MATRIX OF PEER REVIEW COMMENTS: Charge questions for *U.S. Environmental Protection Agency (EPA), "Counts Per Minute (CPM) Electronic Calculator"*						
Commenter	**Charge Question**	**Guidance Section**	**Line Number**	**Details**	**Comment**	**EPA Resolution**
Spreng	A1				I found the web site to be generally well-organized and easy to navigate. I feel that there are some places in the documentation that could be improved by moving or eliminating text to reduce redundancy and to be more internally consistent.	EPA will revise the language as appropriate considering other comments.
Spreng	A2				Yes – The calculator should allow decision makers at Superfund sites to benefit from the advantages of real-time surveys. The process of correlating field measurements with lab analyses should become more standardized.	No change
Spreng	A3				Generally, yes. Some of the instructions within the calculator differ from the step-by-step instructions in the User's Guides. The texts are not conflicting, but they should be consistent.	No change
Spreng	A4				See suggested redline-strikeout changes and comments to the calculator documents.	No change
Spreng	B1a				Assumptions are clear and reasonable, but are potentially so limiting that results may not always be representative. It might be useful to explain whether the overall effect of these assumptions is likely to be conservative – or not.	No change
Spreng	B1b				The limitations are adequately described. Ludlum gamma detectors apparently are the presumed detectors. Variability among other types/brands of field detectors, beyond the detector sensitivity and energy response factor mentioned in 3.4.3, may be another limitation.	Noted.
Spreng	B1c				Generally yes. As mentioned above, there are places where the text clarity suffers from redundancy and inconsistent used of terms.	No change
Spreng	B1d				No response.	No change
Spreng	B2				Yes – I am not aware of any newer superseding sources.	No change
Spreng	B3a				Yes.	No change
Spreng	B3b				Yes. Should/could a link to the MCNP software documentation be provided?	No change
Spreng	B4a				N/A - My background and experience are not adequate enough to respond.	No change
Spreng	B4b				N/A - My background and experience are not adequate enough to respond. Should/could a link to the MCNP software documentation be provided?	No change
Spreng	B5				My background and experience are not adequate enough to respond regarding source material and photonic energy data.	No change
Spreng	B6				No guidance or reference is provided for determining appropriate detector height. It might be useful to explain the sensitivity of this parameter.	Noted; however, the detector height is a drop-down option in the CPM tool.
Spreng	B7				Yes, the rationale seems reasonable especially for the purpose of estimating detector readings.	No change
Spreng	B8				Yes.	No change
Spreng	B9				See suggested redline-strikeout changes and comments to the calculator documents.	No change
Spreng	C1				Yes. The results can be copied and printed out, but it might be helpful to include a print option in the calculator.	No change
Spreng	C2				No response.	No change
Spreng	C3				The derivation of the Area Calculator results is fairly straightforward. The Volume Calculator results, however, depend on the MCNP black box. The explanation for this model is adequate for the purposes of the User's Guide, but a link to documentation for MCNP software might be useful.	The Asano 2022 paper defines the new MCNP/SHIFT methodology.
Spreng	C4				No.	No change
Spreng	C5				The variability among the radionuclides is adequately explained.	No change

Commenter	Charge Question	Guidance Section	Line Number	Details	Comment	EPA Resolution
Spreng	C6				Add titles on the pages of the Calculator that correspond to the titles in Section 2 of the User's Guide to help connect the Guide to the Calculator (e.g., Radionuclides of Interest, Activity Concentrations, etc.). Highlight the statement, "**I have read and understand the limitations of this model set forth in the User Guide and FAQ**", which must be checked in order to move to page 2 of the calculator.	No change
Spreng	D				See suggested redline-strikeout changes and comments to the calculator documents.	EPA will revise the language as appropriate considering other comments.
King	A1				The web site is well organized, described, easy to navigate, and can be user friendly (there are several bugs, as stated), though a deeper review might leave the user with questions. The site is similar to PRG calculators, and that familiarity is helpful. There are some minor issues to consider that could be addressed by a thorough technical editor. For example: • Consistent use of acronyms (e.g., cpm v. CPM) • Consistent use of proper units (e.g., CF = cpm/pCi/g v. CPM/pCi) • Light blue text difficult to see on a green header	No change
King	A2				Does the calculator provide source concentration to CPM conversions? The answer is yes. Would I use the calculator as presented? The answer is maybe. The site works well enough (though there are lots of bugs), so there is hope that the calculator will eventually provide investigators with useful information. The bottom line is that if an investigator assumes the detector will respond as the Calculator predicts, there is a risk of overlooking contamination. The higher than expected Calculator generated values are probably geometry related (from a semi-infinite plane or contamination). If the CPM result is supposed to represent the average measurement across the exposure unit, then that should be stated.	The user's guide has been completely rewritten. The Asano 2022 paper defines the new MCNP/SHIFT methodology.
King	A3				The calculator seems to match the documentation, though some of the information cannot be verified. For example, the gamma energies and yields cannot be verified (no values given), some of the output is inconsistent with input, and the documentation needs to be edited.	No change
King	A4				• Bottom line is that the investigator should be able to use the Calculator to reasonably predict what one would find in the field. Results should be similar to those presented in MARSSIM Table 6.7 or as described in Abelquist 2001 (*Decommissioning Health Physics – A Handbook for MARSSIM Users*). Values do not have to match – they just need to be reasonably close to give investigators a comfort level. As calculated the values are consistently higher (non-conservative) than expected, though not grossly so. • The Area Calculator may not be needed at all. The Volume Calculator already provides results for a 1-cm thick source.	Noted. The two calculators have been combined into one.
King	B1a				Assumptions are clear and reasonable.	No change
King	B1b				Limitations are adequately described.	No change
King	B1c				The Guides are written well enough, but they do need a thorough scrubbing by a technical editor. As detailed below, some of the definitions need to be revised.	No change

