From:	MH Specter
To:	Buckberg, Perry
Subject:	[External_Sender] NRC"s Memorandum and Order CL1-21-01
Date:	Saturday, March 06, 2021 12:03:16 PM
Attachments:	Critique of NRC"s Memorandum and Order CLI-21-01.pdf EXECUTIVE SUMMARY Critique .pdf

Dear Mr. Buckberg,

You may recall that I have filed a petition under the NRC's 2.206 petition process. My past petition actions are now recorded in the ADAMS system under Accession Numbers ML20303A335, ML20303A237, ML20303A338, and ML20346A074.

I ask that the two attached PDFs be considered as continuations of the same petition submittal process as the previous four documents. Would you kindly forward this letter and the two attachments to the NRC's Executive Director for Operations and all other staff personnel involved in the production of Memorandum and Order CL1-21-01?

I thank you very much.

Sincerely,

Herschel Specter, President
Micro-Utilities, Inc.
mhspecter@verizon.net
1-914-761-3748

Critique of the NRC's Memorandum and Order CLI-21-01

EXECUTIVE SUMMARY

HERSCHEL SPECTER

mhspecter@verizon.net

March 1, 2021

CRITIQUE OF NRC'S MEMORANDUM AND ORDER CLI-21-01

Micro-Utilities, Inc.

1.0 EXECUTIVE SUMMARY

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This Memorandum and Order rejected petitions submitted by NY State, local elected officials, and others because these petitions were judged to be either not based on plausible assumptions and/or did not demonstrate a material impact on the decommissioning trust funds (DTFs). Meeting such requirements is a heavy burden for local groups to carry. However, if this is the standard to be applied for admissibility, then both HDI's (Holtec Decommissioning International) Post Shutdown Decommissioning Activities Report (PSDAR) and the NRC Staff's SE should also be rejected.

When the NRC staff examines the radiological risk a nuclear plant presents to the public it starts with a huge number of potential initiating events and, using the rigor of probabilistic risk assessment technology, determines which scenarios might cause offsite consequences, their probabilities, and the magnitude of these potential consequences. By looking at a range of success and failure scenarios the staff determines if it has reasonable assurance that the radiological risk is acceptably low. No such process was used by the NRC staff to estimate decommissioning financial risks borne by the public and if such financial risks were acceptable. Instead, the staff just looked at one success scenario that starts with a date chosen by the applicant. Start dates are quite important because decommissioning trust fund levels vary from day-to-day as market conditions vary. After selecting a start date which had favorable market and DTF conditions, HDI shut out the influence of the market for the next 40 years in its analysis. Had a petitioner presented such a financial model, would the staff have considered it plausible? The HDI financial model is the antithesis of what the Memorandum and Order stated on page 54: *"Over time, market fluctuations that may temporarily affect the value of decommissioning trusts are to be expected, and some fluctuations could potentially be significant enough to raise a dispute about the adequacy of the decommissioning funding presented in the license transfer application."* Evaluating potential market fluctuations is a fundamental issue in estimating financial risks. The fact that petitioners were not capable of quantifying the importance of market fluctuations does not relieve the staff from making such calculations. Instead of just analyzing a single favorable day, 10/31/2019, as HDI did, this critique also examined 12/31/2018, just 10 months earlier, using precisely the same methodology as HDI used. This supplemental analysis found that the DTFs of IP1, IP2, and IP3 all became insolvent with a combined shortfall of $300.6 million dollars after having depleted $2.104 billion dollars from the DTFs from these three units. Yet Entergy had informed the staff of the IP1, IP2, and IP3 DTF levels on 12/31/2018, and this did not precipitate any regulatory action. The staff is fully capable of performing the same 12/31/2018 analysis as is presented in this critique. What would the staff have done if it too calculated that all three IP DTFs would become insolvent if the 12/31/2018 data were used as input to the HDI methodology? Would the staff look closer and detect the fundamental shortcomings of the HDI methodology? The petitioners were rejected for not providing a type of analysis that the staff itself should have done.

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The SE lists hundreds of public comments in its Addendum D. Of these, some 152 entries are on the subject of the sufficiency of the HDI PSDAR, which also is the subject of this critique. When the Memorandum and Order rejected the petitions of NY State, local elected officials, and others it inadvertently rejected the possibility of a hearing during which the authors of these hundreds of comments would have been afforded the opportunity to express their concerns. This is unjust. Unlike the point-by-point commentary in the Memorandum and Order on why the NY State and local elected petitioners were rejected, this opportunity for a large group of citizens was nullified without a stated reason or justification. If this critique is any measure of the contribution members of this large public group can make, these voices need to be heard.

Has this larger public, beyond the State of New York, local petitioners, and others, been treated fairly in this Memorandum and Order?

Critique of the NRC's Memorandum and Order CLI-21-01

HERSCHEL SPECTER

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March 1, 2021

ABOUT THE AUTHOR

Herschel Specter, President of Micro-Utilities, Inc., holds a BS in Applied Mathematics from the Polytechnic Institute of Brooklyn and a MS from MIT in Nuclear Engineering. He is a Licensed Professional Engineer in the State of New York. He has had a long association with the Indian Point nuclear power plants starting as a member of the Atomic Energy Commission (now the Nuclear Regulatory Commission) where he was the Licensing Project Manager for the original licensing of the Indian Point 3 nuclear plant in the 1970s. In the 1980s the New York Power Authority hired Mr. Specter to manage the defense of Indian Point 3 in a federal adjudicatory trial in the wake of the Three Mile Island nuclear accident in Pennsylvania. Prior to joining NYPA, Mr. Specter served at diplomat rank for 5 years at the International Atomic Energy Agency in Vienna, Austria where he headed up an international effort writing design safety standards for nuclear power plants.

Mr. Specter has been Chairman of two national committees on emergency planning and was a guest lecturer for several years on emergency planning at Harvard's School of Public Health. He led an effort as a consultant to Entergy analyzing emergency responses during a hypothetical terrorist attack on Indian Point. Mr. Specter has presented testimony at the National Academy of Sciences on the Fukushima accident and on other nuclear safety matters and has been a guest speaker at many universities on matters of energy policy. Today he is one of 14 Topic Directors in Our Energy Policy Foundation, a group of about 1500 energy professionals who seek to bring unbiased and comprehensive energy information to our political leaders and members of the public.

Mr. Specter has been active on social and environmental matters. He has been a Big Brother and in 1971 had the honor of being selected as "Big Brother of the Year" for all of the USA and Canada. He also received a personal letter of commendation from the President of the United States for his work with the Youth Conservation Corps.

Mr. Specter was born in White Plains, NY and lives there now.

Acknowledgements

The author wishes to thank Mr. Michael Shatzkin, Dr. Leonard Rodberg, Dr. Dietmar Detering, and Mr. C.J. Milmoe for their valuable contributions to this document.

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Has this larger public, beyond the State of New York, local petitioners, and others, been treated fairly in this Memorandum and Order?

2.0 Is the NRC Staff in Violation of its Own Regulations?

This Memorandum and Order immediately raises the question of whether the NRC staff is in violation of its own regulations. NRC regulation 10CFR50.82(a)(4)(ii) states *"The NRC shall also schedule a public meeting in the vicinity of the licensee's facility* ***upon receipt*** *of the PSDAR".* (Emphasis added). Holtec Decommissioning International (HDI) issued its PSDAR (Post Shutdown Decommissioning Activities Report) to the NRC on December 19, 2019. When and where did the NRC staff hold its required meeting?

It appears that no such public meeting was ever held. Such a meeting is not mentioned in the SE. To the contrary, Addendum D of the SE lists hundreds of unanswered comments, of which 152 are on comment topic #6, the sufficiency of the HDI PSDAR. On page 26 of the NRC staff's Safety Evaluation (SE) it is stated *"The staff will only review the HDI PSDAR if and when the proposed license transfer transaction has been consummated".* This SE statement might not have appeared in the SE if the requirements of 10CFR50.82(a)(4)(ii) had been implemented. We noted that the NRC staff has recognized the special importance of comment # 6. Of the 17 comment categories in Addendum D, only comment category 6 is discussed in the body of the SE.

