Land Chapter

Section 1: Land Cover

Land Cover
Reviewed by the Ecological Condition Group, both for inclusion in the Land chapter and for inclusion as a referenced indicator in the Ecological Condition chapter[1]

Consensus Statements for the Indicator as a Land Indicator		
Overall recommendation	**Include with modifications.** (Rank: High)	EPA included the indicator with modifications ad detailed below.
Critical modifications	To establish trends, future NLCD data will be required. The discussion of this indicator should emphasize the importance of continuing data collection, particularly the NLCD database. The reviewers encourage EPA and other federal government agencies to make every effort to guarantee future availability of the dataset. Assuming that EPA plans to use decadal development of NLCD, broad trends could develop through time, but would require many decides to develop robust trends.	EPA added language to the first and second bullets under "Indicator Limitations."
	Similarly, the discussion should emphasize the importance of continuing FIA data collection.	EPA has included this in the second bullet under "Indicator Limitations."
	The indicator could include the National Heritage Program and Nature Conservancy pre-settlement map for context.	EPA could not locate such a map on a national basis. Regional maps exist for some areas.
Suggested modifications	The reviewers encourage EPA to explore ways to resolve a higher spatial resolution from the NLCD dataset (<30 m pixels) for urban land use analysis.	EPA determined that we are not aware of any method to do sub-pixel analyses of current NLCD data.
	Explore whether more discriminatory attribute classes for urban and agricultural areas can be applied (e.g., MODIS).	EPA determined that MODIS data are collected at a resolution of 250 m. This is considerably coarser that the data already being used.

[1] The Ecological Condition reviewers ranked each indicator in terms of its importance to answering the question(s) it was proposed to answer. When ranking an indicator, the reviewers considered the indicator as it would be when revised according to the "critical" modifications listed in the "Consensus" table. The ranking is listed in the upper right-hand corner of the "Consensus" table. A "High" ranking represents the most important indicators. In cases where the reviewers recommended not including an indicator, they did not assign a rank, and these indicators are labeled NA.

Consensus Statements for the Indicator as a Land Indicator		
	The reviewers encourage EPA to work with other federal agencies to develop a standard land cover classification system.	EPA added a bullet under "Indicator Limitations" to address this.
	Recognize the importance of discriminating the types of "developed lands" and assessing their ecological impact. Although the data source will not support further breakdown by type/density of development, this may be worth noting as a limitation and/or suggestion for the future, given the importance of built density in determining ecological impacts.	EPA determined that it is correct that the data source (NLCD) only provides very gross subcategories as part of the "developed" category, and currently provides no trend data. Some discussion of the differences in types of "developed" land cover will be included in the "non-indicator chapter text" that provides context for the indicators.
Other comments	It is impossible to evaluate the state of our nation's environment without rigorous land cover information.	The importance of land cover information has been noted in the indicator write-up.
	The indicator is just a snapshot; there is no trend analysis.	EPA determined that this has been noted under "Indicator Limitations."

Consensus Statements for the Indicator as a Referenced Ecological Condition Indicator		
Overall recommendation	**Include with modifications.** (Rank: Medium)	
Critical modifications	To establish trends, future NLCD data will be required. The discussion of this indicator should emphasize the importance of continuing data collection, particularly the NLCD database. The reviewers encourage EPA and other federal government agencies to make every effort to guarantee future availability of the dataset. Assuming that EPA plans to use decadal development of NLCD, broad trends could develop through time, but would require many decades to develop robust trends.	EPA made the changes. Language was added to the first and second bullets under "Indicator Limitations."
	Similarly, the discussion should emphasize the importance of continuing FIA data collection.	EPA made the changes. This is now covered in the second bullet under "Indicator Limitations."

Consensus Statements for the Indicator as a Referenced Ecological Condition Indicator		
Suggested modifications	Recognize the importance of discriminating the types of "developed lands" and assessing their ecological impact. Although the data source will not support further breakdown by type/density of development, this may be worth noting as a limitation and/or suggestion for the future, given the importance of built density in determining ecological impacts.	EPA determined that it is correct that the data source (NLCD) only provides very gross subcategories as part of the "developed" category, and currently provides no trend data. Some discussion of the differences in types of "developed" land cover will be included in the "non-indicator text" that provides context for the indicators.
Other comments	It is impossible to evaluate the state of our nation's environment without rigorous land cover information.	Language was added to note this.
	The indicator is just a snapshot; there is no trend analysis.	EPA determined that this has been noted under "Indicator Limitations."