Commenter	Charge Question	Guidance Section	Line Number	Details	Comment	EPA Resolution
King	B1d			Part 1 of 3	• Area CPM Calculator User's Guide, 2nd paragraph. "This calculator…minimizes the use of more expensive sample collection and laboratory analysis" needs to be resolved with the apparent contradiction in Sect. 3.5.1, which states, "The Area CPM Calculator does not replace the need for lab-based sampling…" The Calculators may be used for MARSSIM (or similar) classification decisions and judgmental sample location placement, but the former statement implies a greater value in CPM estimates than the latter statement declares. • Area CPM Calculator User's Guide, Sect. 2.1. Why consider decay products ("+D") based on half-lives of hundreds or thousands of years when the common threshold is 6 month? • Area CPM Calculator User's Guide, Sect. 2.2. The TAC example of 5 pCi/g does not fit for an area calculation. Suggest finding an example with area in the denominator. Also, suggest adding the option to use process knowledge (in addition to laboratory analysis) in FAC development. Analytical data are not always available…or sometimes not enough are available. • Area CPM Calculator User's Guide, Sect. 3.3. What is the "outer circumference" of a disk with (per Sect. 3.5.2) infinite lateral extent? The R is infinite h^2 + R^2 = infinity = (7/u)^2, this u = 0. That would be the case in a vacuum. There seems to be some logic breakdown here. The gammas are assumed to be attenuated, but by what? • Area CPM Calculator User's Guide, Sect. 3.3. It is unclear how the mean free path is applied. The surface has no depth (atom thick), so there is no attenuation from the source. Is this the mean free path in air at STP? This does not appear to be the case.	EPA will revise the language as appropriate considering other comments. Progeny inclusion is only up to the next long-lived isotope. New text for this example has been added. EPA will revise the language as appropriate considering other comments. EPA will revise the language as appropriate considering other comments.
King	B1d			Part 2 of 3	• Area CPM Calculator User's Guide, Sect. 3.4.3. It is assumed S comes from the manufacturer. If that is the case, suggest adding that fact, or otherwise let the reader know where the information resides. S values are not provided as inputs or outputs. • Area CPM Calculator User's Guide, Sect. 3.4.4&5. FAC, SAC, or TAC? It is unclear whether or not CPM_FAC is the same as CPM_SAC, and if CPM_SAC_J is the same as TAC_j, why not say CPM_TAC_j? Radionuclide is misspelled in the last line (missing r). • Area CPM Calculator User's Guide, Sect. 3.5.5. How would the user subtract background from the GDR? Unless background is 0, subtraction would result in a negative number. • Area CPM Calculator User's Guide, Sect. 3.6. It is unclear what is meant by "a few" lab analyses. Correlations are very difficult in general and one might argue that uncertainty in the correlation is inversely proportional to the number of data points used in the analysis. • Area CPM Calculator User's Guide, Sect. 4. There is not a non-gaseous form of radon – suggest deleting gaseous. Re. units, becquerels, curies, etc. are lower case when spelled out unless used in reference to the person for which the unit in named. Might also note that 1 curie is the rate of decay from 1 gram of Ra-226. The definition for gross detector response is very weak and adds no value. Suggest simplifying isotope definition to "…the same number of protons in the nucleus but with…" If nuclide is term used to describe the full range of elements, should radionuclide be defined as nuclides that are radioactive? How does a TAC meet the cumulative risk assessment (meets risk goals, perhaps)?	EPA will revise the "S" language as appropriate considering other comments. EPA will revise the "FAC &TAC" language as appropriate considering other comments. Background readings are easily subtracted if GDR is higher than background. EPA will revise the language as appropriate considering other comments. EPA will revise the radon language as appropriate considering other comments. Section 4.11 on the GDR has been updated.

Commenter	Charge Question	Guidance Section	Line Number	Details	Comment	EPA Resolution
King	B1d			Part 3 of 3	• Area CPM Calculator User's Guide, Sect. 6. MARSSIM should be EPA 2000. • It is unclear why the area calculator is needed. Surface area decisions would more likely be associated with alpha or beta/gamma measurements (GM, gas proportional, etc.) and not a pure gamma measurement. The 1-cm-thick option in the Volume Calculator should be good enough for thin sources. • Volume CPM calculator. Source depth does not show values other than 100 cm. CPM values do change with entered value, so the results are probably calculated per the inputs. • Volume CPM calculator. The back button leads to a "Webpage has expired" page. The back button *sometimes* works on the Area Calculator page. • Volume CPM calculator. The hyperlink to listed photons (e.g., 4 photons from Th-234) does not work. Specifically, no photon energies or yield data are presented. Several radionuclides were tried. Same comment for Area Calculator. • Volume CPM Calculator User's Guide, Sect. 3.5. The equation implies the user can enter a source area (e.g., 10 m^2). This is not the case, thus the assumption is the source represents a semi-infinite plane. Adjustments for surface area would be a nice and useful addition.	MARSSIM reference has been updated. The two calculators have been merged. New source depths and materials have been added. Back button function has been completed. Photon link has been updated. Area adjustments will be considered for future updates.
King	B2				Sources and citations are appropriate, though authors should make sure results are comparable to values generated via standard (e.g., MARSSIM) guidance. Some calculations could not be verified given the lack of input/output information. Results do seem reasonable based on scale.	Noted.
King	B3a				The area model assumes an infinite source extent (though the text is inconsistent) without air attenuation. This should model an over-response and could leave investigators with the false assumption that the area is acceptable when it is not. The Area Calculator may not be necessary at all.	The two calculators have been merged.
King	B3b				No response.	No change
King	B4a				As stated in earlier comments, both methods seem to produce over-responses, and the Calculators do not provide all inputs (e.g., S) or outputs (e.g., gammas used). The equations and constants, as presented, as adequately explained and cited, except as already noted.	No change
King	B4b				As stated in earlier comments, both methods seem to produce over-responses, and the Calculators do not provide all inputs (e.g., S) or outputs (e.g., gammas used). The equations and constants, as presented, as adequately explained and cited, except as already noted. The Volume Calculator guide implies that the user can adjust source size, though this is not the case. It should be, however, because investigators are unlikely to encounter an actual or effectively-equivalent semi-infinite plane of contamination.	The two calculators have been reprogrammed based on advanced MCNP/SHIFT methodologies in response to comments.
King	B5				The Calculator would not show energies or yields (blank page each time attempted). Models need to be calibrated to produce values similar to those generated by standard methods. Differences are likely geometry related. Results should have nothing to do with receptor. The detector response in CPM from a source in pCi/g or pCi/cm^2 is independent of actual or hypothetical past, present, or future occupants.	Photon yields are viewable without issue. Agreed. EPA will update text as appropriate.
King	B6				Choice of detectors is reasonable, though MARSSIM also presents results for 1.25x1.5. Results for a FIDLER would be nice. CPM estimates for a NaI and surface source combination is limited.	Noted.