The NRC's handling of the HDI PSDAR has been incoherent. The SE, on page 26, emphasizes the importance of the site-specific decommissioning cost estimate information included in the PSDAR: *"Regarding comment submission topic 6 concerning the sufficiency of the HDI PSDAR, the NRC staff treated the PSDAR as a supplement to the LTA on the determination that the site-specific decommissioning cost estimate information in the PSDAR* ***was necessary to complete the review of the LTA."***(emphasis added).

The site-specific decommissioning cost estimate information the NRC staff is referring to is PSDAR Tables 5-1a, 5-1b, and 5-1c, which are the decommissioning cost estimates for IP1, IP2, and IP3, respectively. On one hand the SE identifies these three PSDAR tables as necessary to complete the review of the license transfer application and on the other hand the NRC staff has not committed to reviewing the very document that these three tables come from. To further compound this confusion about the treatment of the PSDAR, the recent Memorandum and Order frequently refers to specific items in the PSDAR in defense of its conclusions. It cannot be that the NRC Commissioners have carefully reviewed the PSDAR and the NRC staff has not. The only common thread in all these different NRC statements is the refusal to listen to the public's justified concerns about the HDI PSDAR.

This Memorandum and Order not only denies hearing requests by the most senior elected officials from the State of New York and by local officials near Indian Point, it appears to prevent a staff meeting with the citizens at large to resolve the 152 comments on topic # 6.

This critique deals precisely with the many defects in the HDI PSDAR, the inadequacy of the NRC staff's SE, and their impact on Memorandum and Order CL1-21-01.

3.0 A Citizen's Perspective

For almost five decades the people (the rate payers) have contributed to the Indian Point decommissioning trust funds (DTFs). The money in these DTFs is the people's money, it is not Entergy's money, it is not HDI's money, and it is not the NRC's money. This money was collected from the ratepayers to assure that after Indian Point stopped operating it would be decommissioned in a manner that met all federal, state, and local regulatory requirements. It has been reported that, outside of a temporary bridge loan by Energy during the "Great Recession", neither Entergy nor Holtec has contributed to any of these DTFs. Neither Entergy nor Holtec has publicly expressed any interest in remaining in New York and in contributing to the general welfare of people in this State. However, the people will remain and, if the NRC has made a poor decision on this decommissioning effort, it is the people who will bear the consequences. New Yorkers need a much greater degree of assurance that they will not be faced with a nuclear waste dump on the Hudson or the need to spend additional large sums of money to finish the decommissioning process. Since neither Entergy nor Holtec has put any of their own money into these DTFs nor expressed any interest in continuing to be part of the New York community, it places special responsibilities on the NRC to protect the public during this long decommissioning process. Unfortunately, the present SE does not provide reasonable assurance and this Memorandum and Order undermines public confidence in the NRC.

Missing from this whole process is the contractual requirement to return all DTF surpluses to the people, since it is the people's money that is paying for the decommissionings. In turn, this means than any DOE reimbursements, past and future, are placed into the DTFs. These reimbursements do not belong to either Entergy or HDI. This means that if DOE removes the spent fuel by 2030 or so, all unnecessary charges by HDI from that date onward would cease and the unused money would remain in the DTFs until returned to the people. This means that all unused money in the Contingency Allowance is returned to the DTFs.

The review of the HDI PSDAR revealed two major weaknesses, one in methodology and the other in the analysis of the funding level for IP2. The HDI methodology for estimating the costs to decommission IPEC was found to be incomplete, unrealistic, and unstable. With regard to IP2, the DTF may be severely underfunded. If IP2 has decommissioning costs similar to its sister plant IP3 there could be a shortfall of about $300 million dollars, and radiological decommissioning might not be completed. A detailed review of the HDI PSDAR did not produce any justification for HDI's claimed lower costs to decommission IP2; in fact it defies common sense and decommissioning estimates the NRC itself made.

The nation is facing very difficult economic times.No one, including the NRC, can assure the public that a future economic turndown won't severely reduce the amount of money in the DTFs to the point that the decommissioning process would be stopped, leaving a partially destroyed site and largely depleted DTFs. HDI makes it clear that it does not account for inflation in its analyses. Well, it doesn't account for deflation of the DTFs either. Since small changes in the DTFs can cause wide swings from surpluses to deficits, from success scenarios to failure scenarios, starting this Indian Point decommissioning program in May, 2021 is very risky.

Citizens are primarily interested in preventing failure scenarios from occurring and secondarily interested that their money is wisely spent and that any surpluses are returned to the people. Turning over the people's money to HDI is totally counter to the best interests of the people.

4.0 Structure of this Critique

This critique is divided into four parts. Parts One and Two focus on the issue of the $301 million dollar cost difference between decommissioning IP2 versus IP3. If the cost to decommission IP2 is similar to IP3’s cost to decommission, then the IP2 DTF is severely underfunded and the IP2 DTF could be empty and insolvent around year 2031, leaving a shortfall of about $298.6 million dollars. Conversely, if the cost to decommission IP3 matches that of IP2, the public would have been significantly overcharged. More fundamentally, if HDI cannot convincingly demonstrate that this large cost difference is justified, it raises doubts about all the analyses HDI has presented.

Part One concentrates on the years 2021 to 2029. This is the time period of the highest activity at the Indian Point site where actions like pressure vessel segmentation, dismantlement, and demolition are to take place. This is also the time period for which the NRC staff asked HDI to explain this very large cost difference between IP2’s and IP3’s decommissioning costs. HDI’s response to this NRC inquiry is reviewed in this report and is refuted.

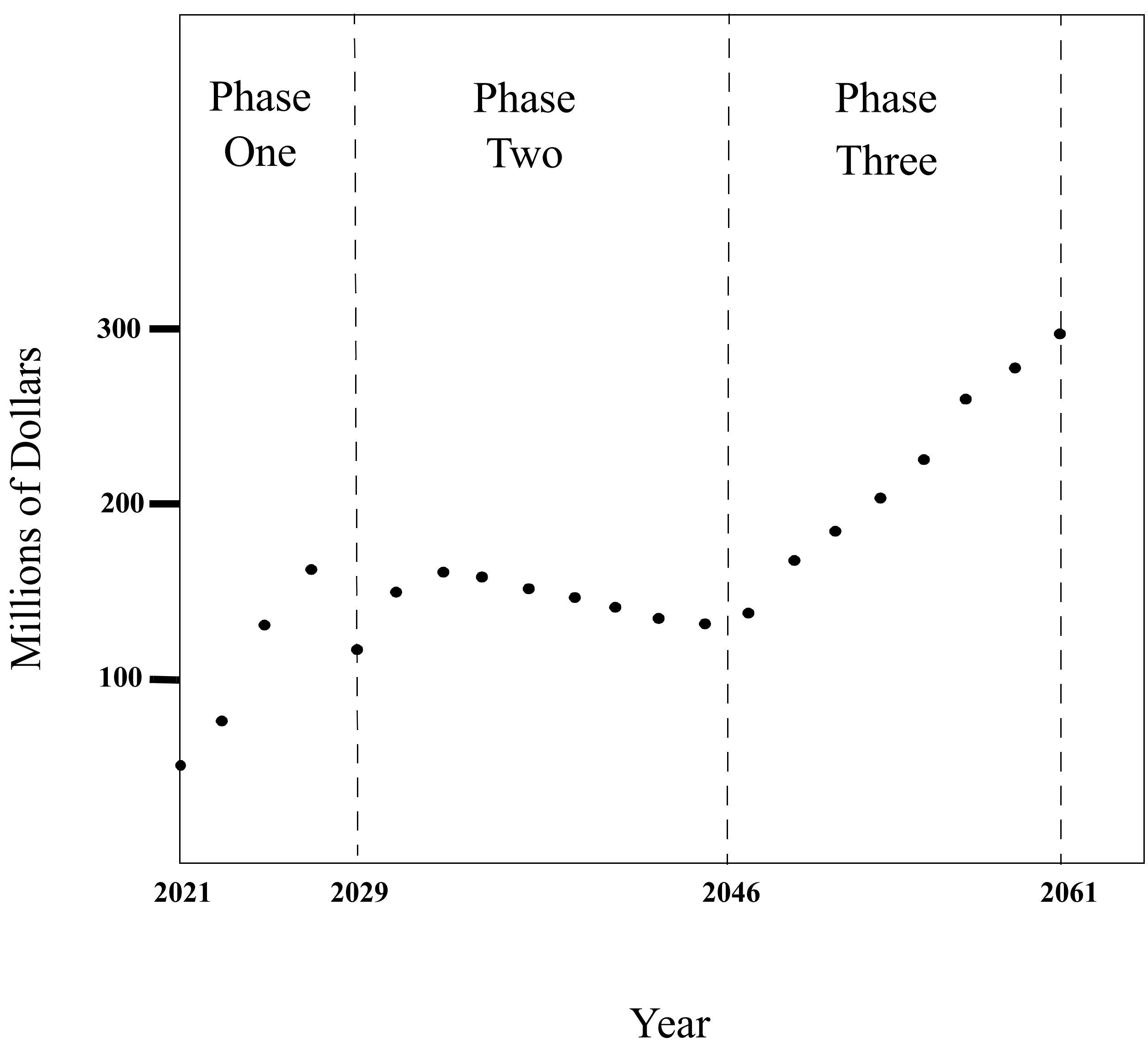
Part Two covers the time period from 2030 to 2062 when cost differences between IP2 and IP3 are dominated by different spent fuel management charges. This 2030 to 2062 time period is critical to showing that the much lower costs to decommission IP2 relative to IP3 are justified, During this time period the cost difference between IP2 and IP3 is $186.9 million dollars, considerably larger than the $113.7 million dollars cost difference between IP2 and IP3 during the 2021 to 2029 years.

