93	92385	Positive	94	436	Negative
SP8579	95	142029	Positive	96	329	Negative
SP8580	97	1017852	Positive	98	3409	Intermediate
Mean Value		1056424	Mean Value		2120.857	
Std Deviation		2674621	Std Deviation		10162.5	
Std Error		382088.7	Std Error		1451.786	

Table 48: Raw Data Returned By Laboratory 26

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	256013	Positive	2	393	Negative
SP8512	3	38829	Positive	4	224	Negative
SP8513	5	3092908	Positive	6	389	Negative
SP8514	7	3321148	Positive	8	2477	Intermediate
SP8515	9	18042	Positive	10	317	Negative
SP8516	11	359554	Positive	12	1219	Intermediate
SP8517	13	517812	Positive	14	424	Negative
SP8518	15	377645	Positive	16	382	Negative
SP8519	17	50915	Positive	18	482	Negative
SP8520	19	21440	Positive	20	474	Negative
SP8521	21	33101	Positive	22	351	Negative
SP8522	23	1784	Intermediate	24	329	Negative
SP8523	25	340592	Positive	26	418	Negative
SP8524	27	2288426	Positive	28	116	Negative
SP8525	29	37900	Positive	30	979	Intermediate
SP8526	31	11035	Positive	32	245	Negative
SP8527	33	12476310	Positive	34	4844	Intermediate
SP8528	35	9660050	Positive	36	531	Negative
SP8529	37	79784	Positive	38	1551	Intermediate
SP8530	39	2182	Intermediate	40	247	Negative
SP8531	41	211040	Positive	42	915	Intermediate
SP8532	43	97371	Positive	44	372	Negative
SP8533	45	78677	Positive	46	281	Negative
SP8534	47	8315	Positive	48	440	Negative
SP8535	49	133077	Positive	50	1863	Intermediate
SP8536	51	1117765	Positive	52	14915	Positive
SP8537	53	165310	Positive	54	276	Negative
SP8538	55	7752	Positive	56	256	Negative
SP8539	57	35367	Positive	58	421	Negative
SP8540	59	35057	Positive	60	197	Negative
SP8541	61	45909	Positive	62	309	Negative
SP8542	63	54764	Positive	64	354	Negative
SP8543	65	8666	Positive	66	308	Negative
SP8544	67	1857570	Positive	68	531	Negative
SP8545	69	7727	Positive	70	290	Negative
SP8546	71	21103	Positive	72	354	Negative
SP8547	73	21443	Positive	74	275	Negative
SP8548	75	124478	Positive	76	1218	Intermediate
SP8549	77	64073	Positive	78	355	Negative
SP8571	79	200287	Positive	80	498	Negative
SP8572	81	21730	Positive	82	295	Negative
SP8573	83	4178	Intermediate	84	356	Negative
SP8574	85	1557329	Positive	86	3929	Intermediate
SP8575	87	2893	Intermediate	88	387	Negative
SP8576	89	311908	Positive	90	562	Negative
SP8577	91	972066	Positive	92	2489	Intermediate
SP8578	93	82869	Positive	94	430	Negative
SP8579	95	141711	Positive	96	301	Negative
SP8580	97	976430	Positive	98	1724	Intermediate
Mean Value		843925.2	Mean Value		1046.796	
Std Deviation		2282027	Std Deviation		2229.778	
Std Error		326003.9	Std Error		318.5397	