Commenter	Charge Question	Guidance Section	Line Number	Details	Comment	EPA Resolution
King	B7				The presented choices are reasonable, though the addition to decay products using the 6-month rule would be more consistent with industry.	The decay product inclusion text has been updated to better reflect time frames.
King	B8				Defaults are adequately explained, sourced, and reasonable.	No change
King	B9				See previous comments.	No change
King	C1				See previous comments. The major black box issue is how the CPMs are combined to achieve an action level associated with the desired remedial activity. This had to be studied a bit. It eventually became clear that CPM is a stand-in for clean-up level, but it is unclear whether the Calculator is working. Consider the following example for soil, 100 cm depth, 2x2, 10 cm from the source: Radionuclide pCi/g_i f_i CPM_i K-40 15 0.8798 1667 Th-232nat 1.0 0.0587 1406 U-235nat 0.05 0.0029 60 U-238nat 1.0 0.0587 1554 pCi/g_T: 17.05 =sum(pCi/gi) f_i varies =pCi/gi / pCi/g_T GDR: 1524 =1/(f_1/CPM_1+…f_4/CPM_4) The Calculator produces a GDR value of 1761 CPM. Could be this example (table) calculation is off. The results for the 2x2/Unat combination produces the same response no matter what source depth is selected.	The two calculators have been reprogrammed based on advanced MCNP/SHIFT methodologies in response to comments.
King	C2				See response for C1.	
King	C3				See response for C1.	
King	C4				See response for C1.	
King	C5				See response for C1.	
King	C6				See response for C1.	
King	D				See previous comments.	

Commenter	Charge Question	Guidance Section	Line Number	Details	Comment	EPA Resolution
Bronson	General			Part 1 of 2	The concept is good. However, this review seems premature, given the state of the software and the document. This tool creates the expected CPM in the instrument. The instrument only reads counts that are above some threshold of energy [pulse height] – perhaps 30-40 keV. Those instruments are very difficult to determine the threshold in energy units. Nowhere in the document does it specify the energy threshold of the instrument. And this threshold varies from instrument to instrument, depending upon how it is adjusted by the user. For large sources there is a lot of scatter and therefore most of the counts are down at low energies. It is not stated what energy the calculations assume that a photon is counted. The referenced Monte Carlo document does calculations all the way down to 1 keV, which is far too low to be useful here. The above two issues make this a very dubious application tool for energies down in the few hundred keV or lower, unless the instrument is calibrated in a standard way, which must be described in this document. There is NO validation that this works. No independent testing with different models. No testing with sources. That is a very critical flaw if you want users to believe this. If a user developed such a tool and used it on a site they were trying to measure, NRC and EPA would certainly demand such proof that it worked, along with reliability estimates – TPU estimates.	The two calculators have been reprogrammed based on advanced MCNP/SHIFT methodologies in response to comments. Energy thresholds have been added. Independent testing is planned for future validation.
Bronson	General			Part 2 of 2	I don't understand why the two tools [area, volume] use completely different methods to compute the results. Both should use the MCNP method. Having a Government Furnished [which implies Government Approved] that only addresses a single vendor's instruments seems inappropriate. What is the plan and mechanism for others to get entered into here? That should be stated somewhere, and the tool should be designed assuming that will happen. The Volume Technical Reference also needs serious review. I don't see anything that is obviously wrong, the document isn't clearly written. E.g. Gail dePlanque's name is spelled wrong both in the Reference table, and spelled wrong in a different way in page 1 of the text.	The two calculators have been reprogrammed based on advanced MCNP/SHIFT methodologies in response to comments. EPA is considering adding additional instruments. The initial 4 instruments were selected based on conversations with EPA Superfund regional staff on most likely instruments used by Superfund staff. In the future, there will not be a method for users to add instruments to the CPM calculator. The technical reference is replaced by the new MCNP/SHIFT model.

Commenter	Charge Question	Guidance Section	Line Number	Details	Comment	EPA Resolution
Bronson	A1				General, or both tools: The software tool is very easy to use, and the input is rather obvious. Using the Back arrow is very annoying; the previous page takes 2 clicks to get to, and nothing is remembered. When clicking on the number of photons button, the Photon Yield and Photon Energy headers show up but the table doesn't populate. The nuclide list is very inconvenient for 90% of the users. Have the dozen nuclides most commonly used displayed on the screen with check-boxes to select. Use a conventional method for the Help. E.g. a button on each screen that gives you the information for that screen; rather than a single place on the first page that is not even labeled Help.	Noted. Back arrows are reprogrammed. Photon Yield table is now displayed. Two pick list are now available. New tool tips have been added.
Bronson	A4				Volume Tool: Entering material wood or entering a depth of 1cm doesn't work; the result page always shows Soil at 100cm. This is such an obvious flaw in a very simple program that it causes much concern about the quality of the calculations.	This has been corrected.
Davies	A1				The web site is reasonable well presented – although the style is pretty old-fashioned and may look archaic to younger readers. See A4.	No change
Davies	A2				'… to help risk assessors, remedial project managers, and others involved with risk assessment and decision making …' appears to be the objective. In which case, the calculators will help, but their place needs to be understood	No change
Davies	A3				Yes, the guides match the calculators.	No change

