

## **Advisory Board on Radiation and Worker Health**

### **Findings for 232 Dose Reconstruction Review Cases (Sets 6-13) and Comparisons to the First 100 Dose Reconstruction Review Cases September 2016**

#### **INTRODUCTION**

Under the Energy Employees Occupational Illness Compensation Program Act Of 2000 (EEOICPA), the Advisory Board on Radiation and Worker Health (the Board) is required to “verify a reasonable sample of the doses” calculated by the National Institute for Occupational Safety and Health (NIOSH) through their radiation dose reconstructions for claimants with cancer who apply for compensation. In the early years of the program, the Board established methods and procedures for conducting these verifications. The Board also established the Subcommittee for Dose Reconstruction Reviews to select cases for review and oversee the reviews which were conducted by our technical contractor. The Board initially established a target of reviewing 2.5 percent of the individual dose reconstructions conducted by NIOSH, but later modified this target to 1 percent. This reduced target was based on the substantial amount of effort required to reach the original target and the judgment of the Board that a 1 percent sample would be adequate.

The Board’s last report to the Secretary of the Department of Health and Human Services (the Secretary) was issued in 2009 and covered the first 100 cases reviewed by the Board. The current report covers the review of an additional 232 individual cases. The following report provides background information on the methods used to select cases for review, the review procedures and methodology, the findings of this review, and the Board’s conclusions and recommendations.

## **OVERVIEW OF REVIEW PROCEDURES**

The Board's Subcommittee for Dose Reconstruction Reviews Subcommittee selects the cases to be reviewed in consultation with the full Board. The cases eligible for review include only claims that have completed the full compensation administrative process at the Department of Labor. The cases for this review were selected based on several criteria that have been modified over time to obtain better representation of all facilities, work eras, occupations or type of work, and cancer type. For the cases reviewed in this report, selection was targeted to include the more comprehensive dose calculations (so-called best estimates) and dose estimates that were closer to the compensable level (Probability of Causation in the range from 45 to 52 percent). The reviewed cases and their selection are described in more detail below.

The cases are referred to the Board's technical contractor (Sanford Cohen & Associates or SC&A which provides technical and scientific expertise to assist the Board in conducting our work) who then reviews the case files and repeats the dose reconstruction procedures utilized by NIOSH for that case and attempts to verify the NIOSH findings. The contractor then prepares a report for each case on its findings including any errors found in how the dose reconstruction was conducted. The report presents a systematic review of the findings following a standard template and evaluation process that also addresses the severity of each finding. Findings with the greatest potential impact on the dose reconstruction calculation are rated as being more serious.

The contractor's report is first presented to two Board members for initial review and discussion of that case. All Board members participate in this phase of the review process with each Board member assigned to review a limited number of cases. The contractor's report on each case is modified in light of the Board members' reviews and sent to NIOSH for comments and/or clarification. Then the report on each case is presented to the Subcommittee for review and discussion. The Subcommittee resolves any differences between the contractor and NIOSH or the contractor and the Subcommittee regarding the review findings. The Subcommittee finalizes a report on the findings on each case review. In addition to the specific case review findings, the review process may also reveal potential problems with the specific procedures or documents

used in the dose reconstruction process. These may be referred to NIOSH or to other Board work groups or subcommittees for further evaluation.

For a small proportion of the reviewed cases, the Board follows a slightly different procedure in that the Board's contractor independently calculates the dose estimates (rather than just verifying the NIOSH calculations.) These are referred to in the report as "Blind Reviews". A report is prepared on each of these cases, reviewed by NIOSH, and then finalized by the Subcommittee.

## **FINDINGS**

### Cases Sent to NIOSH for Reconstruction

As of November 1, 2015 the Department of Labor (DOL), which administers EEOICPA, reported a total of 44,789 case claims sent to NIOSH, of which 42,714 cases (95.4%) had already been returned to DOL for a compensation decision, with the remaining 2,075 (4.6%), both new and returned, still under review at NIOSH . The 42,714 cases returned to DOL included both dose reconstructions and Special Exposure Cohort (SEC) cases compensated due to inability to estimate the radiation dose with sufficient accuracy and reasonable likelihood of health endangerment. (Administratively some of the latter cases were processed individually by NIOSH while and until the SEC classification was determined, and others directly by DOL if and after the SEC class was approved.)