Land Cover Change in Puget Sound Basin
Reviewed by the Ecological Condition Group

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications.** (Rank: Medium)	EPA determined some of the reviewers confused the scale of assessment. The presentation scale of the data analysis (6th field HUC watershed) is closely linked to local watershed and comprehensive planning scales but may be less useful for regional or national assessments - which tend to be aggregated or presented at the 4th filed HUC watershed/sub-basin scale.
Critical modifications	Clarify *land use* versus *land cover*. If keeping the title of "land cover," EPA should clarify how land use relates to land cover (e.g., impervious surfaces). Also, since data originate from Landsat (which measures land cover), the indicator write-up should elaborate on how land use was interpreted from land cover.	EPA decided that because of length limitations in the indicator summary analysis (i.e. < 800 words) land cover and land use are only generally introduced and distinguished. However, in the metadata documentation, land cover is much more highly defined in terms of both specific composition (land cover type) metrics and configuration (land cover pattern) metrics, and these various metrics are applied and presented within general land use classes and reported by watershed area.

Consensus Statements		EPA Response
Suggested modifications	EPA might want to consider other regional analyses that include measures of ecological change (e.g., San Pedro, Camp Pendleton, Willamette Basin) – i.e., more ecologically explicit indicators.	EPA agreed that it is a good idea but very difficult to introduce and relate to the PSGB approach given the report length limitations.

Section 2: Land Use

Land Use
Reviewed by the Ecological Condition Group, both for inclusion in the Land chapter and for inclusion as a referenced indicator in the Ecological Condition chapter [2]

Consensus Statements for the Indicator as a Land Indicator		
Overall recommendation	**Include with modifications.** (Rank: High)	EPA included the indicator with modifications as detailed below.
Critical modifications	If possible, the indicator could distinguish among types of agricultural uses (e.g., crop types).	EPA determined that data is not available that would support a nationwide break-out of crop types. Figure 325.1 now distinguishes between cropland and pasture.

[2] The Ecological Condition reviewers ranked each indicator in terms of its importance to answering the question(s) it was proposed to answer. When ranking an indicator, the reviewers considered the indicator as it would be when revised according to the "critical" modifications listed in the "Consensus" table. The ranking is listed in the upper right-hand corner of the "Consensus" table. A "High" ranking represents the most important indicators. In cases where the reviewers recommended not including an indicator, they did not assign a rank, and these indicators are labeled NA.

Consensus Statements for the Indicator as a Land Indicator		
Suggested modifications	Land use is necessarily more difficult to compile than land cover, requiring many separate data sources and classification interpretations. This system has sufficient classification granularity for non-urban uses, but is totally inadequate for "developed" lands. Also, maps of use and use change are needed to show differential geographic impacts of land use change. Some types of change and locations (residential growth in coastal areas) are more important to more sensitive ecosystems. The indicator currently lacks this information. EPA could improve the indicator by using one of the existing land use classifications, such as the modified Anderson system, which lends itself to multiple resolutions and remote sensing data at regional scales.	EPA considered this recommendation and determined: The limitations of NRI data to distinguish types of developed land are now noted in the "Indicator Limitations." The available national maps are the same as were used in the ROE03. Updated national data are not available in map form. The main data source for this indicator is the NRI which uses "cover use" categories that are not the same as the modified Anderson categories. A new classification would not address the issue of data availability and would imply the need to generate a new set of national data using the new classifications.
Other comments	Figure 3 is the most informative of the figures.	

Consensus Statements for the Indicator as a Referenced Ecological Condition Indicator		
Overall recommendation	**Include with modifications.** (Rank: Medium)	
Critical modifications	Figures 1 and 2 should be accompanied by text that strongly emphasizes the disproportionate impact of developed lands. Without this information, the figures may be misleading.	EPA added text to the "What the Data Show" section.