Commenter	Charge Question	Guidance Section	Line Number	Details	Comment	EPA Resolution
Davies	A4				• The web pages look like I wrote them. I know I'm not a good web author and thus I ask experienced designers to create web pages for me. • Secure/insecure content warnings appear repeatedly – puts me off and would do others. • The requirement to acknowledge the 'I have read and understand the limitations of this model set forth in the User Guide and FAQ' for every visit to the site is tedious – couldn't this be handled by 'cookies'? • I'm not sure why the Nuclide entry, Target Activity and other Selection entries are on separate pages – a clumsy implementation. • The radionuclide selector table has a footnote that says ' n = second metastable state nat = naturally occurring' This does not appear to be correct, as 'n' is used for natural series. • The 'No. of photons' feature in the final results tables does not work – always yields an empty table. • The 'Back' button always requires a page re-send – surely this can be avoided in 2014?	(1) No change, the webpages are designed to look like other chemical and radiation risk assessment calculators. (2) No change, these warnings will not appear when the CPM is finalized and not password protected. (3) No change, it is important for the user to acknowledge this each time as a reminder. There may be considerable time between uses of the calculator. (4) All selections on one page would be daunting. (5) Text has been updated. (6) Fixed. (7) This is a function of the password protected status of the draft calculator.
Davies	B1a				• Assumptions are not specifically listed in the user guides – however, the text describes the limitations. • The inherent limitation that the calculators only work for a semi-infinite (lateral) source are not discussed and should be. The use of the CPM calculator for sources which are not semi-infinite could lead to underestimation of the specific activity(s) for smaller sources. • Sections 2.1: '… secular equilibrium in a hundred to a thousand years'. I'm not sure how this has been discussed anywhere in the documentation. Does this mean that decay chains that reach equilibrium in ten years will not be automatically added? Perhaps a phraseology problem. • The calculator cannot (let's be fair) know about gaseous radionuclides that may escape from a matrix (especially for U-238n, Ra-226 etc.) – but perhaps that assumption should be stated.	The user guide has been updated to state limitations. Limitation is noted. User's guide has been updated to include discussion. Radon has been removed from the pick list.
Davies	B1b				• The exclusion of 'build-up' from the Volume calculations appears to be a serious flaw. This *will* generate differences in between instrumental measurements and laboratory analysis – see next note. While excluding build-up will produce 'safer' results, this is can increase waste volumes and thus costs substantially. • The Area CPM user manual states 'A correction factor for cpm analysis established between this calculator's results and lab sampling analysis may be needed to account for ground truthing and other field nuances.' This implies that these types of correction factor should be expected and are acceptable. The wording also implies that the measurements can be expected to be 'wrong' when in fact the both the sampling and analytical measurements, and the Calculator may be 'wrong'. The use of correction factors should be avoided at all costs – when such factors appear to be required by discrepancies in results, the cause should be sought, not an arbitrary fix. • Both manuals, in section 2.2, state 'The FAC is based on laboratory analysis'. I think this should read '… should be based on …' to make the reader understand that they are providing this information, and that it is not pre-defined in the calculator.	Buildup has been addressed in new MCNP/SHIFT modeling. Documentation in Asano 2022 has been added. Correlations from the model to reality are expected to be consistently off but close for the purpose intended by this calculator. FAC is based on lab data provided by the user.

Commenter	Charge Question	Guidance Section	Line Number	Details	Comment	EPA Resolution
Davies	B1c				The User Guides are well presented. Perhaps the calculators could have used more up-to-date features of web programming.	No change. The calculator webpages are designed to be consistent with other Superfund calculators
Davies	B1d				No response.	No change
Davies	B2				I don't think the manuals require more referencing. The References covered most of my queries.	No change
Davies	B3a				I'm not sure why MCNP or similar codes were not used for the complete calculation – effectively to determine the CPM results in one process. These codes are ideal and proven for Sodium Iodide detectors and will properly account for 'build-up' etc. The use of a series of analytical calculations and assumptions is certainly not the current state of knowledge for environmental radiation measurements.	The two calculators have been reprogrammed based on advanced MCNP/SHIFT methodologies in response to comments.
Davies	B3b				I'm not sure why MCNP or similar codes were not used for the complete calculation – effectively to determine the CPM results in one process. These codes are ideal and proven for Sodium Iodide detectors and will properly account for 'build-up' etc. The use of a series of analytical calculations and assumptions is certainly not the current state of knowledge for environmental radiation measurements. The Volume user guide states 'The Volume CPM Calculator model was developed using 248 case runs of MCNP to simulate the spectrum of the desired radionuclide(s).' Why, if it was so important that everything else had to be determined analytically?	The two calculators have been reprogrammed based on advanced MCNP/SHIFT methodologies in response to comments.
Davies	B4a				• I believe that the calculation of CPM through dose/flux is inherently flawed: • Even if it was, the calculation of dose/flux using a (2D) surface tally in MCNP does not appear logical, as the detectors are 3D. • The 'back-end' calculations in relation to mixed radionuclides are appropriate. • I have compared the CPM results for Cs-137, Co-60 and Ra-226 with previous calculations I have done. While the Area and shallow Volume results are in good agreement, the thicker Volume result appear to be underestimates potentially by a factor of 2 (compared to my MCNP calculations, of course, which I don't state as definitive). To my mind, this is due to the lack of 'build-up' in the calculations.	The two calculators have been reprogrammed based on advanced MCNP/SHIFT methodologies in response to comments.
Davies	B4b				• I believe that the calculation of CPM through dose/flux is inherently flawed: • Even if it was, the calculation of dose/flux using a (2D) surface tally in MCNP does not appear logical, as the detectors are 3D. • The 'back-end' calculations in relation to mixed radionuclides are appropriate. • I have compared the CPM results for Cs-137, Co-60 and Ra-226 with previous calculations I have done. While the Area and shallow Volume results are in good agreement, the thicker Volume result appear to be underestimates potentially by a factor of 2 (compared to my MCNP calculations, of course, which I don't state as definitive). To my mind, this is due to the lack of 'build-up' in the calculations.	The two calculators have been reprogrammed based on advanced MCNP/SHIFT methodologies in response to comments.
Davies	B5				• Material definitions (in the MCNP report) appear ok – but it would have been nice to have more detailed references, for example, 'Steel' appears to be Stainless 316. • Unfortunately, I was unable to check photonic data as this feature of the web site ('Number of photons' see earlier) was broken.	Detailed material definitions have been added. Photonic data is restored.