### Types of Dose Reconstruction

The cases reconstructed since the Board's inception fall into three basic types: 1) 'best estimate' dose reconstructions; 2) 'over-estimated' dose reconstructions; and 3) 'under-estimated' dose reconstructions. NIOSH's overestimating approach is an efficient way to process claims which are evidently non-compensable upon initial examination. This time saving method confirms the initial observation and is employed only for non-compensable claims. Under-estimation is similarly a time saving approach used for claims that are evidently compensable upon initial examination. Once the evidence of compensability is confirmed, a more precise estimate of dose is not necessary. The best estimate approach is used for cases that are not clearly compensable or non-compensable upon initial examination and gives the most precise estimate of dose in

order to make a decision on compensation. [Note that dose reconstructions are not undertaken for claims in facilities approved for SEC classes. In claims for facilities with SEC classes for which the cancers declared are not among the 22 that are compensable under the SEC provisions of EEOICPA, a partial dose reconstruction is undertaken, enabling DOL to make a compensation decision based on the fraction of radiation doses that remain feasible to reconstruct.]

Dose Reconstruction Cases

At the conclusion of the dose reconstruction reviews for Sets 6-13, which are the focus of this part of the report, NIOSH reported a total of 31,534 claims with completed dose reconstructions sent to the Department of Labor. The remaining recommendations were primarily SEC cases, but also included some cases returned to DOL for administrative reasons. The distribution of types of dose reconstructions (DR’s) for these claims, made since the inception of the program in 2001, is as follows (Table 1):

**Table 1. Types of Dose Reconstruction for the First 31,534 DRs\***

<b>Best Estimate</b>	<b>Over-Estimate</b>	<b>Under-Estimate</b>	<b>Partial</b>
2,452 (7.8%)	18,960 (60.1%)	8,104 (25.7%)	2,018 (6.4%)

\* Completed as of Nov. 1, 2015.

Thus a majority of the claims submitted involved over-estimated dose reconstructions, and an overwhelming majority (85.8 percent) either over- or under-estimates. Only 7.8 percent were reconstructed based on the more precise but more time-consuming best estimate method. Partial dose reconstructions comprised the remaining 6.4 percent.

Following the initial Report to the Secretary in 2009, the Board directed NIOSH to decrease the percentage of cases involving over-estimates (resulting in denial of compensation) through more frequent use of best estimates for dose reconstructions. However, over-estimates remain in frequent use in order to complete dose reconstructions on a timely basis within available resources.

Overall, 13.4 percent of the claims were made by female employees. No data were collected on race or ethnicity of the claimants except for those filing for skin cancers, for whom differences in overall incidence rates by race are scientifically observed and thus needed to be taken into account in the dose reconstructions.

#### Dose Reconstruction Cases Reviewed

Of the dose reconstruction cases reviewed for this report, the Subcommittee under the direction of the Board and with technical assistance from NIOSH, its subcontractor ORAU (Oak Ridge Associated Universities), and the Board's technical contractor (SC&A, Inc.), has been able to undertake more reviews of best-estimate dose reconstructions. Although best estimate dose reconstructions are relatively infrequent among all cases processed under the NIOSH program, they are particularly important in that errors could potentially result in DOL being advised to make incorrect compensation decisions. Also best estimates require much more sophisticated calculations, more complete records, and more challenging professional decisions to bridge information gaps both plausibly and claimant favorably. Hence reviews of best estimates test the dose reconstruction process more effectively than over- and under- estimated cases.

Cases for review were selected primarily from among best estimate dose reconstruction cases, typically already adjudicated by DOL. The criteria used in selecting these cases were Probabilities of Causation (POCs) between 45 and 55 percent (more recently between 45 and 52 percent), appropriate representation of facilities (Department of Energy and Atomic Weapons Employers, diversity of occupations among persons selected for review, diversity of decades worked and length of time worked, and diversity of cancer types.) More recently, representation by gender has also been included as a selection criterion.

Of the 232 recently reviewed cases, 193 (82%) were best estimates, 32 (14%) were over-estimated and 7 (3%) were under-estimated. Thus, a total of 17% of reviewed cases were either over- or under-estimates. These results stand in sharp contrast to the results from our 2009 Report on the first 100 cases reconstructed in which 93 percent were either over- or under-estimates. (Table 2)

**Table 2. Types of Dose Reconstruction Reviews**

<b>Cases Reviewed (Yr. of Report to Secretary)</b>	<b>Best Estimate</b>	<b>Over- Estimate</b>	<b>Under- Estimate</b>
First 100 cases (2009)	7 (7%)	76 (76%)	17 (17%)
Next 232 cases (2016)	193 (83%)	32 (14%)	7 (3%)