Part Two is further divided into years 2030 to 2046 and 2047 to 2062 to better correlate with HDI’s Table 3-6, titled “IPEC DOE Fuel Acceptance Allocation”. Part Two can be characterized as a long passive time period, which is contrary to Part One which is very active. This is a time period when the Indian Point site would be so inactive that HDI concluded that, by 2033, the site would be ready for a partial release to some purchasing entity. This is a time period when very few people would be required to be on the Indian Point site, a time when only minor tasks like site surveying and report writing would remain, a time when passive spent fuel holding canisters would quietly sit on a concrete slab as the Department of Energy slowly retrieved them. During the passive years from 2032 to 2061 HDI would seek a total payment of about $646.8 million dollars from the three IP DTFs, mainly to provide spent fuel management. FIGURE A-1 displays these three different time periods and is based on HDI Tables 5-1b and 5-1c. TABLE A-17 in the Appendix was created by subtracting the withdrawal rates from the IP2 DTF from the withdrawal rates from the IP3 DTF, year by year. These subtractions are the measure of how much money must be saved at IP2, relative to IP3, in order to match HDI’s $301 million dollar lower IP2 decommissioning cost. Figure A-1 is a plot of the cumulative IP2 savings, derived from the data in TABLE A-17 in the Appendix.

Part Three explores the HDI methodology through the use of 11 different alternative scenarios. These scenarios identify a number of sequences that could lead to insolvency in one or more Indian Point DTFs. Such alternative scenarios should have been generated by the NRC staff as a check on the HDI analyses. Part Three also examines other decommissioning-related subjects like compensatory actions, major decommissioning periods, U.S. Treasury payments, inflation, the contingency allowance, and discrete risk events.

Part Four draws upon decommissioning experiences from other sites that offer the public greater assurance that they will not be left with a partially decommissioned site or pressed to supply even more public money to finish the job. One strategy would require Entergy to establish a high quality Financial Assurance Mechanism which would be administered by the New York Public Service Commission combined with a written contractual commitment that decommissioning will be satisfactorily completed without any further decommissioning financial burden on the public.

FIGURE A-1 Cumulative Savings at IP2 Based on HDI Data, $ in Millions



5.0 PART ONE - Is the IP2 DTF Underfunded?

5.1 The Active Years 2021-2029

5.1.1 Introduction

As of October 30, 2019, the Indian Point 2 DTF that was smaller than the IP3 DTF by $262 million dollars. Nonetheless, HDI claims it can decommission IP2 for $301 million dollars less than what it costs to decommission IP3, and end up with a surplus of $72.7 million dollars. A review of the HDI PSDAR did not provide support for this claim. Nor was there a detailed accounting for this large cost difference provided in the SE. The NRC requested additional information (RAI) on this topic from HDI, but neither this RAI nor HDI's responses have been fully shared with the public. When the SE listed potential IP2 cost savings relayed to the NRC staff by HDI, it did not quantify what each of these claimed savings were or if the total savings accounted for the $301 million dollar difference. This critique refutes all of the claimed IP2 savings listed in the SE.

The HDI claim that it can decommission IP2 for $301 million dollars less that it takes to decommission its sister plant, IP3, defies common sense. It is also inconsistent with HDI's PSDAR and other HDI documents. No other site in the entire USA that has sister PWRs on it has produced significantly different decommissioning costs from one unit to another. Further, the NRC has estimated radiological decommissioning costs for many pairs of PWRs on the same site and has published these results in SECY-18-0078. The NRC did not identify large cost differences between any pairs of PWRs in this SECY report. The NRC also made radiological decommissioning cost estimates specifically for IP2 and IP3 and they are identical. The HDI claim of large savings between IP2 and IP3 is unique.

The very nature of these claimed cost savings also is puzzling. Savings cannot be achieved for IP2 compared to IP3 because of design differences. Everyone is in agreement that the two units have virtually the same design. Savings cannot be claimed for greater efficiency from "Lessons Learned" first from IP3 and then used to reduce costs at IP2. HDI goes to considerable lengths to show that it is well prepared to decommission IPEC (Indian Point Energy Center). (See HDI PSDAR pages 90-92, copied in the Appendix). It seems totally inconsistent for HDI to be very well prepared and then learn major things on the job, year-after-year. Further, it seems implausible for HDI to know on December 18, 2019 when it issued its PSDAR what cost savings might be achieved through greater efficiency that might benefit IP2 many years before these cost savings might occur. If HDI knew enough to quantify these future cost reductions through greater efficiency on December 18, 2019 why didn't HDI apply these insights to IP3 first?

Further, not only does this critique refute HDI's claimed IP2 savings listed in the SE, the HDI claimed savings would only apply to years 2021-2029. HDI did not offer any explanation about the IP2 to IP3 cost differences in years 2030 to 2062. Yet HDI projects even greater IP2 cost savings relative to IP3 costs during this later time period than during the 2021-2029 time period. It appears that the NRC staff did not ask HDI to justify the larger IP2 to IP3 differences in this later period, and no justifications were given.

5.1.2 Unsupported HDI IP2 Cost Savings, Years 2021 to 2029

The SE provides several examples of HDI's claimed justifications for the much lower IP2 decommissioning cost. Many of these claimed justifications are refuted by cost data in HDI's own PSDAR, the Post Shutdown Decommissioning Activities Report.

5.1.2.1 Savings Through Efficiency Improvements

One claimed cost reduction justification is that there will be savings at IP2 through greater efficiencies gained because the IP3 decommissioning somewhat precedes that of IP2. These "efficiency" savings would have to go on year after year, but are not described in any detail in the PSDAR or in the SE. How can HDI claim on December 19, 2019 that it will apply yet unknown efficiency savings, calculated with six to nine significant figure precision, years into the future? If HDI actually had such knowledge back on December 19, 2019, why wouldn't it apply it to IP3 first to reduce its costs? On the other hand, if the potential savings from efficiency improvements years ahead were unknown at the time the HDI report was issued, then there would not be any basis for the numbers HDI listed in its Table 5-1b.