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Davies	B6				• I'm not quite sure about the usability of the smallest detector (0.5x1), except in areas which are grossly contaminated. • I am confused by the absolute limitation of detector height for the Drywall material to 0.5cm height – surely measurements might be taken at other heights? Unless this height is mandated by legislation?	The two calculators have been reprogrammed with new materials and depths in response to comments.
Davies	B7				• The documentation should include some reference(s) to the detection of beta radiation by gamma detectors. While for the detectors quoted, which have relative thick aluminum cases, detection will be quite small, there may be detection of direct beta radiation from, say, Sr-90/Y-90 and of Bremsstrahlung from shallow sources. • The documentation might be changed to note that the decay of certain radionuclides may include gases which will escape from an un-sealed matrix such as soil or dryboard. For example, for U-238n or Ra-226, this may reduce the total gamma signal by 30% - enough to want to know about.	Beta radiation was not considered in the scope of modeling. Gases have been removed from the pick lists.
Davies	B8				I'm not sure I can see any have been used.	No change
Davies	B9				Some comments above about assumptions etc., but otherwise they are ok.	No change

MATRIX OF PEER REVIEW COMMENTS: Welcome, Introduction, and FAQs for *U.S. Environmental Protection Agency (EPA), "Counts Per Minute (CPM) Electronic Calculator"*						
Commenter	**Charge Question**	**Guidance Section**	**Paragraph Number**	**Details**	**Comment**	**EPA Resolution**
Spreng		Welcome			Paragraphs and sentences re-arranged into a more logical sequence.	EPA will revise the language as appropriate considering other comments.
Spreng		Welcome	Para 1	Sentences 2-4	Move to Welcome, as Para 3. Change to read [deleted items crossed out, new text in bold]: This tool is provided to help calculate the ~~radiation~~ gamma detector reading**s** in counts per minute (cpm) that corresponds to the level of radioactivity in a surface or volume of medium by converting radioactivity in either pCi/cm2 or pCi/g to cpm. The CPM calculator h~~as two major sub-calculators based on the field survey scenario~~ **addresses two types of field surveys:** (1) ~~ground-based~~ scanning ~~of~~ surface contamination, and (2) ~~ground-based~~ scanning ~~of~~ volumetric contamination.	The two calculators have been merged into one making the naming of the two separate calculators unnecessary.
Spreng		Welcome			Insert as Para 4: Real-time (CPM) field measurements can supplement required sample collection and lab analysis efforts and can support decision making by reducing uncertainty. Other advantages of real-time surveys include reduced costs, greater flexibility, reduced remediation time frames, and a reduction of both characterization and remedial wastes.	EPA will revise the language as appropriate considering other comments.
Spreng		Introduction		Heading	Delete heading	EPA will revise the language as appropriate considering other comments.
Spreng		Introduction	Para 1		Move to Welcome, Para 1, as Sentences 2-3.	EPA will revise the language as appropriate considering other comments.
Spreng		Introduction	Para 2	Sentences 1-2	Move to Welcome as Para 2, Sentences 1-2.	EPA will revise the language as appropriate considering other comments.
Spreng		Introduction	Para 2	Sentence 3	Delete	EPA will revise the language as appropriate considering other comments.
Spreng		Introduction	Para 3	Sentences 1-2	Delete	EPA will revise the language as appropriate considering other comments.
Spreng		Introduction	Para 3	Sentence 3	Move to Welcome, Para 2 as sentence 3.	EPA will revise the language as appropriate considering other comments.
Spreng		FAQs			I'm not sure these would be my most pressing questions. Some of these paragraphs are more complete than the corresponding paragraphs in the User's Guides. I'd suggest integrating these paragraphs into the User's Guides, then deleting this FAQs sheet. If the FAQs sheet is a requirement, I'd at least integrate these paragraphs into the User's Guides, then the FAQs sheet can be abridged by referencing the appropriate sections in the User's Guides.	The FAQ page has been reorganized and updated.

MATRIX OF PEER REVIEW COMMENTS: Area CPM User's Guide for *U.S. Environmental Protection Agency (EPA), "Counts Per Minute (CPM) Electronic Calculator"*						
Commenter	**Charge Question**	**Guidance Section**	**Paragraph Number**	**Details**	**Comment**	**EPA Resolution**
Spreng		1			The Introduction in the User's Guide is somewhat redundant with the Introduction on the calculator home (Welcome) page and the two could be combined in one place or the other. If not combined, they should be better integrated. I would move the last sentence of the 2nd paragraph to follow the highlighted warning in the 3rd paragraph. Shouldn't the ultimate caution be, "The user should always verify real-time survey results with lab analyses."? See the end of Section 3.7.	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 1		Replace Para 1 with: Data collection at radioactively-contaminated sites determines whether areas require remediation and then whether an area has been remediated to acceptable levels. Real-time (CPM) field measurements can supplement required sample collection and lab analysis efforts and can support decision making by reducing uncertainty. Other advantages of real-time surveys include reduced costs, greater flexibility, reduced remediation time frames, and a reduction of both characterization and remedial wastes.	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 1-2		Delete paragraph break to create one paragraph.	The User Guide was rewritten as the two calculators were combined.
Spreng		1	Para 2	Sentence 1	Insert bolded terms: The Area CPM Calculator is a web-based calculator that estimates a gamma **scintillation** detector response **in cpm** for a target level of **radiological** contamination on a surface.	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 2	Sentence 2	Delete: provides a rapid, exceptionally cost-effective assessment of contamination and cleanup standards based on	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 2	Sentence 2	Insert after "calculator": supports the acquisition of	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 2	Sentence 2	Comment: The calculator does not assess "contamination" or "cleanup standards". Cost effective?? It's free.	No change
Spreng		1	Para 2	Sentence 3	Move to follow first sentence of Para 3: A correction factor for cpm analysis established between this calculator's results and lab sampling analysis may be needed to account for ground truthing and other field nuances.	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 2-3		Delete paragraph break to create one paragraph.	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 3	Sentence 1	Replace "sampling" with "analyses"	EPA will revise the language as appropriate considering other comments.
Spreng		1	Bullet list	Bullet 3	Insert bolded item: • choice of target activity **concentration**	EPA will revise the language as appropriate considering other comments.
Spreng		2			The step-by-step instruction in Section 2 makes it the most important part of these Guides. It is the "how to" that most users will rely on when first using the calculator. The rest is supplemental, support, or background information.	No change
Spreng		2.1			These instructions should match the instructions for this page in the calculator.	EPA will revise the language as appropriate considering other comments.
Spreng		2.1	Bullet	Sentence 2	This next-to-last sentence is different in the instructions for this page in the calculator ("To calculate the parent and daughter activities manually…"). Both sentences could be included in both places	EPA will revise the language as appropriate considering other comments.
Spreng		2.1	Para 1		Regarding sentence: "Remedial activity can be calculated using the PRG, BPRG, SPRG, DCC, BDCC, and SDCC calculators." Doesn't belong here. See section 2.2 below.	EPA will revise the language as appropriate considering other comments.
Spreng		2.2			These instructions should match the instructions for this page in the calculator. More information on how to derive FACs is needed here or in Section 3.4.	EPA will revise the language as appropriate considering other comments.