The review of the first 100 cases that were largely processed as over- and under-estimates reflects the imperative to rapidly process the large initial batch of claims during the early years of the EEOICPA program and eliminate the resulting case backlog. As the program has matured:

- The backlog of individual claims has now been reduced so that about as many individual cases as are sent to NIOSH quarterly are processed during that quarter;
- Many site exposure profiles for covered facilities have been completed based on site document research and visits by staff and Board members, and much of this work has been reviewed through the establishment of 37 different site-specific Board Work Groups, and
- Many more analytical procedures have been developed, documented, and automated where feasible, based on staff input and the activities of the Board’s Procedures Review Subcommittee so that dose reconstruction decisions are now better regularized and more uniform.

As a result, best estimate dose recalculations now comprise more than four-fifths of the cases being reviewed.

Findings among Reviewed Cases

In examining the 232 cases from Sets 6-13, the Subcommittee reviewed a total of 626 findings (an average of 2.70 per case) in which there were initial differences between the dose assessments for individual cases made by NIOSH and those made by the Board’s technical consultants (after initial review by individual Board members). These findings were then discussed first by the respective staffs and then by the Subcommittee. Of the 626 findings, 513 (82%) were ultimately determined to be of potentially low impact on the compensation decision, 91 (15%) of potentially medium impact, and 22 (4%) of potentially high impact.

A finding is categorized to have a low impact if it has only a marginal impact on the compensation decision, involving for example a minor quality assurance concern, a minor factual or technical clarification, or a change in estimated dose (increase or decrease) of only a few millirems (mrem). A finding is found to be of medium impact if it was related to some change in procedures, a more involved discussion or clarification of the DR methods, or involved a change in dose of greater than a few mrem up to a few rem quantities. A finding is found to be high impact if it prompted a major change in procedures that would affect several cases, or if it involved a change in assigned dose of several rems or more.

As a result of discussion and review of these findings, the compensation recommendation related to a Probability of Causation was noted to be changed in only one case (0.3% of cases reviewed by the DRSC Subcommittee). In this case, the NIOSH dose reconstruction had resulted in a positive compensation decision, whereas the determination of the Subcommittee would have been below the level for compensation. The claimant-favorable assumptions made by NIOSH in response to the original claim were the best information available at that time. The Subcommittee findings were based on additional information not available initially to NIOSH.

As might be expected, the above result of 2.70 findings per case is 32 percent less than the 3.98 per case reported in 2009. However, the distribution of impacts in this report (82% Low, 15% Medium and 4% High) is quite similar to those from the 2009 report (86% Low, 12% Medium and 3% High). This result may reflect the fact that the dominant over- and under-estimations in the first report were broad assessments, not likely to present major differences in dose reconstruction estimates. For this report, dominated by best estimates, the chances for differences were far greater. Due to improved assessment procedures and protocols implemented by NIOSH, the percentage of high-impact findings has been kept low – that is, these two effects have had counteracted each other to keep the percentage of high-impact review findings low.

In addition to assessing the degrees of impact of deficiencies for each case reviewed, the Subcommittee began in Set 6 to assess and categorize findings by type of issue or issues involved in these deficiencies. The types of issues and their distribution among findings for the 232 cases are presented in Table 3.

**Table 3. Findings by Type of Deficiency for Sets 6-13\***

<b>Category</b>	<b>Type of Deficiency</b>	<b>No. Of Findings</b>
A	Was the proper judgment made regarding placing a person physically at a work location?	13 (2%)
B	Were all exposure scenarios considered (i.e., neutron, thorium)?	28 (4%)
C	Were the correct external dose model and assumptions used?	253 (40%)
D	Were the correct internal dose model and assumptions used?	134 (21%)
E	Is it a quality concern?	95 (15%)
F	It does not meet any of the above criteria.	103 (16%)
	<b>Total</b>	<b>626*</b>

\*NOTE: Some of the 232 cases had more than one type of deficiency.

As is clear from Table 3, the greatest source of findings (40 percent) is disputed modeling or assumptions about external doses, followed by the same (21 percent) for internal doses. The former deficiency often reflects differences about the radioactive materials to which an energy employee was exposed. If a discrepancy is found in a reviewed case, all similar cases that have not already been compensated, are reviewed by NIOSH, and provided a new dose reconstruction when appropriate. If the new dose reconstruction would modify the compensation decision, the Department of Labor will take appropriate action to reverse the earlier decision. It should also be noted that NIOSH utilizes the same process of reconsidering and revising dose reconstructions upon its own review and improvement of dose reconstruction data and methods, independently of the Board's review.