Consensus Statements for the Indicator as a Referenced Ecological Condition Indicator		
Suggested modifications	Land use is necessarily more difficult to compile than land cover, requiring many separate data sources and classification interpretations. This system has sufficient classification granularity for non-urban uses, but is totally inadequate for "developed" lands. Also, maps of use and use change are needed to show differential geographic impacts of land use change. Some types of change and locations (residential growth in coastal areas) are more important to more sensitive ecosystems. The indicator currently lacks this information. EPA could improve the indicator by using one of the existing land use classifications, such as the modified Anderson system, which lends itself to multiple resolutions and remote sensing data at regional scales.	EPA considered this recommendation and the limitations of NRI data to distinguish types of developed land is now noted in the "Indicator Limitations." The available national maps are the same as were used in the ROE03. Updated national data are not available in map form. The main data source for this indicator is the NRI which uses "cover use" categories that are not the same as the modified Anderson categories. A new classification would not address the issue of data availability and would imply the need to generate a new set of nation data using the new classifications.
	The indicator should also distinguish among types of agricultural lands/crops.	EPA determined data is not available that would support a nationwide break-out of crop types. Figure 325.1 now distinguishes between cropland and pasture.
Other comments	Although imperfect, this indicator it is the best available to characterize land use.	
	Figure 3 is the most informative of the figures.	

Urbanization and Population Change
Reviewed by the Ecological Condition Group, both for inclusion in the Land chapter and for inclusion as a referenced indicator in the Ecological Condition chapter [3]

Consensus Statements for the Indicator as a Land Indicator		
Overall recommendation	**Include.**	(Rank: High)

[3] The Ecological Condition reviewers ranked each indicator in terms of its importance to answering the question(s) it was proposed to answer. When ranking an indicator, the reviewers considered the indicator as it would be when revised according to the "critical" modifications listed in the "Consensus" table. The ranking is listed in the upper right-hand corner of the "Consensus" table. A "High" ranking represents the most important indicators. In cases where the reviewers recommended not including an indicator, they did not assign a rank, and these indicators are labeled NA.

Critical modifications	• None required

Consensus Statements for the Indicator as a Referenced Ecological Condition Indicator	
Overall recommendation	**Include.** (Rank: Medium)
Critical modifications	• None required
Other comments	• In their discussion of new indicators, reviewers will suggest more robust indicators of population impacts (such as ecological footprint).

Section 3: Chemicals

Fertilizer Applied for Agricultural Purposes
Reviewed by the Land Chemical Group

Consensus Statements		**EPA Response**
Overall recommendation	**Include with modifications.**	
Critical modifications	None.	
Suggested modifications	For graphical representation of the data consider per-acre normalization of fertilizer use. Also, data in Figure 2 should be reduced to 1 or 2 significant figures.	EPA has changed Figure 1 to represent per-acre usage, which also resulted in changes to the "What the data show" discussion of the indicator. Figure 2 numbers reduced to 2 significant figures.
	This statement should be included under the limitations: Loading of nutrients into aquatic systems may not necessarily correlate with agricultural fertilizer use.	EPA adopted some of the changes.
Other comments	See below.	

Peer Review Comments

As stated earlier, the reason this indicator is included is due to the adverse environmental effects of nutrient loading into aquatic ecosystems. The major concern with this indicator is that it focuses entirely on agricultural inputs and may lead a reader (especially a lay reader) to interpret this to mean that only agriculture is responsible for nutrient inputs. While agricultural interests are arguably the major users of fertilizer, these only account for about 85 % of total fertilizer demand (Chemical and Engineering News, April 2000). Approximately 14 % is associated with Professional Lawn Care, Consumer Retail, and Golf courses – all patterns associated with urban/suburban watersheds. While this is only 14 % of total demand, many applications are made in close proximity to impervious surfaces (i.e., streets, parking lots, etc.) and may actually present a higher risk of runoff than agricultural settings.

Nutrient loadings from turf runoff, septic systems, and sewage treatment plants often dominate loadings in suburban watersheds. The indicator that EPA is proposing to use is valid; however, the above limitation should be noted as a limitation in the discussion.

Including minor crops would be impossible, of course, but a summary indication of how tree crops and row crops represent the balance of fertilizer chemicals used in cited growing regions would be helpful.