The largest cost difference between IP2 and IP3 occurs between 2048 and 2062 and amounts to $170.1 million dollars. This IP2 cost reduction was not achieved by greater efficiency since IP2 and IP3 would have long since been demolished. The real reason that HDI calculates a much small cost for IP2, relative to IP3, in this time period is the method that HDI uses to determine DOE's removal of spent fuel assemblies from the ISFSI. Table 3-6 of the PSDAR shows that all the spent fuel assemblies from IP2 would be removed before any of the IP3 assemblies would even begin to be removed. Since HDI charges the DTFs, year-by-year, for spent fuel remaining in the ISFSI, the late removal of IP3 spent fuel assemblies runs its costs up. These lower IP2 "rental" costs have nothing to do with achieving greater efficiency. Had HDI based its cost analysis of the IP3 spent fuel assemblies being removed before the IP2 spent fuel being removed, the calculated IP3 surplus would have been considerably larger and the IP2 DTF would have become insolvent. As discussed later in this critique, the HDI scheme for removing spent fuel assemblies from the Indian Point site appears to be in conflict with guidance issued by the Department of Energy.

5.1.2.2 Need for a Crane for IP3 Only

Page 12 of the SE states "*HDI also provided clarifying information in its response to the NRC staff RAI regarding the differences in spent fuel management costs between IP2 and IP3. HDI indicated that the differences in spent fuel heat load between IP2 and IP3 and the allocation of specific costs, such as those related to the use of a crane for IP3 only, were the* ***primary factors*** *that explain the differences in spent fuel cost estimates between IP2 and IP3."* (Emphasis added)

On page 92 of the HDI PSDAR it is stated that the reactor building overhead crane and the turbine building overhead crane will be available and are adequate. What is the purpose of an additional crane for IP3 and how much would it cost? This question is answered on page 40 of the Commissioners' Memorandum and Order, CLI-21-01. *"The applicants state that certain activities related to the crane are already underway and that these activities are being funded by Entergy from sources outside the decommissioning trusts. They argue that HDI therefore did not need to factor*

these activities into its cost estimates." Therefore the SE statement on page 12 is wrong and this **primary cost factor** for an additional IP3 crane is zero.

5.1.2.3 Class A Wastes

On page 11 of the SE it is stated "*Specifically, HDI indicated that its schedule and sequence for performing the major decommissioning activities, including reactor segmentation, dismantling and demolition at the IPEC and differences in the estimated Class A waste volumes, accounted for much of the differences in the radiological costs between the units as depicted in the SSCE.*"

As to Class A wastes Table 3-1b of the PSDAR lists a cost of $13,978,756 for IP2 for the management of decommissioning low level wastes. The comparable number for IP3 is $15,176,111, a $1,197,355 difference. If ~$1.2 million dollars represents "much of the differences in the radiological costs between the units as depicted in the SSCE", then there cannot be a $301 million dollar total cost difference between IP2 and IP3

This example highlights the page 26 SE statement "*The staff will only review the HDI PSDAR itself if and when the proposed license transfer is consummated.*" If the NRC staff did not review the PSDAR, it could not have determined that the Class A waste costs are actually a very small contributor to the differences between the IP2 and IP3 cost estimates. If HDI cannot show that the differences between IP2 and IP3 decommissioning costs are justified, then the calculations presented in their PSDAR should be rejected.

5.1.2.4 Reactor Segmentation, Dismantling, and Demolition

The reactor segmentation, dismantling, and demolition of IP2 and IP3 are all actions that are projected to be concluded by 2029 and would have no bearing on the differences in IP3 versus IP2 costs beyond that date. The cost difference between IP2 and IP3 for "Conventional Dismantling, Demolition, and Site Restoration" is only $25.8 million dollars (See HDI Tables 3-1b and 3-1c), according to HDI. As to dismantling of reactor internals, WBS code #01.02.04.05.01, both IP2 and IP3 have exactly the same costs, of $38,350,000. (See HDI Tables 6-1b and 6-1c). As stated in the HDI PSDAR[1] *"Due to the similarities in the design of the IP2& IP3 reactors, the same tooling will be used to segment each of the IP2 and IP3 reactor vessels and reactor vessel internals."* Therefore this task does not support a claim that IP2 can be decommissioned for $301 million dollars less than IP3.

5.1.2.5 Spent Fuel Heat Load

Page 12 of the SE attributed spent fuel heat load as one of the contributors to the cost differences between IP2 and IP3, but did not describe the basis for this claim or quantify its cost impact. HDI's spent fuel heat load statement is reflected in HDI's Figure 3-1 which shows that fuel removal from IP2, comes earlier than IP3 fuel removal. This eliminates any claim for lower IP2 costs due to lessons learned through greater efficiency when IP3 tasks precede IP2 tasks. It is also noted that there are more IP2 fuel assemblies, 1,988, compared to IP3 with its 1,870 fuel assem-

[1] See Page 11 of the HDI PSDAR.

blies. All other things being equal, the IP2 cost to load 1,988 fuel assemblies into canisters and move these 1,988 canisters to the ISFSI should be more expensive than loading IP3's 1,870 fuel assemblies into canisters and moving these canisters to the ISFSI.

For both IP2 and IP3, during years 2021 to 2024, it is assumed that the oldest and coldest spent fuel would be loaded into canisters first. This means that the heat load issue would not be of concern for IP3 until all cooler spent fuel assemblies have been placed into canisters. During the time that the cooler spent fuel assemblies are being loaded into canisters, the most recently irradiated spent fuel's heat load would be decreasing. By delaying the transfer of the last fuel to be irradiated into canisters, the importance of initially higher heat loads is diminished.

Therefore it is assumed that the importance of heat load is negligible between IP2 and IP3 for the first three years of spent fuel removal from the IP3 spent fuel pool. Any additional spent fuel heat load expenses for IP3 should be restricted to an additional cost for IP3's last year, 2024, of placing spent fuel into canisters. However, this fourth year, 2024, at IP3 should resemble the third year at IP2. Accordingly, the additional cost for the higher spent fuel heat load at the IP3 spent fuel pool should not exceed some fraction of the $11.4 million dollars assigned to the third year at IP2. (See year 2023 in HDI Table 5-1b). Clearly, the cost of dealing with a higher spent fuel load for the last batch of fuel to be irradiated at IP3 is a small fraction of the $301 million dollar difference.

5.1.2.6 Wet Storage at IP2 and IP3

Page 12 of the SE states that among the primary factors affecting the cost difference between IP2 and IP3 is "...differing amounts of spent fuel stored in wet storage between IP2 and IP3". Once again no specific dollar amounts are given to quantify this claim. What is peculiar about this statement is that the number of spent fuel assemblies for IP2 is 1,998 and 1,870 for IP3, according to Table 3-6 of the PSDAR. If anything, the costs for wet storage should be higher at IP2 compared to IP3.

5.1.2.7 Other Potential IP2 Cost Reductions

Other potential cost reductions for IP2 relative to IP3 are too small to explain the claimed $301 million dollar lower cost for decommissioning IP2. Site restoration costs between the two sister plants only differ by about $3.8 million dollars. Referring to Table 2-1 of HDI's PSDAR, only one WBS element has a start date that was earlier for IP3 than IP2. Unless a WBS element in IP3 precedes the same WBS element in IP2, it is difficult to explain how an efficiency based improvement in IP2 cost reduction might be possible.

Other areas can be eliminated as possible sources of IP3 to IP2 cost reductions. According to HDI there will not be problems in a variety of areas like local ventilation, the availability of adequate cranes in the reactor building and in the turbine building, nor problems caused by the use of specialized subcontractors for water sampling, or by plant systems to carry out the spent fuel to ISFSI pad transfer campaign which are in an operational status. Therefore no improvements in efficiency can be claimed in any area that is already covered by HDI's claimed extensive experience or by the availability of existing plant systems or procedures.