#### Observations among Reviewed Cases

In addition to the findings under review, SC&A consultants made 206 observations (slightly less than one per case reviewed). Observations, which began being noted and recorded in Set 8, are instances where SC&A had comments or questions about NIOSH/ORAU dose assessments which were discussed by the parties and reviewed by the Subcommittee to confirm that proper procedures were followed and applied correctly. If not confirmed, the instances initially assessed as observations were changed to findings and re-examined appropriately. Thus, none of the 206 observations recorded resulted in a change of estimated POC.

### Number of Dose Reconstruction Cases Reviewed

As of November 1, 2015, the Subcommittee had reviewed since its inception 332 cases among the 31,534 claims filed which required dose reconstruction. Thus, this Subcommittee has completed reviews of 1.05 percent of all such claims filed as of this date, achieving its current goal of 1 percent of all such claims reviewed. Initially the Board had set a goal of 2.5 percent, as reported to the Secretary in 2009, reflecting our experience of conducting reviews, 93 percent of which were over- and under-estimates. However, the Board's decision to increase the percentage of best-estimate cases slowed down the review process. Subsequently, the Board approved reducing our goal to 1 percent of all Dose Reconstruction cases. This goal has been met. The Board fully expects to continue meeting this goal during the next operational period.

### Distribution of Dose Reconstruction Sites across Employment Sites

In addition, the Subcommittee has worked assiduously since 2009 to assure that cases selected for review represented an appropriate cross-section of all the plants and facilities for which compensation claims have been made. The breakdown of employment sites covering Sets 6-13 is presented in Figure 1. Sites with only one or two cases reviewed are represented collectively with 38 sites having one case reviewed and 26 having two.

In Figure 2 the blue bar next to each of the 26 large and medium sites represents the number of cases needed to be reviewed in order to achieve 1 percent of all Dose Reconstructions reviewed for that site. [NOTE: The Board's goal is 1 percent reviewed of the total of all claims involving dose reconstruction cases, not 1 percent of all claims for any given facility. Some facilities, for example, may deserve greater attention due to the complexity of the DR's involved.] In Figure 2 the second bar next to each site is the sum of cases which have been reviewed since the inception of the program, combining those for the first 100 cases (in red) and those for the next 232 cases (in green). Thus if the height of the red-green bar for the reviewed exceeds that of the blue bar, then the reviews undertaken by the have exceeded 1 percent of the Dose Reconstructions for that site.

As indicated for the 26 named sites in Figure 2, the Subcommittee has met or exceeded the measure of one-percent reviewed for 11 of them and has not met this measure for the other 15 named sites. For sites with one or two reviewed cases (Figure 2, bottom two lines) the Subcommittee has far exceeded 1 percent reviewed, with 82 reviews completed when 53 would have been needed to achieve one-percent reviewed. This gives evidence that sites with small numbers of claims were appropriately covered in the review process.

#### Distribution of Probabilities of Causation among Cases Reviewed

Figure 3 shows the distribution of Probabilities of Causation (POC) among cases reviewed in Sets 6-13. Cases with POC between 45-52% have been targeted for selection in the recent past since slight errors in these have the potential to change the compensation recommendation from non-compensated to compensated or *vice versa*. Thus, almost one-third of the case reviews (30%) since the 2009 Secretary's Report have been in the POC range of 45 to less than 50 percent. This is a major increase in reviews in this POC range, compared to only 5% of reviews in this range for the first 100 case reviews reported in 2009. This reflects both the increased percentage of best estimate cases reviewed since 2009 and our focus on assuring correct compensation decisions.

Another subgroup, those cases with POC from 50-52%, have also been targeted recently along with the 45 to <50% group. For the subgroup from 50-52% the Subcommittee wants to assure that slight errors in this subgroup have not resulted in erroneous compensation decisions. As a matter of policy when such errors are found, the inappropriately-compensated claimant is not asked to return his/her compensation money. However, finding such errors can help both the Board and staff avoid such compensation errors in the future. Even with this focus, however, the percentage of reviews in this report (21%) which have POC at or over 50% is less than the corresponding value of 27% in the 2009 Report. This reflects a sharp decline in under-estimation cases since 2009. Similarly the percentage of cases reviewed with POC below 45% has declined from 68% before 2009 to 49% in this report, in this instance reflecting a decline in over-estimation reviews since 2009. The bottom line in both of these instances is that the Board is now more clearly focused on reviewing cases for which small errors in radiation dose

reconstruction can change the compensation decision, hence seeking further to minimize possible errors in the final compensation decision.