EPA Response

The non-agricultural fertilizer uses will be discussed in the non-indicator chapter text, including the data gaps section. Non-agricultural use represents a gap in indicators needed to answer the question rather than a limitation of this indicator.

While it would be possible to summarize other tree crops and row crops, that would involve analyzing hundreds of data points and there is insufficient time to complete such analyses for this report. Major other crops would include wheat, sugarbeets, and rice.

Reported Toxic Chemicals in Wastes Released, Treated, Recycled, or Recovered for Energy Use
Reviewed by the Land Chemical Group

Consensus Statements		**EPA Response**
Overall recommendation	**Include with modifications.**	
Critical modifications	Use graphical representation that was used in draft ROE 2003.	EPA considered this recommendation and similar graphics have been generated.
Suggested modifications	None.	
Other comments	See below.	See below

Peer Review Comments

There are a few typographical errors that should be corrected: 1) in paragraph 4 on the first page, "categories" should be "category". In the QA/QC section under T1Q1, the acronym EPCRA should be defined. For T2Q3, the answer provided does not appear to address the question. In T4Q4, an additional statement should be added that changing legal reporting requirements would also influence the trend data. This is implied in the statement provided, but needs to be specifically stated.

There is an extra "systems" in paragraph 1, and "categories" should be singular in paragraph 4. Paragraph 8 refers to "off-site transfers." Is this the same as "off-site releases" in 338.1? If so, please use the same term. If not, please explain the difference.

It might be useful to estimate the number of facilities required to file TRI reports and the number not required to file TRI reports for each year to give the reader an idea whether there are any trends in that ratio.

- T2Q3: The answer should be "No".
- T4Q3: Does the variability described impact the conclusions that can be inferred from the data and the utility of the indicator?
- T4Q4: Might these gaps mislead a user about fundamental trends in the indicator over space or time period for which data are available?

This is an indicator that clearly warrants more attention because of the potential effects of its subject materials, and the potential for unproven or risky practices.

EPA Response

As recommended, the typographical errors have been corrected. We have also clarified the acronym EPCRA, and TT2Q3 is now "No." T4Q4 has been changed to include the peer review comment. Additionally, the language has been further clarified and checked for consistency.

We have also added the number of facilities required to file TRI reports, were however unable to determine how many are not required to report.

We have noted that the answer to T2Q3 is "No". We have also noted that the variability described does impact the conclusions that can be inferred from the data and the utility of the indicator. We have noted in T4Q4 that the gaps may mislead a user about fundamental trends in the indicator over space or time period for which data are available.

Pesticide Residues in Food

Reviewed by the Land Chemical Group

Consensus Statements		**EPA Response**
Overall recommendation	**The reviewers did not reach consensus on whether the indicator should be included, included with modifications, or not included.**	
Point of divergence	Pesticide residues in food are ambient conditions. The indicator may or may not be applicable to the question depending upon a reader's definition of ambient condition and environment. Specifically, the ROE question is not worded in such a way that explicitly includes ambient conditions and exposure to pesticide residues (i.e., Level 4 and 5 indicators), and raises the question of whether a food commodity is considered an environmental medium.	EPA determined that the non-indicator text addresses the issue and points out the pesticide residues on food represent ambient conditions and therefore an indirect measure of chemicals on the land.
Critical modifications	All reviewers agree that the data are excellent and provide very valid and valuable information. Therefore, reviewers suggest rewording the question to address these issues.	EPA decided that question was not re-worded, but the non-indicator text addresses this.
Suggested modifications	None.	
Other comments	See below.	

Peer Review Comments

A statement should probably be added in the text of the discussion and in the QA/QC section (T4Q4) that the USDA PDP program does include most of the pesticides currently on the market. When reading this section and seeing the trend of increasing numbers of "zero pesticides detected" on crops, it is not apparent whether the list of pesticides analyzed in the PDP is current with the pesticides used in the market place. It would assist the reader if this were mentioned in two to three sentences in the text of the discussion of the indicator.

The change in reporting of pesticide metabolites from 2002 to 2003 produced no apparent reduction in the percent of samples that had 2, 3, or 4 or more residues detected. It would be interesting to have some explanation for this unexpected result.