Commenter	Charge Question	Guidance Section	Paragraph Number	Details	Comment	EPA Resolution
Spreng		2.2	Bullet list	Bullets 1-2	These instructions should match the instructions for this page in the calculator.	EPA will revise the language as appropriate considering other comments.
Spreng		2.3			How sensitive is the input of the distance from detector to source? Should that be mentioned here?	No change
Spreng		2.3	Bullet list	Bullet 2	Regarding sentence: "Enter the estimated distance between the source and the detector in centimeters. Click "Next"." Guidance on an appropriate estimate for this parameter would be useful.	EPA will revise the language as appropriate considering other comments.
Spreng		2.4		Results table in calculator	The results table can be copied and then printed. Can a “print page” option be added?	Download option has been added.
Spreng		3.1	Para 2	Sentence 3	Replace "three" with "four"	EPA will revise the language as appropriate considering other comments.
Spreng		3.2	Section name		Insert bolded term: Daughters and **Decay** Chains	EPA will revise the language as appropriate considering other comments.
Spreng		3.4			More information on how FACs should be derived could be included. I assume that the FAC inputs could be an average of activity measurements for each radionuclide over the area of interest with the assumption that field ratios are uniform over that area. The ratios of some radionuclides are fairly precise (e.g., Pu and its daughter Am) and can be used to determine contaminant source areas in the field. Variations in the isotopic ratios for U are also used to determine contaminant sources: DU, EU, and natural U.	EPA will revise the language as appropriate considering other comments.
Spreng		3.4	Para 1	Sentence 2	Typo (correction in bold): **e**stablished	EPA will revise the language as appropriate considering other comments.
Spreng		3.4.5	Para 2		Typo (correction in bold): **r**adionuclide	EPA will revise the language as appropriate considering other comments.
Spreng		3.5			Could variability among different types/brands of field detectors, beyond the detector sensitivity and energy response factor mentioned in 3.4.3, be a limitation?	Correct. A detector validation effort is required.
Spreng		3.5.3			I’d prefer to have the more complete explanation provided in the FAQs included here in the User’s Guide. The FAQs section could reference this section for greater detail.	EPA will revise the language to add some of the language from the FAQ section, but the FAQ section will retain its level of information for consistency with the FAQs in other Superfund calculators.
Spreng		3.6	Para 1	Sentence 1	Replace: "designed and applied to correlate" with "developed by correlating"	EPA will revise the language as appropriate considering other comments.
Spreng		3.6	Para 1	Sentence 1	Delete: sampling	EPA will revise the language as appropriate considering other comments.
Spreng		3.6	Para 1	Sentence 1	Replace: "to" with "with"	EPA will revise the language as appropriate considering other comments.
Spreng		3.7	Para 1	Sentence 1	Replace: "methods" with "surveys"	EPA will revise the language as appropriate considering other comments.
Spreng		3.7	Para 1	Sentence 1	Insert: "(EPA 1999)" after "*Radiation Risk Assessment At CERCLA Sites: Q&A* "	EPA will revise the language as appropriate considering other comments.
Spreng		3.7	Para 1	Sentence 2	Typo (correction in bold): measur**e**ments	EPA will revise the language as appropriate considering other comments.

Commenter	Charge Question	Guidance Section	Paragraph Number	Details	Comment	EPA Resolution
Spreng		3.7	Bullet list	Bullet 2, Sentence 2	Typo (correction in bold): measur**e**ments	EPA will revise the language as appropriate considering other comments.
Spreng		3.7	Bullet list	Bullet 2, Sentence 2	Replace: "should" with "does"	EPA will revise the language as appropriate considering other comments.
Spreng		4			Possible additional terms: photon spectrum, scintillation detector (rather than “detector”).	EPA will revise the language as appropriate considering other comments.
Spreng		4		MARSSIM definition	Insert hyphen: dose-	EPA will revise the language as appropriate considering other comments.
Spreng		6		ITRC, 2006	Insert bolded letter: Radionuclide**s** [in "Real-Time Radionuclide Team"]	EPA will revise the language as appropriate considering other comments.
Spreng		6		ITRC, 2006	Delete: "Real-Time" [from "Real-Time Radionuclide Team"] The existing citation is the one suggested at the front of the document. The actual team name, however, is simply Radionuclides Team.	EPA will revise the language as appropriate considering other comments.
Bronson		General			The guide should be divided into different sections: - How to use the software - Technical reference - Regulatory applications	EPA disagrees. The format of the User Guide is intended to be consistent with the format used for other EPA Superfund calculators.
Bronson		2.1	Para 2	Sentence 1	What defines “reaching” secular equilibrium ?	EPA will define.
Bronson		2.1	Para 2	Sentence 1	What happens to those daughters that are <100 or >1000 y ??	Section 3.1 includes these descriptions.
Bronson		2.1	Para 2	Sentence 4	??? don’t understand this sentence .	EPA will revise the language as appropriate considering other comments.
Bronson		2.4	Para 3	Sentence 1	?? isn’t it really “above”; all decays have X-rays that are lower than the detection range, and I didn’t see any notes. I didn’t’ see any notes for Cs137, and the 36 keV photon is also likely outside the range of the detectors.	EPA will revise the language as appropriate considering other comments.
Bronson		2.4	Para 3	Sentence 2	Doesn’t work.	EPA will revise the language as appropriate considering other comments.
Bronson		3.1	Para 3	3x3 graph	The 3x3 graph is considerably different from the others, and I don’t understand why; something is not right.	Correct. A detector validation effort is required.
Bronson		3.2	Para 1	Sentence 1	I don’t understand the 100-1000y part of this. The user wants to know the instrument response on the date of measurement, not what it will be 100-1000 y from now. How is the case of freshly processed Thorium handled, where most of the easily-measured daughters are removed and take 20-40y to mostly grow back ??	The output doesn't represent the future; it represents progeny that may be present. This can be deactivated.
Bronson		3.3	Para 1	Sentence 3	Regarding "seven mean free paths (7/μ):" MFP in Air ??? if so, then state it	EPA will revise the language as appropriate considering other comments.
Bronson		3.3	Para 1	Sentence 3	This is far too much information for the user. Just say that the model is an infinite diameter planar disc source.	EPA will revise the language as appropriate considering other comments.
Bronson		3.4.1		Definition of gamma coefficient	Where does this come from ? Reference; Where does “μ” come from ??	EPA will revise the language as appropriate considering other comments.