#### Distribution of Dose Reconstruction Reviews by Years of Employment

Figure 4 shows the distribution of dose reconstructions by years of employment. As noted two-thirds (67%) of the 232 persons for whom doses were reconstructed and reviewed by the Subcommittee worked in EEOICPA-covered facilities for 20 years or more, 13% for 10 to 20 years and 20% for less than 10 years (average 24.1 years).

The present results reflect a slight average increase in years of employment compared to those reported in the 2009 Report at 53% for 20 years or more, 21% for 10 to 20 years and 26% for less than 10 years, respectively (average 22.4 years). This is not surprising since the current report has been developed six years after the first, allowing more years of employment by claimants before developing cancers and/or applying for claims. Also in the ensuing years since the 2009 Report, the trends for 5-year relative survival rates of cancer victims have continued to rise, allowing claimants more years of employment before they file their claims if they so choose.

#### Distribution of Cases Reviewed by Risk Model

Figure 5 presents the breakdown by type for 28 cancers. The types with the largest numbers of cases evaluated are Non-melanoma Skin (63 cases), All Male Genitalia (47 cases), Lung (45 cases), and Urinary Tract (36 cases). Half of the urinary tract cases are cancers of the bladder and the other half cases excluding the bladder. These results are similar in distribution to those reviewed for the first 100 cases.

#### Distribution of Cases Reviewed by Decade First Employed

Figure 6 presents the distribution of 232 cases by decade first employed. Fully 72 percent of the cases reviewed were first employed before 1960: 49 percent were from the 1950s, 21 percent from the 1940s and 2% from the 1930s. As expected given the decades-long latency periods of most cancers, these percentages have declined in more recent decades from 18% in the 1960s to 6% in the 1970s and 4% in the 1980s. None were reviewed in this cohort from the 1990s or later.

Comparing these results with those from the 2009 Secretary’s Report, there is now a large increase in the percentage of cases reviewed from before 1960 (72%) compared to 51% in the earlier report.

Comprehensive or Blind Reviews

To further assure the accuracy of claimants’ dose reconstructions and hence POCs, the Board adopted a policy in 2012 of initiating more comprehensive (so-called blind reviews) in a limited number cases – that is, tasking SC&A independently to conduct dose reconstructions for cases already reconstructed by NIOSH and comparing the results, which are then reviewed by the Dose Reconstruction Review Subcommittee. While this process is resource-intensive, it is a better way to quantify how well two independent dose reconstructors can interpret the same data and identify decision points that could result in inconsistencies in dose calculations. During the past two years, the program has solicited six blind review cases per year .So far fourteen cases have been reviewed using this process, of which thirteen reviews have been completed and one is still under examination. All thirteen completed reviews are in agreement with respect to their compensation decisions. (Table 4) This is quite good agreement given the selection of cases which needed best-estimate assessments (typically resulting in POCs in the 45-52 percent range), the complexities of these dose reconstruction calculations and the

**Table 4. Blind Case Reviews**

<b>Blind Case No. (Facility)</b>	<b>POC by SC&amp;A</b>	<b>POC by NIOSH/ORAU</b>
<i>A. First contract period</i>		
1. Portsmouth Gas Diffusion	49.35%	48.75%
2. X-10	48.00%	43.63%
<i>B. Set 17 Blinds</i>		
3. Allied Chemical & Dye	DR under review	DR under review
4. Fernald	38.12%	48.27%
5. Hanford	43.18%	45.27%
6. Rocky Flats	42.65%	47.51%
7. Savannah River	51.00%	51.39%
8. Y-12 and X-10	50.47%	50.46%
<i>C. Set 20 Blinds</i>		
9. Nevada Test Site	40.59%	41.17%
10. Hanford/Weldon Springs Plant	40.71%	42.49%

11. Hanford/Pacific NW Natl. Lab.	36.43%	42.31%
12. Rocky Flats	43.78%	42.91%
13. Brookhaven Natl. Lab.	51.05%	52.54%
14. Y-12	49.48%	49.46%

absence of extensive internal and external dose measurements for many individuals.