6.0 PART TWO - Is the IP2 DTF Underfunded?

6.1 The Passive Years 2030-2061

6.2 Introduction

Section 5 of this critique explored the Indian Point decommissioning active time period from 2021 to 2029 to see if the HDI claims for much lower decommissioning costs at IP2 relative to IP3 could be verified. A review of the HDI PSDAR did not support these HDI claims. This section, Section 6, continues this search into the passive years, 2030 to 2061. The difference between IP2 and IP3 in the passive phase years is dominated by spent fuel management costs. Whereas the NRC issued a request for additional information to HDI to explain why the decommissioning of IP2 and IP3 differed so significantly, the answers it received relate only to the active years. The active period HDI answers were reviewed in Section 5 and were refuted. The staff's SE makes no mention of questioning HDI about this longer passive time period even though the total difference between IP2 and IP3 cost estimates are larger. Specifically, the active time period had a total IP2 to IP3 cost difference of $113.7 million dollars while the total IP2 to IP3 cost difference for the passive time period comes to $186.9 million dollars.

6.3 Description of the Passive Phase

In this final passive phase, IP1, IP2, and IP3 will have long been dismantled and demolished and all the spent fuel would now be in passive canisters awaiting removal from the site by the Department of Energy. The site would be quite empty with no craft laborers and no management laborers and very few professional laborers. Based on the HDI PSDAR, the professional labor costs and full time equivalent hours in the final phase for IP2 is less than one percent of the IP3 professional labor costs and hours. This final passive phase, as shown in HDI's Figure 3-1, is comparatively inactive, with lesser tasks like taking site surveys, writing final reports, and a few other limited actions. Nonetheless, HDI claims that there would be a savings of $186.9 million dollars at IP2 compared to IP3 during this passive phase. This section of the critique concentrates on these HDI spent fuel management charges.

6.4 Historical Data

Spent Fuel Management at the Indian Point site is not new. The ISFSI is a simple structure on which the spent fuel canisters sit until removed by the DOE, plus providing a location for low level waste to be held until removal. The ISFSI to be built at IPEC is an extension of an existing ISFSI that Entergy has used to store the present spent fuel canisters on the IPEC site. All the spent fuel functions that would be part of HDI's spent fuel management effort have already been done before by Entergy including constructing an ISFI; loading spent fuel into canisters; transferring these canisters to the ISFSI; unloading these canisters onto the ISFSI; monitoring the performance of these canisters; and providing security. Rather than HDI projecting costs for spent fuel management far into the future, the first priority should be to review the actual spent fuel management costs that Entergy incurred over many years at the Indian Point site. This Entergy experience should be the basis of the HDI spent fuel management cost estimates. It has not been established if HDI did this or if the NRC staff asked for this to be done.

The HDI ISFSI dollar amounts appear to be radically different from ISFSI cost figures presented by Entergy to the NRC[2]. Entergy identifies an ISFSI obligation as of 12/31/19 at $10.45 million dollars[3].

6.5 DOE Fuel Acceptance Priority Ranking (APR)

HDI's Table 3-6 is titled IPEC DOE Fuel Acceptance Allocation. The HDI PSDAR also lists DOE/RW-0567 as a reference.[4] One might think that HDI used DOE/RW-0567 to develop its Table 3-6. However, the requirements of DOE/ RW-0567 and HDI's Table 3-6 are inconsistent. As stated on page 1 of this DOE report, "*As required by the Standard Contract, the APR is based on the date the spent nuclear fuel was permanently discharged, with the oldest spent nuclear fuel, on an industry-wide basis, given the highest priority".*

6.5.1 Impact of APR on IP1

The oldest spent fuel on the Indian Point site is the 160 fuel assemblies from IP1. Based on the APR these fuel assemblies should get the highest priority in being removed from the Indian Point site. However, this is not the case displayed in HDI's Table 3-6 where 155 IP1 spent fuel assemblies are to be removed by DOE in 2048 and the remaining 5 in 2049. Based on HDI's Table 3-6 there is enough DOE spent fuel removal capacity to remove all IP1's160 fuel assemblies in 2021.

Based on HDI Table 5-1a, keeping the IP1 spent fuel assemblies on site from 2021 through 2047 results in HDI charges totaling $72,381,000 dollars. If the cost to remove the IP1 spent fuel assemblies equaled the HDI 2021 IP1 spent fuel cost of $2,676,000 dollars, implementing the APR priorities would immediately reduce IP1 costs by $69,705,000 dollars. Further, assuming the same 2% per year real rate of return as HDI has used, this ~70 million dollar savings would grow to about $211 million dollars by 2061.Would this large sum of money belong to Holtec or to the ratepayers in New York? In any case, not removing the IP1 spent fuel first results in unwarranted income for HDI.

6.5.2 Impact of APR on Indian Point 2 and Indian Point 3

HDI's Table 3-6 describes a situation where all of the IP2 spent fuel is removed by DOE before any of the IP3 spent fuel is removed. This arrangement results in the IP2 DTF charges ending in 2047 but with the IP3 charges continuing on to 2062. Even though IP2 has more fuel assemblies than IP3; 1,988 to 1,870, the HDI spent fuel removal arrangement results in higher spent fuel management costs for IP3 compared to IP2. Specifically, HDI would charge the IP2 DTF

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[2] Entergy letter CNRO2020-00002, March 26, 2020, to the NRC, Enclosure 3, page 1, Note 2.

[3] *Based on Entergy's Decommissioning Funding Plans (10 CFR 72.30) dated December 17, 2018 (Accession No. ML18351A478), escalated at 3% per annum to account for inflation.*

[4] DOE/RW-0567, "Acceptance Priority Ranking & Annual Capacity Report", July 2004.

$188,278,000 dollars and the IP3 DTF $371,370,000 dollars, or a difference of $183,092,000 dollars.

However, the time distribution of IP2 and IP3 spent fuel removal from the Indian Point site, as shown in HDI's Table 3-6, is inconsistent with Table 2 of DOE/ RW-0567, reproduced below in TABLE A-1.

TABLE A-1 DOE Annual Allocations (MTU)

Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
IP 2	3.0	27.7	32.8	27.1	52.8	33.8	63.5	31.1	33.0	25.8	330.6
1P 3	-	-	-	29.3	34.7	34.7	33.0	36.1	28.4	33.8	229.9

The main lesson from TABLE A-1 is that application of the DOE annual allocation program would not delay the removal of IP3 spent fuel until all the IP2 spent fuel had been removed. IP2 and IP3 spent fuel assemblies would be removed in a an overlapping mode. If HDI's Table 3-6 were recalculated to show overlapping years where both IP2 and IP3 spent fuel were being removed from the IP3 site, it would take years longer to remove all the IP2 spent fuel, increasing the spent fuel management costs for IP2. It would then have to be determined if this additional cost was enough to cause the IP2 DTF to become insolvent.

HDI's Table 5-1b lists about $76 million dollars left in the IP2 DTF by 2048, out of a starting amount of $654.1 million dollars. According to HDI Table 3-6, it would take until 2048 to remove all the IP2 spent fuel assemblies from the Indian Point site. However, if the spent fuel removal from the Indian Point site was similar to that shown in TABLE A-1 it would take longer than 2048 to remove all the IP2 spent fuel and this would incur further HDI spent fuel management costs. HDI should recalculate IP2 spent fuel management costs with a removal process manner consistent with DOE/ RW-0567. Once this is done it could be determined if there is enough money to cover HDI's additional spent fuel management costs.

HDI needs to answer why its description of spent fuel removal process for IP2 differs from the program laid out in DOE/ RW-0567. Until this issue is resolved the license transfer from Entergy to Holtec should not go forward.

6.5.3 Further Analysis of HDI Spent Fuel Management Charges

In order to gain further insights on HDI's spent fuel management charges, three PSDAR tables were combined to produce TABLE A-2, below. Use is made of the PSDAR Table 3-6 to determine the year-by-year number of fuel assemblies remaining on the ISFSI for IP2 and IP3. Cost figures for Spent Fuel Management were taken from PSDAR Tables 5-1b, and 5-1c for IP2 and IP3, respectively. TABLE A-2 also includes the cumulative number of assembly-years for IP2 and IP3 where the number of assembly-years added in any given year is just the product of the number of assemblies from IP2 or IP3 in residence at the Indian Point site for a single year.