Table 49: Raw Data Returned By Laboratory 27

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	140234	Positive	2	287	Negative
SP8512	3	16940	Positive	4	296	Negative
SP8513	5	11179167	Positive	6	459	Negative
SP8514	7	2757847	Positive	8	1285	Intermediate
SP8515	9	16211	Positive	10	298	Negative
SP8516	11	253690	Positive	12	1103	Intermediate
SP8517	13	266720	Positive	14	454	Negative
SP8518	15	218132	Positive	16	320	Negative
SP8519	17	24530	Positive	18	247	Negative
SP8520	19	12396	Positive	20	253	Negative
SP8521	21	17283	Positive	22	293	Negative
SP8522	23	702	Intermediate	24	280	Negative
SP8523	25	257876	Positive	26	327	Negative
SP8524	27	2754213	Positive	28	388	Negative
SP8525	29	29147	Positive	30	384	Negative
SP8526	31	14092	Positive	32	373	Negative
SP8527	33	10898732	Positive	34	299	Negative
SP8528	35	4052646	Positive	36	1306	Negative
SP8529	37	73047	Positive	38	384	Negative
SP8530	39	1232	Intermediate	40	306	Negative
SP8531	41	133972	Positive	42	939	Intermediate
SP8532	43	59267	Positive	44	283	Negative
SP8533	45	45870	Positive	46	342	Negative
SP8534	47	5743	Positive	48	354	Negative
SP8535	49	94809	Positive	50	609	Negative
SP8536	51	615689	Positive	52	1562	Intermediate
SP8537	53	83549	Positive	54	271	Negative
SP8538	55	6046	Positive	56	294	Negative
SP8539	57	30016	Positive	58	184	Negative
SP8540	59	25137	Positive	60	184	Negative
SP8541	61	18140	Positive	62	270	Negative
SP8542	63	66021	Positive	64	227	Negative
SP8543	65	7305	Positive	66	495	Negative
SP8544	67	1366142	Positive	68	441	Negative
SP8545	69	17995	Positive	70	233	Negative
SP8546	71	2773	Intermediate	72	193	Negative
SP8547	73	13563	Positive	74	250	Negative
SP8548	75	65758	Positive	76	673	Negative
SP8549	77	25845	Positive	78	331	Negative
SP8571	79	117150	Positive	80	383	Negative
SP8572	81	30030	Positive	82	394	Negative
SP8573	83	1785	Intermediate	84	237	Negative
SP8574	85	964590	Positive	86	1958	Intermediate
SP8575	87	2890	Intermediate	88	301	Negative
SP8576	89	156454	Positive	90	420	Negative
SP8577	91	593827	Positive	92	2452	Intermediate
SP8578	93	67871	Positive	94	433	Negative
SP8579	95	108784	Positive	96	213	Negative
SP8580	97	689805	Positive	98	1057	Intermediate
Mean Value		783707.4	Mean Value		516.8367	
Std Deviation		2280645	Std Deviation		473.6938	
Std Error		325806.4	Std Error		67.6706	

Table 50: Raw Data Returned By Laboratory 28

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	204753	Positive	2	406	Negative
SP8512	3	34234	Positive	4	424	Negative
SP8513	5	14243953	Positive	6	641	Negative
SP8514	7	13576475	Positive	8	2607	Intermediate
SP8515	9	15979	Positive	10	282	Negative
SP8516	11	745162	Positive	12	1105	Intermediate
SP8517	13	631365	Positive	14	552	Negative
SP8518	15	361400	Positive	16	406	Negative
SP8519	17	58341	Positive	18	661	Negative
SP8520	19	12930	Positive	20	533	Negative
SP8521	21	31676	Positive	22	539	Negative
SP8522	23	2369	Intermediate	24	423	Negative
SP8523	25	485778	Positive	26	363	Negative
SP8524	27	8476550	Positive	28	393	Negative
SP8525	29	28249	Positive	30	2025	Intermediate
SP8526	31	29161	Positive	32	449	Negative
SP8527	33	4700815	Positive	34	414	Negative
SP8528	35	15755832	Positive	36	462	Negative
SP8529	37	137512	Positive	38	539	Negative
SP8530	39	1566	Intermediate	40	456	Negative
SP8531	41	424001	Positive	42	1012	Intermediate
SP8532	43	88461	Positive	44	305	Negative
SP8533	45	64398	Positive	46	523	Negative
SP8534	47	9591	Positive	48	570	Negative
SP8535	49	168046	Positive	50	1705	Intermediate
SP8536	51	1414349	Positive	52	2774	Intermediate
SP8537	53	166721	Positive	54	506	Negative
SP8538	55	3648	Intermediate	56	441	Negative
SP8539	57	18491	Positive	58	522	Negative
SP8540	59	24365	Positive	60	336	Negative
SP8541	61	34697	Positive	62	266	Negative
SP8542	63	72633	Positive	64	398	Negative
SP8543	65	21593	Positive	66	716	Intermediate
SP8544	67	2122636	Intermediate	68	615	Positive
SP8545	69	9378	Positive	70	323	Negative
SP8546	71	4207	Intermediate	72	450	Negative
SP8547	73	27845	Positive	74	635	Negative
SP8548	75	145719	Positive	76	947	Intermediate
SP8549	77	73003	Positive	78	324	Negative
SP8571	79	203451	Positive	80	412	Negative
SP8572	81	52049	Positive	82	370	Negative
SP8573	83	1959	Intermediate	84	339	Negative
SP8574	85	1633502	Positive	86	6206	Positive
SP8575	87	3160	Intermediate	88	346	Negative
SP8576	89	279735	Positive	90	589	Negative
SP8577	91	1088546	Positive	92	4302	Intermediate
SP8578	93	72259	Positive	94	378	Negative
SP8579	95	131717	Positive	96	2481	Intermediate
SP8580	97	1387163	Positive	98	1859	Intermediate
Mean Value		1413907	Mean Value		904.6939	
Std Deviation		3667282	Std Deviation		1113.633	
Std Error		523897.4	Std Error		159.0905	