If some modifications were made in the sampling and analyses protocols to include uneaten foliage and other matrices to which the chemicals are applied but that are not the consumed fraction, to consider analyzing the Raw Agricultural Commodity rather than only the edible fraction, or to also look at processing fractions, then perhaps, these data could contribute significantly to the question that the indicator was intended to address.

EPA Response

A statement was added to both the indicator discussion and the QA/QC section about extent of pesticides for which the program samples.

In response to he change in reporting of pesticide metabolites from 2002 to 2003 which produced no apparent reduction in the percent of samples , currently we have no explanation to offer.

The objective of the USDA-PDP program is to collect pesticide residue data on foods most likely consumed by infants and children. Program sampling procedures are designed to capture residues in the U.S. food supply as close as possible to the point of consumption. Program objectives, developed as part of the implementation of the 1996 Food Quality Protection Act, would have to be changed to allow the broader sampling and analyses suggested, which would allow the PDP data to contribute better to the question being asked about chemicals applied to the land and their effects on human health and the environment.

Peer Review Comments on Graphic Presentations

The graphical presentation in Figures 064-1, 064-2 and 064-3 are very nicely illustrated and adequately reflect the discussion in the associated text. There are a couple of typographical errors in the legend of 064-2 that need to be corrected: “analyzed” should be “analyzed” and in the same sentence, a space needs to be added between “samples” and “for”.

The part of the Y-axis from 60 to 100% should be eliminated and the part from 0 to 60% should be correspondingly expanded.

EPA Response

As recommended, the typographical errors were corrected, and the changes were made to the part of the Y-axis.

Peer Review Comments on the Additional Post-Peer Review Modification

In the process of verifying all the numbers used for the data points in the three figures (Figure 064-1: Pesticide detects in food. Figure 064-2: Detected residues of pesticides with no established tolerance, 1994-2003), it was discovered that some discrepancies exist in the way PDP reports percent of samples for residues with no established tolerance. The graph in Figure 064-3 was generated using percent of sample numbers from the executive summary pages of the annual PDP reports. For one of the years (2002), the percentage number used (2.7%) refers to the number of samples excluding drinking water samples (12,200), which is a different number than the total number of samples used for the other graphs (12,899). It is not possible to tell from the executive summaries, if the percent of samples consistently excludes drinking water samples or not, but given the possible inconsistency, Figure 064-3 (Detected residues of pesticides with no established tolerance, 1999-2003) was deleted.

Pesticide Poisonings
Reviewed by the Land Chemical Group and the Human Health Group

Land Chemical Group Review

Consensus Statements	EPA Response

Consensus Statements		EPA Response
Overall recommendation	None.	
Critical modifications	None.	
Suggested modifications	None.	
Other comments	The indicator does not relate to ROE question. However, the indicator may be an indicator of the toxicity of chemical products that are available to the general public. Data are good but do not address the question.	EPA considered this recommendation and has revised the indicator to clearly articulate what the data represent.

Human Health Group Review

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications.**	
Critical modifications	Figure 276-2 (Exposure) should be deleted because "exposure" measurement is misleading; it represents only the fact that the poison center received a report, not that an actual exposure occurred.	EPA considered this recommendation and changes were made in the document.
Important modifications	Data from the American Association of Poison Control Centers (AAPCC) represent the best available data, but at the same time EPA should clearly acknowledge that (1) poison control centers typically only capture between 24 and 34 percent of poisonings as cited in the indicator QA/QC documentation, (2) the data collection process is standardized, but is a passive system, and (3) data are collected by multiple poison centers with follow-up likely performed in different ways.	EPA considered this recommendation and changes were made in the document.
Other comments	None.	