Of the 13 completed cases in Table 4, nine were found to have one or both of their estimated POC's between 45 and 52 percent. The median of the absolute value of the difference between estimated POC's was 1.8%. The average value of these absolute differences was 2.5%. While these figures give pause for cases in which POC's are near 50%, it should be noted for all of these estimates, both results were either above or below 50% and hence in agreement regarding potential compensability.

### **Other Board Review Activities**

In interpreting the findings of these individual case reviews, it is important to consider this review process in the context of other reviews conducted by the Board. The dose reconstructions are based on a large number of technical documents that provide a description and history of the activities at each facility covered by the legislation and potential sources of radiation exposure for people working at that facility over time. In addition, there are a large number of other reference documents and procedures that are used in the dose reconstruction process. These documents are continually being revised and updated to reflect newly available information and adapted to improve the dose reconstruction process. The Board has reviewed, or is in the process of reviewing nearly all of these documents and often recommends changes to these documents that are then implemented by NIOSH.

In addition, there have been many petitions to add designated groups of people working at specific facilities during designated time periods to the Special Exposure Cohort. NIOSH evaluates these petitions to determine if there is adequate information available to conduct individual dose reconstruction. If not, the group is added to the Special Exposure Cohort, and those people are eligible for compensation for specific cancers without individual dose

reconstructions. The Board then reviews the NIOSH evaluation and makes a recommendation to the Secretary of DHHS whether or not to add the group to the Special Exposure Cohort.

These other review activities by the Board have a large indirect effect on the Board's verification of dose reconstructions. Often while an individual case is being reviewed or after the review, a procedure or other technical document used in the dose reconstruction may have changed due to the availability of new information or in response to a recommendation from the Board's review, or the claimant may be added to the Special Exposure Cohort. The Board's review of the individual case does not reflect those potential changes. It relies only on the procedures and information in place at the time that the original dose reconstruction was done and does not attempt to incorporate any subsequent modifications. However, as noted above for individual case reviews, NIOSH does review all individual dose reconstructions that may be impacted by a change in procedure or other technical document used in the dose reconstruction, recalculate the estimated POC when appropriate, and notify the Department of Labor if the compensation decision might change.

## **Conclusions**

1. The Board's review of 232 individual dose reconstructions yielded 626 findings. Only 22 (4%) of these findings had the potential for a significant impact on the outcome of the individual dose reconstruction. Given that the cases selected for review in this second set were much more likely than the first set to have findings that could have a significant impact on potential compensability of the case, these findings indicate that the NIOSH dose reconstruction process has improved compared to our earlier findings based on the initial review of 100 cases.
2. Most of the findings with the potential for a significant impact on dose reconstruction were due to the limited availability of exposure and other data from the facility where the individual worked. The dose reconstruction process often relies on documentation that is still available from work done 50 or more years ago. Dose reconstructors must use their professional judgement to estimate the claimants' exposures based on this often incomplete information. Differences between the original dose reconstruction and the recalculation of the dose by the reviewer(s) is not surprising under these circumstances.

3. The limited number of more comprehensive reviews (so called Blind Reviews) also show good agreement between the NIOSH dose calculations and those of the Board's contractor. One of the more comprehensive case reviews was deferred until a more complete review of all of the data from the facility where the claimant worked could be conducted.
4. The above three conclusions along with the Board's ongoing reviews of the NIOSH dose reconstruction procedures provides the Board with a high level of confidence that the dose reconstruction process is scientifically sound. However, the methods and information used for dose reconstruction process are not static. As new information on the many sites covered by this program becomes available and better methods are developed to estimate dose, the methods used for dose reconstructions need to continually change to reflect this new information and methods.

### **Recommendations**

Based on the findings of this review and further deliberation by the Board, the Board recommends the following:

1. The Board should continue the individual review process consistent with the current goal of reviewing one percent of the dose reconstruction cases.
2. The Board should modify the review process to make it more efficient and timely by focusing more effort on the critical parts of dose reconstruction evaluation.
3. The Board should continue conducting the more comprehensive (so-called blind) reviews at the current rate.
4. The Board should initiate a process to conduct reviews focused on evaluating the consistency and accuracy of dose reconstructions for claims where the dose reconstructors must make individual judgments about what exposure data or other information should be used for conducting the dose reconstruction and where these choices are not proscribed by the guidance documents applicable to that site. For example, these reviews could focus on the consistency of the dose reconstructions for several cases with similar work histories at a given site or the consistency in the application of co-worker models for a specific exposure situation. The Board should work with the Subcommittee, NIOSH, and the Technical Contractors to identify key targets and methodologies to implement these more focused reviews.