Table 51: Raw Data Returned By Laboratory 29

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	286984	Positive	2	5300	Positive
SP8512	3	27195	Positive	4	614	Negative
SP8513	5	14614523	Positive	6	41466	Positive
SP8514	7	2554717	Positive	8	17798	Positive
SP8515	9	13286	Positive	10	3356	Intermediate
SP8516	11	363429	Positive	12	2065	Intermediate
SP8517	13	469140	Positive	14	9285	Positive
SP8518	15	274039	Positive	16	1108	Intermediate
SP8519	17	29565	Positive	18	2555	Intermediate
SP8520	19	15506	Positive	20	569	Negative
SP8521	21	24475	Positive	22	503	Negative
SP8522	23	11885	Positive	24	1051	Intermediate
SP8523	25	276386	Positive	26	434	Negative
SP8524	27	2384699	Positive	28	8772	Positive
SP8525	29	27397	Positive	30	2500	Intermediate
SP8526	31	22870	Positive	32	530	Negative
SP8527	33	13784117	Positive	34	266513	Positive
SP8528	35	3820186	Positive	36	236967	Positive
SP8529	37	77845	Positive	38	7051	Positive
SP8530	39	155669	Positive	40	72848	Positive
SP8531	41	161232	Positive	42	8289	Positive
SP8532	43	81227	Positive	44	3157	Intermediate
SP8533	45	52166	Positive	46	4451	Intermediate
SP8534	47	10795	Positive	48	2862	Intermediate
SP8535	49	95250	Positive	50	3057	Intermediate
SP8536	51	787863	Positive	52	12327	Positive
SP8537	53	142040	Positive	54	2356	Intermediate
SP8538	55	5943	Positive	56	2289	Intermediate
SP8539	57	26479	Positive	58	1982	Intermediate
SP8540	59	28840	Positive	60	1416	Intermediate
SP8541	61	25161	Positive	62	1832	Intermediate
SP8542	63	82410	Positive	64	4019	Intermediate
SP8543	65	8276	Positive	66	1424	Intermediate
SP8544	67	1775834	Positive	68	1544	Intermediate
SP8545	69	14450	Positive	70	1644	Intermediate
SP8546	71	4783	Intermediate	72	1390	Intermediate
SP8547	73	22464	Positive	74	2311	Intermediate
SP8548	75	132967	Positive	76	2164	Intermediate
SP8549	77	17777	Positive	78	1482	Intermediate
SP8571	79	158866	Positive	80	1951	Intermediate
SP8572	81	26092	Positive	82	1710	Intermediate
SP8573	83	3752	Intermediate	84	1353	Intermediate
SP8574	85	976828	Positive	86	3787	Intermediate
SP8575	87	6634	Positive	88	2438	Intermediate
SP8576	89	278967	Positive	90	1625	Intermediate
SP8577	91	510865	Positive	92	4134	Intermediate
SP8578	93	93483	Positive	94	1810	Intermediate
SP8579	95	151665	Positive	96	1595	Intermediate
SP8580	97	768352	Positive	98	2219	Intermediate
Mean Value		932354.6	Mean Value		15589.86	
Std Deviation		2865843	Std Deviation		50677.55	
Std Error		409406.1	Std Error		7239.649	