The purpose of calculating assembly-years is to test whether the HDI spent fuel management charges are proportional to the number of fuel assemblies still at the Indian Point site for any given year. As expected, the number of assembly-years for IP3, 59,262, exceeds the IP2 number of assembly-years of 29,913. This higher number of assembly-years for IP3 is a direct result of the

HDI selection to keep the IP3 fuel assemblies on site until all of the IP2 fuel assemblies had been removed. This also shows up in costs with IP2 having a spent fuel management cost of $188,278,000 dollars while the IP3 spent fuel management cost was listed as $371,370,000 dollars, a difference of $183,092,000 dollars. There is very close agreement between IP2 and IP3 in terms of dollars per assembly year, $6,294/assembly year for IP2 and $6,266/assembly-year for IP3. This close agreement is interpreted to mean that the cost difference between IP2 and IP3 is directly determined by the time distribution of the removal of spent fuel assemblies from the Indian Point site. If DOE requirements force a different time distribution where IP2 fuel assemblies remain longer on the Indian Point site, the HDI decommissioning cost estimate presented in HDI Table 5-1b would be too low for IP2.

TABLE A-2 IP2 and IP3 Spent Fuel Assembly-Years, Costs

End of Year	Number of IP2 spent fuel assemblies remaining at the ISFSI	Cumulative Number of IP2 Assembly-Years	IP2 Annual Cost in Thousands, Spent Fuel Management, HDI Table 5-1b	Number of IP3 spent fuel assemblies remaining at the ISFSI	Cumulative Number of IP3 Assembly-Years	IP3 Annual Cost in Thousands, Spent Fuel Management, HDI Table 5-1c
2023	1,988	1,988	11,439	0	0	N/A
2024	1,988	3,976	4,337	1,870	1,870	30,858
2025	1,988	5,964	1,608	1,870	3,740	1,421
2026	1,988	7,952	1,636	1,870	5,610	1,407
2027	1,988	9,940	1,635	1,870	7,480	1,451
2028	1,988	11,928	1,548	1,870	9,350	1,638
2029	1,988	13,916	1,553	1,870	11,220	1,638
2030	1,988	15,904	6,857	1,870	13,090	1,638
2031	1,838	17,742	6,857	1,870	14,960	1,638
2032	1,766	19,508	5,905	1,870	16,830	1,561
2033	1,642	21,150	7,701	1,870	18,700	4,763
2034	1,449	22,599	5,990	1,870	20,570	3,607
2035	1,298	23,897	6,000	1,870	22,440	3,607
2036	1,086	24,983	6,014	1,870	24,310	3,612
2037	939	25,922	6,000	1,870	26,180	3,607
2038	805	26,727	5.990	1,870	28,050	3,607
2039	676	27,403	6,000	1,870	29,920	3,607
2040	597	28,000	6,005	1,870	31,790	3,612
2041	510	28,510	6,000	1,870	33,660	3,607
2042	421	28,931	6,000	1,870	35,530	3,607

2043	421	29,352	6,000	1,870	37,400	3,607
2044	251	29,603	6,005	1,870	39,270	3,612
2045	179	29,782	5,990	1,870	41,140	3,607
2046	110	29,892	3,152	1,870	43,010	4,433
2047	21	29,913	749	1,870	44,880	7,453
2048	0	29,913	0	1,870	46,750	11,953
2049	0	29,913	0	1,697	48,447	11,917
2050	0	29,913	0	1,605	50,052	11,927
2051	0	29,913	0	1,508	51,560	11,917
2052	0	29,913	0	1,322	52,882	11,953
2053	0	29,913	0	1,226	54,108	11,927
2054	0	29,913	0	1,130	55,238	11,927
2055	0	29,913	0	952	56,190	11,917
2056	0	29,913	0	856	57,046	11,943
2057	0	29,913	0	764	57,810	11,927
2058	0	29,913	0	579	58,389	11,927
2059	0	29,913	0	487	58,876	11,927
2060	0	29,913	0	386	59,262	11,943
2061	0	29,913	0	0	59,262	11,912
Total	N/A	29,913	0	N/A	59,262	2,459

Although there is good agreement between IP2 and IP3 in terms of dollars per assembly-year, there are unexplained anomalies too. For example, in TABLE A-2, IP2 has the same spent fuel management cost of $6,000,000 for years 2035 and 2043. Yet in 2035 there are 1,298 IP2 spent fuel assemblies remaining at the ISFSI. For 2043 there are only 421 IP2 spent fuel assemblies remaining at the ISFSI, about a third of the number that were at the ISFSI in 2035, yet HDI charges the same $6,000,000 per year. If spent fuel management costs are proportional to the number of remaining spent fuel assemblies on the Indian Point site, then the HDI charge to IP2 for 2043 should be $1,946,000, not $6,000,000. Similar observations have been made for IP3. Years 2054 and 2059 both have a spent fuel management cost of $11,927,000. However, there are 1,605 IP3 spent fuel assemblies in the ISFSI in 2054, but only 487 in 2059. These seemingly inconsistent numbers need to be explained and justified.

Starting in 2048 and for 14 years in a row, HDI would charge the IP3 DTF a constant ~$11.5 million dollars/year for spent fuel management, or about a total of $161 million dollars. While the HDI charges were held essentially constant over these 14 years, the number of IP3 remaining spent fuel assemblies decreased from 1,870 to zero. It seems implausible that HDI's charges for spent fuel management are not related to the number of spent fuel assemblies remaining on site in any given year. If spent fuel management charges are not related to the number of spent fuel assemblies still on site, what then is the basis of HDI's spent fuel management charges? One observation is that in 2048 the IP3 DTF, according to HDI, had $285.1 million dollars in it while the IP2 DTF in 2048 only had $77.2 million dollars in it. HDI has to prove that the $161 million

dollars it would deplete from the IP3 DTF in these 14 years is justified and not just a drawdown of the IP3 DTF because that is where the money would be.

6.6 Four Possibilities

Since neither HDI nor the NRC staff has shown that there are justifiable decommissioning cost differences between IP2 and IP3, three possibilities arise:

a. The IP3 DTF is being overcharged, or
b. The IP2 DTF is underfunded, or
c. Combinations of a and b above, or
d. Neither the IP2 nor the IP3 decommissioning cost estimates are correct.

6.7 Conclusion

Neither HDI nor the NRC staff has provided an adequate explanation of why IP2's decommissioning should cost $301 million dollars less than IP3's decommissioning. Until this is done it is prudent to assume that decommissioning IP2 would cost the same as decommissioning IP3. That being the case, IP2's DTF would become insolvent in 2031 with a $298.6 million dollar shortfall.

7.0 PART THREE - Exploring NRC and HDI Methodologies

7.1 Systemic Issues

Both the NRC staff and HDI have systemic issues in their analysis of the decommissioning costs for the three Indian Point nuclear plants that need to be addressed.

7.1.1 NRC Staff Systemic Issues

7.1.1.1 Introduction

The central purpose of the NRC is to protect the public. In radiological risk assessments, such as potential core melt accidents, the NRC staff looks for scenarios that might lead to reactor core damage. For each potentially damaging scenario the probability of such a scenario is estimated as are the possible consequences. Radiological risk is then defined as the product of multiplying the estimated probability of occurrence times the calculated consequences. Then a judgement has to be made whether this level of risk is acceptable. To make such a judgement the idea of what constitutes acceptable risk has to be established.

Radiological risk assessment is a more advanced mathematical process for decision-making than the process used to determine Reasonable Assurance in the domain of decommissioning. Nonetheless, portions of this more advanced decision-making process can be utilized when judgements are based on acts of Reasonable Assurance. The NRC staff needs to search for scenarios that would potentially lead to IPEC DTFs becoming insolvent. It does not appear that the staff took this approach.