Commenter	Charge Question	Guidance Section	Paragraph Number	Details	Comment	EPA Resolution
Bronson		3.4.1			Regarding "is designed so that the range from the detector to the boundary is 7 mean free paths:" Why 7 ? Just pick a big number and use it for everything.	Four mean free paths was selected going forward.
Bronson		3.5.2	Para 1	Sentences 1-2	?? not sufficient; you really mean that each individual radionuclide has a uniform concentration everywhere on the surface	EPA will revise the language as appropriate considering other comments.
Bronson		3.5.2	Para 1	Sentence 3	Regarding "radionuclide ratios:" concentration, not ratios	EPA will revise the language as appropriate considering other comments.
Bronson		3.5.3	Para 1	Sentence 1	?? still pure alphas and pure betas there; seems like the list	EPA will revise the language as appropriate considering other comments.
Bronson		3.5.3	Para 2	Sentence 1	Regarding "between 40 keV and 2 MeV:" why a high energy cutoff ? the instrument only has a lower energy threshold, it still counts photons with energies >2MeV.	Three MeV was selected going forward.
Bronson		3.5.3	Para 2	Sentence 2	Seems that you should put all the energies in the library and let the analysis software figure out which ones to use. The cutoff will not always be 40 keV, and I doubt that it is that here for all detectors. And might not be for other detectors that it has been claimed that will be added sometime in the future.	All energies have been added to the database.
Bronson		3.7	Bullet list	Bullet 2, Sentence 2	These instruments are NOT exposure rate instruments, they are count-rate instruments.	EPA will revise the language as appropriate considering other comments.
Bronson		4		Detector definition	Sensor, not instrument	EPA will revise the language in the whole section to be consistent with other EPA calculators.
Bronson		4		Fractivity definition	??? Did you guys just make up this word ??	EPA will revise the language in the whole section to be consistent with other EPA calculators.
Bronson		4		Fractivity definition	I thought that in secular equilibrium, the daughter activity is equal to the parent activity ??	EPA will revise the language in the whole section to be consistent with other EPA calculators.
Bronson		4		Gamma radiation definition	Regarding "Gamma rays are very penetrating and require dense materials:" Actually they require massive materials, density must makes the mass smaller.	EPA will revise the language in the whole section to be consistent with other EPA calculators.
Bronson		4		Mean free path definition	Regarding "completely attenuated:" It is actually only attenuated 1000x; if it started out really strong, the beam still might not be “negligible”. When the technical reference document is completed, it should prove that 7mfp in these calculations is sufficiently close to infinite mfp.	EPA will revise the language in the whole section to be consistent with other EPA calculators.
Bronson		4		Yield definition	Insert bolded text: particles emitted **at a specific energy** per radionuclide decay.	EPA will revise the language in the whole section to be consistent with other EPA calculators.
Bronson		6			There are no citation marks in the document showing where these references were referenced.	References have been added.

MATRIX OF PEER REVIEW COMMENTS: Volume CPM User's Guide for *U.S. Environmental Protection Agency (EPA), "Counts Per Minute (CPM) Electronic Calculator"*						
Commenter	**Charge Question**	**Guidance Section**	**Paragraph Number**	**Details**	**Comment**	**EPA Resolution**
Spreng		1			The Introduction in the User's Guide is somewhat redundant with the Introduction on the calculator home page and the two could be combined in one place or the other. If not combined, they should be better integrated. I would move the last sentence of the 2nd paragraph to follow the highlighted warning in the 3rd paragraph. Shouldn't the ultimate caution be, "The user should always verify real-time survey results with lab analyses."? See the end of Section 3.7.	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 1		Replace with: Data collection at radioactively-contaminated sites determines whether areas require remediation and then whether an area has been remediated to acceptable levels. Real-time (CPM) field measurements can supplement required sample collection and lab analysis efforts and can support decision making by reducing uncertainty. Other advantages of real-time surveys include reduced costs, greater flexibility, reduced remediation time frames, and a reduction of both characterization and remedial wastes.	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 2	Sentence 1	Insert bolded term: target level of **radiological** contamination in a source	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 2	Sentence 2	Replace pCi/area with pCi/volume	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 2	Sentence 4	Delete sentence ["A correction factor for cpm analysis established between this calculator's results and lab sampling analysis may be needed to account for ground truthing and other field nuances."]	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 3	Sentence 1	Replace "sampling" with "analyses"	EPA will revise the language as appropriate considering other comments.
Spreng		1	Para 3	Sentence 1	Insert after Sentence 1: A correction factor to account for ground truthing and other field nuances can be derived from a correlation between this calculator's results and lab analyses.	EPA will revise the language as appropriate considering other comments.
Spreng		1	Bullet list	Bullet 8	Typo: including	EPA will revise the language as appropriate considering other comments.
Spreng		2			The step-by-step instruction in Section 2 makes it the most important part of these Guides. It is the "how to" that most users will rely on when first using the calculator. The rest is supplemental, support, or background information.	No response needed.
Spreng		2	Para 1		These instructions should match the instructions for this page in the calculator.	EPA will revise the language as appropriate considering other comments.
Spreng		2.1			These instructions should match the instructions for this page in the calculator.	EPA will revise the language as appropriate considering other comments.
Spreng		2.1	Para 1		Regarding sentence: "Remedial activity can be calculated using the PRG, BPRG, SPRG, DCC, BDCC, and SDCC calculators." Doesn't belong here. See section 2.2 below.	EPA will revise the language as appropriate considering other comments.