Section 4: Waste

Quantity of Municipal Solid Waste Generated and Managed

Reviewed by the Land Waste Group

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications.**	EPA included the indicator with the modifications as detailed below.
Critical modifications	Add this statement to the indicator text: The quantity of municipal solid waste placed on land does not necessarily track impacts on human health and the environment. Therefore this indicator is only an indirect measure of the actual risk of land disposal.	The indicator does not seek to track health and/or ecological effects associated with MSW. It is simply an indicator of the quantity of MSW produced and managed over time which is important to answering the Land Waste question. Therefore, the fact that it does not directly measure effects is not a limitation of the indicator, and the suggested language is not included. Additional information on the potential for wastes to affect human health and the environment added to the background section. This concern is further addressed in the non-indicator text.
	Clarify whether this indicator is intended to assess the impact of waste on all media or just land.	The indicator is not specific to any media or endpoint, which will be clarified in the non-indicator chapter text. References to media impacted or potentially impacted will be discussed in non-indicator chapter text.
	In other (i.e., non-land) chapters of the ROE, address the multimedia impacts associated with municipal solid waste management (e.g., greenhouse gases from landfills, incinerator emissions).	The multimedia impacts will be discussed in the non-indicator chapter text, including linkages to other indicators and chapters.
	Add this statement to the indicator text: This indicator may not be appropriate to evaluate the impact of land-disposed waste on human health and the environment because there is no established direct link or relationship between quantity and impact.	See response to first comment.
	In the indicator text, clearly state that the information on the materials flow methodology is proprietary and confidential and therefore not transparent.	EPA has added a citation for the materials flow methodology to the indicator and the full document outlining the methodology will be attached to the indicator metadata form.
	In the indicator text, provide a more complete and organized list of all assumptions and limitations to the data used to generate this indicator.	More information on assumptions and limitations was added. In addition, the full methodology document outlining more specifics will be provided along with the indicator metadata form.

Consensus Statements		EPA Response
	Add the 2003 data on municipal solid waste generation.	EPA added this information.
	Clearly define the target population.	The target population is defined in paragraphs 1 and 3 of the indicator text.
	Show all data points in the indicator graphics (not just every 10 years) to better appreciate fluctuation in generation rates.	EPA revised the graphic to show annual data as suggested.
Suggested modifications	In the indicator text, state that the data generated by Franklin Associates are not reproducible by a third party.	EPA agrees with this comment and has revised the indicator to provide documentation that details the methodology.

Quantity of RCRA Hazardous Waste Generated and Managed
Reviewed by the Land Waste Group

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications**	
Critical modifications	Add this statement to the indicator text: The quantity of hazardous waste placed in land does not necessarily track impacts on human health and the environment. Therefore this indicator is only an indirect measure of the actual risk of land disposal.	EPA determined that the indicator does not claim to track health and/or ecological effects associated with hazardous waste. It is simply an indicator of the quantity of RCRA hazardous waste produced and managed over time which is important to answering the Land Waste question. Therefore, the fact that it does not directly measure effects is not a limitation of the indicator, and the suggested language is not included.
	In other (i.e., non-land) chapters of the ROE, address the multimedia impacts associated with hazardous waste management.	EPA determined that the multimedia impacts are discussed in the non-indicator chapter text, including linkages to other indicators and chapters.
	Since the data set is limited to two or three data points, eliminate references to trends in the indicator text.	EPA determined the data referred to changes rather than trends.
	Clearly define the target population.	EPA considered this recommendation and clarified throughout the hazardous waste encompassed by this indicator.

Consensus Statements		EPA Response
	In the indicator text, correct a typographical error by stating that the 18% decline in land disposal occurred in 2001 (not 2002 as currently written).	Following peer review, this indicator was updated to include 2003 data. Therefore, percentages and dates changed throughout. This 18% is no longer relevant, nor is the 2002.
Suggested modifications	In the indicator text, clarify that the universe of inclusions is not constant because the indicator measures the amount of legally defined hazardous waste, which changes annually due to the delisting process.	A statement was added to the indicator limitations section to clarify that RCRA quantities can be influenced by a number of factors, including delisting.

Section 5: Contaminated Lands

Contaminated Groundwater Under Control on Contaminated Lands
Reviewed by the Land Waste Group and the Water Group

Land Waste Group Review

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications.**	
Critical modification	In the indicator text, add statements to clearly describe the indicator limitations detailed in the comments below.	EPA considered this recommendation and made the changes.
	For future versions of the ROE, look for alternative indicators to answer this question.	EPA considered this recommendation and agrees.
Suggested modifications		

Peer Review Comments on Appropriateness, Adequacy, and Usefulness of the Indicator
This indicator is somewhat appropriate, adequate, and useful for evaluating and/or contributing to an overall picture of the trends in contaminated lands and their effects on human health and the environment.