Table 52: Raw Data Returned By Laboratory 30

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	150139	Positive	2	352	Negative
SP8512	3	23400	Positive	4	366	Negative
SP8513	5	4870125	Positive	6	1275	Intermediate
SP8514	7	14496254	Positive	8	1393	Intermediate
SP8515	9	11988	Positive	10	269	Negative
SP8516	11	218473	Positive	12	758	Intermediate
SP8517	13	316907	Positive	14	400	Negative
SP8518	15	200128	Positive	16	283	Negative
SP8519	17	22244	Positive	18	301	Negative
SP8520	19	17646	Positive	20	303	Negative
SP8521	21	26320	Positive	22	309	Negative
SP8522	23	1475	Intermediate	24	328	Negative
SP8523	25	187418	Positive	26	303	Negative
SP8524	27	10591875	Positive	28	383	Negative
SP8525	29	31272	Positive	30	494	Negative
SP8526	31	13237	Positive	32	246	Negative
SP8527	33	7271327	Positive	34	250	Negative
SP8528	35	12887383	Positive	36	1785	Intermediate
SP8529	37	60673	Positive	38	439	Negative
SP8530	39	932	Intermediate	40	374	Negative
SP8531	41	256105	Positive	42	3922	Intermediate
SP8532	43	75020	Positive	44	319	Negative
SP8533	45	32393	Positive	46	293	Negative
SP8534	47	7926	Positive	48	291	Negative
SP8535	49	114088	Positive	50	441	Negative
SP8536	51	637621	Positive	52	3302	Intermediate
SP8537	53	95534	Positive	54	261	Negative
SP8538	55	3302	Intermediate	56	400	Negative
SP8539	57	13271	Positive	58	361	Negative
SP8540	59	19172	Positive	60	256	Negative
SP8541	61	25916	Positive	62	287	Negative
SP8542	63	71001	Positive	64	303	Negative
SP8543	65	5759	Positive	66	328	Negative
SP8544	67	1512749	Positive	68	467	Negative
SP8545	69	4557	Intermediate	70	330	Negative
SP8546	71	10286	Positive	72	245	Negative
SP8547	73	15790	Positive	74	256	Negative
SP8548	75	77087	Positive	76	627	Negative
SP8549	77	76579	Positive	78	371	Negative
SP8571	79	74929	Positive	80	418	Negative
SP8572	81	18657	Positive	82	311	Negative
SP8573	83	1359	Intermediate	84	255	Negative
SP8574	85	968962	Positive	86	1288	Intermediate
SP8575	87	3484	Intermediate	88	305	Negative
SP8576	89	135400	Positive	90	649	Negative
SP8577	91	637485	Positive	92	2345	Intermediate
SP8578	93	55262	Positive	94	339	Negative
SP8579	95	101958	Positive	96	322	Negative
SP8580	97	790375	Positive	98	1943	Intermediate
Mean Value		1168189	Mean Value		649.9184	
Std Deviation		3237811	Std Deviation		776.841	
Std Error		462544.4	Std Error		110.9773	

Table 53: Raw Data Returned By Laboratory 31

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	140059	Positive	2	357	Negative
SP8512	3	21622	Positive	4	431	Negative
SP8513	5	6188275	Positive	6	1218	Intermediate
SP8514	7	16716241	Positive	8	581	Negative
SP8515	9	10888	Positive	10	477	Negative
SP8516	11	323235	Positive	12	1508	Intermediate
SP8517	13	322041	Positive	14	747	*Negative*
SP8518	15	211604	Positive	16	1762	*Negative*
SP8519	17	31964	Positive	18	273	Negative
SP8520	19	9096	Positive	20	415	Negative
SP8521	21	18646	Positive	22	351	Negative
SP8522	23	1409	Intermediate	24	296	Negative
SP8523	25	156262	Positive	26	337	Negative
SP8524	27	9181554	Positive	28	259	Negative
SP8525	29	51703	Positive	30	650	Negative
SP8526	31	15914	Positive	32	246	Negative
SP8527	33	3755711	Positive	34	314	Negative
SP8528	35	547275	Positive	36	3731	Intermediate
SP8529	37	53778	Positive	38	389	Negative
SP8530	39	3967	Intermediate	40	1327	*Negative*
SP8531	41	165898	Positive	42	4718	Intermediate
SP8532	43	48960	Positive	44	563	Negative
SP8533	45	42359	Positive	46	832	*Negative*
SP8534	47	8064	Positive	48	924	*Negative*
SP8535	49	86376	Positive	50	853	*Negative*
SP8536	51	619144	Positive	52	2384	Intermediate
SP8537	53	109478	Positive	54	2958	Intermediate
SP8538	55	3679	Intermediate	56	494	Negative
SP8539	57	14257	Positive	58	518	Negative
SP8540	59	17798	Positive	60	234	Negative
SP8541	61	20919	Positive	62	445	Negative
SP8542	63	68903	Positive	64	477	Negative
SP8543	65	9849	Positive	66	387	Negative
SP8544	67	1254801	Positive	68	620	Negative
SP8545	69	3080	Intermediate	70	546	Negative
SP8546	71	3593	Intermediate	72	419	Negative
SP8547	73	13340	Positive	74	389	Negative
SP8548	75	73920	Positive	76	496	Negative
SP8549	77	49456	Positive	78	353	Negative
SP8571	79	83950	Positive	80	371	Negative
SP8572	81	21366	Positive	82	226	Negative
SP8573	83	3822	Intermediate	84	372	Negative
SP8574	85	722429	Positive	86	1156	Intermediate
SP8575	87	1537	*Positive*	88	340	Negative
SP8576	89	146805	Positive	90	448	Negative
SP8577	91	363331	Positive	92	2193	Intermediate
SP8578	93	37816	Positive	94	423	Negative
SP8579	95	55034	Positive	96	949	*Negative*
SP8580	97	317322	Positive	98	1106	Intermediate
Mean Value		859765.9	Mean Value		854.3469	
Std Deviation		2825953	Std Deviation		918.3658	
Std Error		403707.6	Std Error		131.1951	