7.1.1.2 Unheeded Warnings

The NRC staff had many warnings that should have resulted in a more comprehensive and questioning review of HDI and the HDI PSDAR. It appears that the HDI DECON analysis for IP1 does not agree with the Entergy SAFSTOR analysis for IP1. Entergy's analysis showed that it would take decades before the IP1 DTF, in a SAFSTOR decommissioning mode, could accumulate enough funds just to achieve radiological decommissioning. By contrast, the HDI analysis claims that both radiological and non-radiological decommissioning of IP1 could be accomplished by the DECON method starting in 2021, even though the DECON method would rapidly deplete the IP1 DTF, thereby reducing the funds that the DTF itself might generate during the decommissioning process. Page 15 of the NRC's SE lists a HDI IP1 radiological decommissioning cost estimate of $485,015,000 in 2019 dollars.The HDI estimate also does not agree with the Entergy estimate of $592.89 million dollars based on SAFSTOR expenditures[5]. This seeming HDI DECON/Entergy SAFSTOR disparity on IP1 is not the only early warning. Table 2 of the NRC's SECY-18-0078 lists an estimated remaining cost to complete radiological decommissioning for IP1 of $560,500,000 in 2016 dollars. Updating the NRC's SECY estimate to 2019 dollars would bring the NRC's IP1 radiological decommissioning cost estimate to $597,045,000 dollars, very similar to Entergy's IP1 estimate. Comparing the updated NRC radiological decommission-

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[5] Entergy letter CNRO2020-00002, March 26, 2020, to the NRC, Enclosure 1, page 1.

ing estimate for IP1 to HDI's IP1 cost estimate leaves an unexplained $112.0 million dollars discrepancy. It appears that the HDI DECON analysis for IP1 does not agree with the NRC SECY's cost estimate to complete IP1's radiological decommissioning.

Another warning is contained in the October 29, 2020 letter to the NRC staff from Micro-Utilities, Inc. about HDI's claim that it could decommission IP2 for $301 million dollars less than the cost to decommission sister plant IP3. Since these are nearly identical sister plants on the same site this HDI claim defies common sense. The SE shows that further information on this subject was requested by the staff on this subject and replies were received from the Applicant. Neither this NRC staff's request for additional information nor HDI's responses have been shared with the public. This critique looked into this issue more closely and found that the Applicant's responses, as broadly described in the SE, appear to be inconsistent with information in the PSDAR. If IP2 costs as much as HDI claims it costs to decommission IP3, there would be a shortfall around $300 million dollars. HDI's claim that there could be very large cost differences between two sister plants on the same site is unique. No other pair of sister PWRs on the same site exhibits the cost differential that HDI claims for IP2 and IP3 and that alone should have been a warning to the NRC staff.

Micro-Utilities also compared the estimated decommissioning costs per megawatt-electric for 16 different nuclear units in TABLE A-3 of its October, 2020 report, "Decommissioning Indian Point One", which was sent to the NRC prior to the issuance of the staff's SE. The HDI dollars/MWe for IP2 and IP3 are lower than all but one other unit. How does HDI, with no experience in decommissioning large PWRs on a crowded site, come up with lower costs per MWe than all of these other nuclear plants? This question is especially concerning for IP2 with its dollars per MWe about one third that of the nearly identical two Diablo Canyon PWRs. Did this warning in the Micro-Utilities document cause the NRC staff to investigate such wide differences?

The NRC staff recognized that there can be large fluctuations in the market, both up and down. These fluctuations directly affect the amounts of money in the DTFs. Having made this correct observation, it is not apparent that the NRC staff pursued the implications of this market variability, yet such a pursuit is possible, as shown in this critique. Recalculating HDI's Tables 5-1a, 5-1b, and 5-1c with the IPEC DTFs on December 31, 2018 would result in IP1, IP2, and IP3 calculated to become insolvent prior to the completion of all radiological decommissioning tasks. Such recalculations also identify what year a DTF would run out of money and how large the shortfall would be. All such Micro-Utilities recalculations employ exactly the same input data, assumptions, and methodology that HDI used. All that is required is to substitute the DTFs on 12/31/2018 for HDI's DTFs 10/31/2019, the base date for HDI's Tables 5-1a, 5-1b, and 5-1c and then calculate the annual numbers. Such recalculations appear in the Appendix of this critique, Sections 9.2, 9.3, and 9.4 for IP1, IP2 and IP3, respectively. The start date of 12/31/2018 is not unique, as other start dates could have been chosen and additional recalculations could have been made. The result of some recalculations, each at a start date when the market was higher than it was on October 31, 2019, would be larger surplus than the surpluses HDI calculated. However, other dates, when the market was below that on October 31, 2019, may engender failure scenarios similar to that calculated for 12/31/2018. Had multiple recalculations been made covering 2019 and 2020, the NRC staff would have ended up with a distribution of results, some being success scenarios and others being failure scenarios. The method for determining reasonable assurance when there is a distri-

bution of success and failure scenarios has not been demonstrated in the SE. While analyzing many scenarios with different start dates is more laborious than what HDI did, the result would be far more realistic than letting HDI choose a single start date which has favorable DTF conditions.

By only looking at HDI's single selected start date of 10/31/2019 the NRC staff lost an opportunity to estimate how sensitive the initial amounts of money in the DTFs are to market fluctuations. This too has been calculated and is reported in this critique. It is now known that the initial DTFs are fairly sensitive to changing market conditions, with IP1, IP2, and IP3 having somewhat different sensitivities. It is estimated that for each one percent decrease in the market there would be a calculated aggregate decrease of about $25 million dollars in the total DTF dollars at IPEC.

The largest missed opportunity for the NRC staff is not holding a hearing prior to issuing the SE, in order to directly learn more from the 152 commenters identified in the SE's Addendum D on Comment Topic Reference Number 6 "Concerns About the Sufficiency of the HDI PSDAR". To be able to respond to these 152 commenters, the NRC staff would have to read and analyze the PSDAR. However, on page 26 of the SE it is stated "The staff will only review the HDI PSDAR itself if and when the proposed license transfer transaction is consummated".

7.1.1.3 Conclusion

It would be beneficial if the processes to reach a conclusion of Reasonable Assurance more closely followed the processes used in decision making in the area of radiological risk assessment. However, developing this capability could be a time consuming effort. Further, radiological risks are so very low, reaching a conclusion of acceptable radiological risk is comparatively easy.This may not be the case for financial risk assessments for decommissioning because of the anticipated wide bands of uncertainty and because calculated mean values may be too high to achieve widespread acceptance.

7.1.2 HDI Systemic Issues

HDI's Tables 5-1a, 5-1b, and 5-1c are all estimates of future decommissioning costs at IP1, IP2, and IP3, respectively. These estimates reach far into the future, possibly until 2063 or later. However, multiple issues arise on how well HDI deals with long range cost projections.

7.1.2.1 Issues Not Dealt With

In some situations future costs and their impacts on Tables 5-1a, 5-1b, and 5-1c are just not dealt with at all. Three examples of this are the effects of inflation, the rising costs for goods and services, and the potential impact of discrete risk events.

7.1.2.2 Impact of Market Forces

Perhaps the largest long term systemic cost issue for HDI is how it deals with the relationship between the stock market and the amounts of money in the IPEC DTFs. There are two parts to this issue. The first part is HDI's selection of a single day, October 31, 2019, as the sole connection between the market and the Indian Point decommissioning trust funds. How does a single day's DTFs represent the impact of market forces over a 40 year time span when it is known that mar-

kets go up and markets go down? What was the process for selecting this favorable start date? Where is the NRC guidance on start dates? The second part to this start date issue, is that once it is selected (by HDI) no further interactions between the market and the monies in the DTFs are considered. So the HDI methodology places extreme importance on the market and its DTF impacts for just one day and then does not consider any market forces for the next 40 years.