This indicator is more relevant to land contamination than the broad measurement of human exposure. It is surprising that the percent of sites that have groundwater under control is less than the number of sites with human exposure under control. Groundwater "under control" does not mean that there are no longer environmental and health impacts from other affected media. For example, some of the groundwater management techniques (e.g., air stripping) potentially have significant environmental and health impacts.

EPA Response

Language has been added to the indicator limitations noting the above.

Peer Review Comments on the Importance for Answering the Question

This indicator is of minor importance for answering the question: What are the trends in contaminated lands and their effects on human health and the environment?

Groundwater contamination is probably the most important consequence of land contamination since a majority of the US population depends on groundwater for potable and irrigation water. However, this indicator focuses only on NSP sites, which have higher cleanup likelihood than other contaminated sites. EPA needs to further test this indicator by studying the rest of the universe of contaminated lands that they are tracking to see if these could potentially skew the data significantly. Further, this indicator does not reflect other land-based exposure pathways such as surface water contamination and direct contact with contaminated soil or hazardous wastes.

EPA Response

The statements are true. EPA is looking for better approaches to discuss land contamination, including better datasets to describe the extent of land contamination beyond NPL and RCRA Corrective Action Sites (which are included in the indicator as well).

Water Group Review

Consensus Statements		**EPA Response**
Overall recommendation	**Include with modifications.**	
Critical modifications	None.	
Suggested modifications	Consider presenting the size of the sites and/or the size of the population that may be relying on groundwater beneath these sites. Smaller or lower-priority sites could be included in this indicator if they serve a large population.	EPA considered this recommendation and determined that data are not currently available. This will be explored in the future.
	Clearly define this indicator as a pressure indicator.	EPA considered this recommendation and has made the changes.
	Cross-reference this indicator with the indicator for *Nitrate and Pesticides in Groundwater in Agricultural Watersheds*.	EPA considered this recommendation and determined that cross-walk occurs in non-indicator Land chapter text.
	Determine whether the data are adequate to present regional comparisons.	EPA considered this recommendation and determined that OSWER previously answered "yes" to this question, but the comparison was never done.
	Define the symbol "GM" in the title of Figure 221-2.	EPA considered this recommendation and changed the figure.
Other comments	This indicator could be linked with other indicators to show a response or effect.	EPA considered this recommendation and determined that this will be done in the non-indicator Land Chapter text.

Consensus Statements		EPA Response
	This indicator is somewhat subjective because it relies on the judgment of the program manager to state whether any violations of standards have occurred.	EPA considered this recommendation and agrees.
	The indicator text is misleading when it classifies the sampling techniques as well defined and standardized.	EPA considered this recommendation and the text has been changed.

Human Exposure Under Control on Contaminated Lands
Reviewed by the Land Waste Group and the Human Health Group

Land Waste Group Review

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications.**	
Critical modifications	In the indicator text, add statements to clearly describe the indicator limitations detailed in the comments below.	EPA considered this recommendation and made the recommended changes.
	For future versions of the ROE, look for alternative indicators to answer this question.	EPA has agreed and may consider in the future.
Suggested modifications		

Peer Review Comments on Indicator Appropriateness, Adequacy, and Usefulness

This indicator is somewhat appropriate, adequate, and useful for evaluating and/or contributing to an overall picture of the trends in contaminated lands and their effects on human health and the environment.

The indicator selected, human exposure under control, is an appropriate measure of the impact of contaminated lands. However, the National Priority List captures a small fraction of contaminated lands and these sites receive priority in assessment and remediation funded by the Superfund. There are thousands of leaking underground storage tank sites, RCRA corrective action sites, Department of Energy sites, and state sites missing from this list. Most of the RCRA Corrective Action sites are not currently included. It is questionable as to whether the percent of sites with human exposure under control at NPL sites reflects the trend for all sites with contaminated lands.