Table 54: Raw Data Returned by Laboratory 32

Suerc Ref No	Pot No	Terminal Counts	Classification	Pot No	Terminal Counts	Classification
SP8511	1	161830	Positive	2	419	Negative
SP8512	3	23924	Positive	4	310	Negative
SP8513	5	16400179	Positive	6	293	Negative
SP8514	7	3140230	Positive	8	880	Intermediate
SP8515	9	38935	Positive	10	385	Negative
SP8516	11	204433	Positive	12	1142	Intermediate
SP8517	13	264976	Positive	14	501	Negative
SP8518	15	242851	Positive	16	368	Negative
SP8519	17	43376	Positive	18	263	Negative
SP8520	19	23491	Positive	20	386	Negative
SP8521	21	16167	Positive	22	354	Negative
SP8522	23	870	Intermediate	24	245	Negative
SP8523	25	197572	Positive	26	400	Negative
SP8524	27	5963699	Positive	28	483	Negative
SP8525	29	99303	Positive	30	580	Negative
SP8526	31	12561	Positive	32	311	Negative
SP8527	33	13315124	Positive	34	375	Negative
SP8528	35	10543553	Positive	36	548	Negative
SP8529	37	51541	Positive	38	403	Negative
SP8530	39	1280	Intermediate	40	327	Negative
SP8531	41	247988	Positive	42	657	Negative
SP8532	43	51717	Positive	44	308	Negative
SP8533	45	39335	Positive	46	389	Negative
SP8534	47	6515	Positive	48	449	Negative
SP8535	49	93062	Positive	50	580	Negative
SP8536	51	1050224	Positive	52	2196	Intermediate
SP8537	53	87778	Positive	54	374	Negative
SP8538	55	3776	Intermediate	56	452	Negative
SP8539	57	19188	Positive	58	432	Negative
SP8540	59	22679	Positive	60	355	Negative
SP8541	61	24470	Positive	62	357	Negative
SP8542	63	36051	Positive	64	455	Negative
SP8543	65	6499	Positive	66	448	Negative
SP8544	67	1197954	Positive	68	437	Negative
SP8545	69	19776	Positive	70	437	Negative
SP8546	71	2624	Intermediate	72	323	Negative
SP8547	73	11831	Positive	74	498	Negative
SP8548	75	47744	Positive	76	487	Negative
SP8549	77	68148	Positive	78	448	Negative
SP8571	79	112900	Positive	80	467	Negative
SP8572	81	19271	Positive	82	500	Negative
SP8573	83	1379	Intermediate	84	290	Negative
SP8574	85	884003	Positive	86	1637	Intermediate
SP8575	87	2240	Intermediate	88	224	Negative
SP8576	89	140838	Positive	90	486	Negative
SP8577	91	550275	Positive	92	2470	Intermediate
SP8578	93	103315	Positive	94	406	Negative
SP8579	95	114961	Positive	96	389	Negative
SP8580	97	731153	Positive	98	2118	Intermediate
Mean Value		1151910	Mean Value		572.2857	
Std Deviation		3361527	Std Deviation		493.4273	
Std Error		480218.2	Std Error		70.4896	