Commenter	Charge Question	Guidance Section	Paragraph Number	Details	Comment	EPA Resolution
Spreng		2.2			These instructions should match the instructions for this page in the calculator. More information on how to derive FACs is needed here or in Section 3.4.	EPA will revise the language as appropriate considering other comments.
Spreng		2.3			How sensitive is the input of the distance from detector to source? Should that be mentioned here?	EPA is considering conducting a sensitivity analysis.
Spreng		2.3	Bullet list	Bullet 4	Guidance on an appropriate estimate for this parameter would be useful.	EPA will revise the language as appropriate considering other comments.
Spreng		2.4			The results table can be copied and then printed. Can a “print page” option be added?	EPA will revise the language as appropriate considering other comments.
Spreng		3.3	Section name		Insert bolded term: Daughters and **Decay** Chains	EPA will revise the language as appropriate considering other comments.
Spreng		3.7	Para 1		Replace: "designed and applied to correlate a few" with "developed by correlating"	EPA will revise the language as appropriate considering other comments.
Spreng		3.7	Para 1		Delete: "sampling"	EPA will revise the language as appropriate considering other comments.
Spreng		3.7	Para 1		Replace: "to" with "with"	EPA will revise the language as appropriate considering other comments.
Spreng		3.8	Para 1	Sentence 1	Replace: "methods" with "surveys"	EPA will revise the language as appropriate considering other comments.
Spreng		3.8	Para 1	Sentence 1	Insert: "(EPA 1999)" after "*Radiation Risk Assessment At CERCLA Sites: Q&A* "	EPA will revise the language as appropriate considering other comments.
Spreng		3.8	Para 1	Sentence 2	Typo: measur**e**ments	EPA will revise the language as appropriate considering other comments.
Spreng		3.8	Bullet list	Bullet 2, Sentence 2	Typo: measur**e**ments	EPA will revise the language as appropriate considering other comments.
Spreng		3.8	Bullet list	Bullet 2, Sentence 2	Replace: "should" with "does"	EPA will revise the language as appropriate considering other comments.
Spreng		4			Possible additional terms: photon spectrum, scintillation detector (rather than “detector”).	EPA will revise the language as appropriate considering other comments.
Spreng		4		MARSSIM definition	Insert hyphen: dose- [this comment was not in the reviewer's Volume CPM User's Guide review document; however, the reviewer made this comment regarding the MARSSIM definition in the review document for the Area CPM User's Guide; since the two definitions are identical, the comment is included in this matrix]	EPA will revise the language as appropriate considering other comments.

Commenter	Charge Question	Guidance Section	Paragraph Number	Details	Comment	EPA Resolution
Spreng		6		ITRC, 2006	Insert bolded letter: Radionuclide**s** [in "Real-Time Radionuclide Team"]	EPA will revise the language as appropriate considering other comments.
Spreng		6		ITRC, 2006	Delete: "Real-Time" [from "Real-Time Radionuclide Team"] The existing citation is the one suggested at the front of the document. The actual team name, however, is simply Radionuclides Team.	EPA will revise the language as appropriate considering other comments.
Bronson		3.1			Why isn't the "more sophisticated" and "more rigorous" method used in both sections ?? The Area calculations are just thin weightless volumes.	The calculators have been combined into one developed based on the same technology.
Bronson		3.1	Para 2	Sentence 2	Regarding "including attenuation:" didn't the Area CPM account for air attenuation?	EPA will revise the language as appropriate considering other comments.
Bronson		3.1	Para 2	Sentence 2	Regarding "source shielding:" not accounted for because not relevant for thin sources	EPA will revise the language as appropriate considering other comments.
Bronson		3.1	Para 2	Sentence 2	Regarding "scattering and buildup:" [this is really scattering], backscatter	EPA will revise the language as appropriate considering other comments.
Bronson		3.2	Para 2		This paragraph isn't relevant to this document.	MCNP has been used to update the detector implementation in this calculator.
Bronson		3.4	Para 1	Sentence 4	Diagram not linked	Diagram is linked.
Bronson		3.4	Para 2	Sentence 2	Too restrictive; what if the user wants to measure the drywall at 10 or 30 or 100cm like the others ?	Modeling time limitations required limited thicknesses.
Bronson		3.5.1	Para 2	Sentence 1	Regarding "The output of the MCNP software is energy fluence per MCNP source particle, SP (Φ_E/cm^2 - SP):" Is the equation listed correct ??	All the equations have been revamped to reflect MCNP/SHIFT methodology.
Bronson		3.5.1	Para 2	Equation for conversion factor	Explain all the terms in this equation; fix spelling [depth, not dept]	EPA will revise the language as appropriate considering other comments.
Bronson		3.5.1	Para 3	Sentence 4	Regarding Technical Background Document: This document needs a lot of work	This document is no longer the main description of the current MCNP/SHIFT models being used.
Bronson		3.5.2	Para 1	Sentence 1	The equation uses pCi, not pCi/g	EPA will revise the language as appropriate considering other comments.
Bronson		3.5.2	Para 1	Sentence 2	Same comment as before [the equation uses pCi, not pCi/g]	EPA will revise the language as appropriate considering other comments.
Bronson		3.6.3	Para 3		The MC reference document says that bremsstrahlung IS included.	EPA will revise the language as appropriate considering other comments.