EPA determines whether "contamination is below protective, risk-based levels at NPL and high priority RCRA Corrective Action Sites." It is not clear that EPA has predetermined risk-based levels for all contaminants found at these sites. EPA claims, "'Unacceptable risk' is defined based on the cancer risk range." There are other human risks associated with these sites that lie outside of this assumption (e.g., endocrine disruptors). How significant might these be? The EPA is not including new sites that are discovered as a result of due diligence (All Appropriate Inquiry Rule) on property transfers. EPA is also not including new sites that are created with the "reportable quantity" spill response program. The indicator only looks at human health and does not look at the environment.

EPA Response
The above mentioned peer review comments have been included in the Indicator Limitations.

Peer Review Comments on the Trends in Contaminated Lands
This indicator is of minor importance to answering the question: What are the trends in contaminated lands and their effects on human health and the environment?

Trending might be impacted by the EPA statement, "Advances in risk assessment practice to better address sensitive populations will be automatically incorporated into the indicator as they are incorporated into practice" which may expand the number of sites in the future. They also need to reassess the consistency of their risk assessments and the moving target of correcting previously conducted risk assessments for their impact on sensitive populations. Further, because the NPL sites receive priority in remediation, it is not likely that they necessarily reflect the trends for all sites with contaminated lands. EPA needs to rethink this indicator by studying the rest of the universe of contaminated lands that they are tracking to see if these could potentially skew the trend significantly.

EPA tracks all reportable quantity spills in the United States. Some of these spills have human exposures and ecological damage. They are not included in the Superfund list of sites that is tracked by this indicator. However, they are covered by the National Contingency Plan. There is a need to investigate whether the exclusion of reportable spills represents a significant impact on what this indicator has been suggested to measure.

EPA Response

Text reflecting the above has been included in the indicator limitations.

Human Health Group Review

Consensus Statements		**EPA Response**
Overall recommendation	**Include with modifications.**	
Critical modifications	None.	
Important modifications	The indicator name should be changed to better reflect the fact that "exposure" is not being measured. The indicator represents the amount of "uncontained" waste, not exposure. For example: "Cleanup and control of hazardous waste sites"	EPA considered this recommendation and made the recommended changes to the title and additional data included.
	EPA should discuss the indicator as a change in pressure or stressor as a source of exposure to humans (Level 3), not as an administrative action (Level 2).	EPA considered this recommendation and added Language to make this point.

Consensus Statements		EPA Response
	The number and status of NPL and RCRA corrective action sites (clean or unclean) is important because exposure is a function of and/or influenced by the source and magnitude of toxic waste in the environmental media (air, water, soil). NPL sites are a primary source of concern, in particular for the approximately 40 million people who live within 2.5 miles of a site. Therefore, EPA should include information on the total number of NPL and RCRA sites and the proportion that have been remediated (e.g., ROE03, Exhibit 3-49).	EPA determined this information is presented in other EPA documents. Some details are included in the non-indicator text in describing the extent of land contamination.
	For the future, EPA should work with other groups to determine the broader extent of contaminated lands across the country beyond NPL and RCRA sites. For example, EPA should initiate small studies to determine what portion of contaminated sites across the country are NPL and RCRA sites.	EPA considered this recommendation and agrees.
	Also for the future, EPA should better monitor the exposure around NPL and RCRA sites. For example, EPA should work with ATSDR to collect biomeasure data at NPL and RCRA sites.	EPA considered this recommendation and agrees.
Other comments	None.	

Pesticide-Resistant Arthropod Species
Reviewed by the Land Chemical Group and by the Ecological Condition Group (as a Referenced Indicator)

Land Chemical Group Review

Consensus Statements		EPA Response
Overall recommendation	**Do not include.**	**This indicator will not be included**
Critical modifications	• Not applicable.	
Suggested modifications	• Not applicable.	

Ecological Condition Group Review

Consensus Statements		EPA Response
Overall recommendation	**Do not include.** (Rank: NA)	
Reasons for exclusion	• While it is an ecologically important phenomenon, this indicator does not provide a clear measure of the state of the environment or the condition of ecological systems. • The survey may not continue. • The analytical capabilities, types of pesticides, and application rates have been changing. • Understanding of the index is complicated by the introduction of new compounds (i.e., the development of resistance depends on the presence of opportunities to develop resistance).	This indicator will not be included.