7.1.2.3 Predicting Future Efficiency Improvements

The HDI methodology also creates issues dealing with future unknown costs. Two examples of this are cost reductions at IP2 based on improved efficiencies by lessons learned from the decommissioning of IP3 and Contingency Allowances. The HDI PSDAR was issued on December 19, 2019. How is it possible for HDI to quantify, sometimes to 6 or 9 place precision, unknown efficiency improvements years into the future? If the ability to decrease decommissioning costs at IP2 through improved efficiency was precisely known on December 19, 2019, why wouldn't these recognized efficiencies be applied to IP3 first? If, on the other hand, these future efficiencies were not known on December 19, 2019, how can HDI quantify their cost benefits and insert these numbers into Tables 5-1a, 5-1b, and 5-1c?

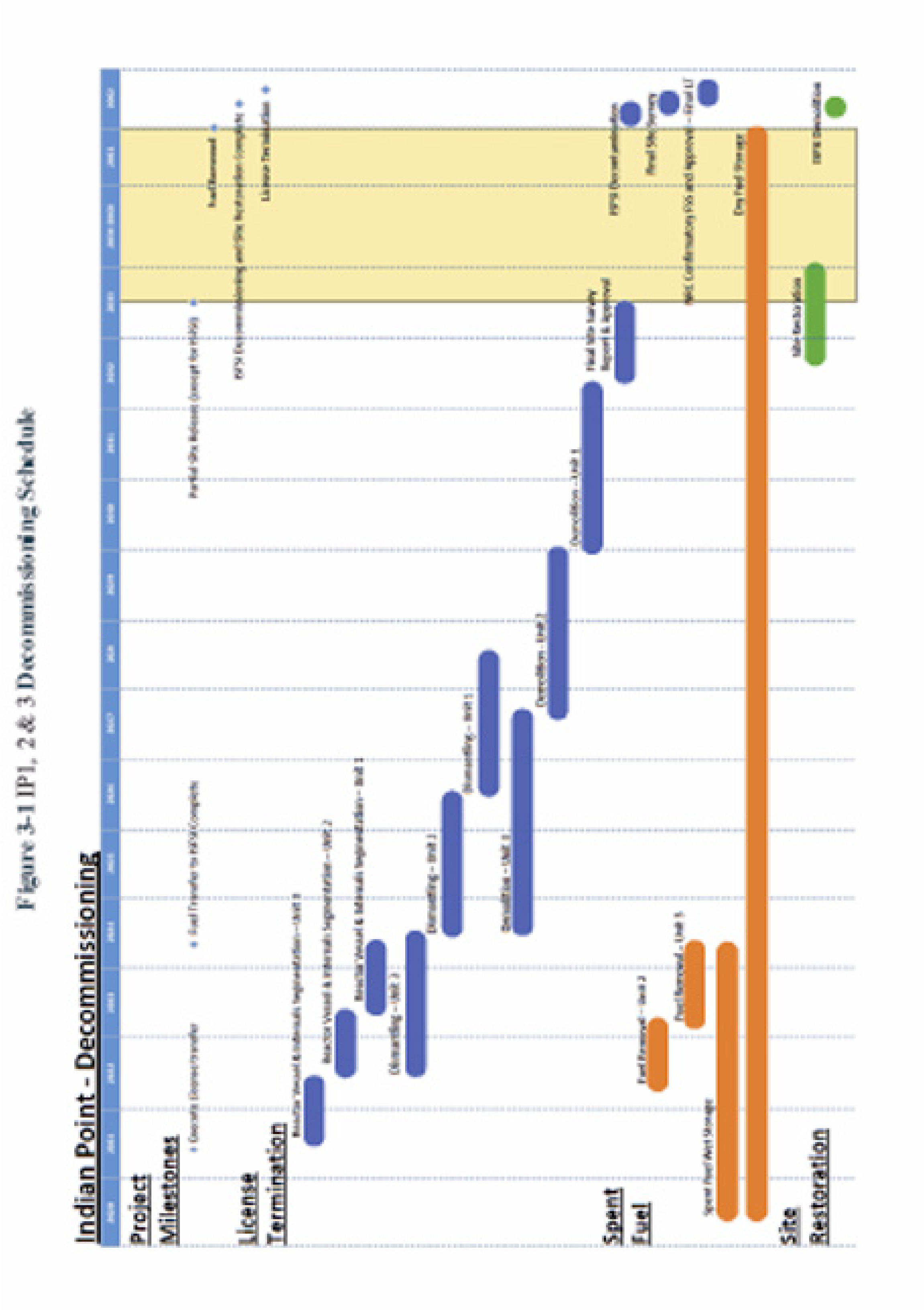
7.1.2.4 Contingency Allowances

The most important observation about HDI's use of a Contingency Allowance is the analysis presented in Section 7.5.5.1 of this critique. It appears that HDI's application of its 18% figure results in a zero Contingency Allowance.

HDI claims it uses an 18% allowance, except for the ISFSI (the Independent Spent Fuel Storage Installation) where the allowance is 25%. The purpose of the Contingency Allowance is to deal with the inherent uncertainties in HDI's cost analyses. This 18% allowance is at a 85% confidence level. This is interpreted to mean that 85% of the time the effects of unknown events will have a cost impact equal to or less than 18% of the cost to implement the task at hand. When this happens there should be money left over out of the Contingency Allowance, which should be returned to the DTF that funded the completion of these tasks.

Over the span of forty years, many tasks will need to be carried out. The nature of these tasks will vary significantly from major physical actions like reactor vessel and internals undergoing segmentation and containment building demolition in the first 12 years, to far fewer active events in later years when there are tasks like site surveys and report writing. Therefore the uncertainty components that were considered in the generation of the 18% Contingency Allowance, at an 85% confidence level, will change over time. Because the design of IP1 differs from the design of IP2 and IP3, it has its own set of uncertainties. It seems appropriate for HDI to set an 18% Contingency Allowance but inappropriate to claim that this 18% Contingency Allowance will be fully consumed for each and every task, year after year. When HDI issued its PSDAR on December 19, 2019 it had no way of knowing which situation dependent events would occur in the future, their costs, and which ones might fully consume the Contingency Allowance. From a public protection point of view, all unused monies in the Contingency Allowance should be returned to the respective DTFs. This return of unused monies should be done task by task and closely monitored by independent inspectors. All of the above HDI issues have this in common: they work to HDI's benefit.

FIGURE A-2 HDI's Decommissioning Schedule



7.2 Exploring HDI Methodology

7.2.1 Introduction

Part One is a review of the process that HDI used to calculate its proposed financial decommissioning scheme. The NRC staff used the HDI results to reach a conclusion of reasonable assurance that IPEC could be adequately decommissioned while meeting all federal regulatory requirements. Part One concludes that the present HDI decommissioning assessment process is incomplete, unrealistic, and unstable. Because of these defects, NRC staff's approval of the IPEC license transfers and exemptions places New York citizens at considerable risk.

Part One used the same material the NRC staff relied on in its SE, HDI's Tables 5-1a, 5-1b, and 5-1c from HDI's PSDAR, plus Decommissioning Trust Fund (DTF) data provided by Entergy to the NRC. HDI's own data, assumptions, and methodology were used to generate eleven alternative scenarios that demonstrated that HDI's methodology is incomplete, unrealistic, and unstable. These alternative scenarios exposed multiple pathways that can end with fully depleted DTFs prior to completing all radiological decommissioning tasks, along with significant financial shortfalls that the public might be burdened with.

7.2.2 Description of the Three HDI Scenarios and the Eleven Alternative Scenarios

7.2.2.1 Scenarios #1a, #1b, and #1c

These three scenarios can be found in HDI's PSDAR Tables 5-1a, 5-1b, and 5-1c for IP1, IP2, and IP3, respectively. These three HDI scenarios are based on the amounts of money in the IP1, IP2, and IP3 DTFs on October 31, 2019, less pre-closure deductions. The initial dollar amounts HDI used in these scenarios were $533,532,000, $654,078,000, and $916,100,000 for IP1, IP2, and IP3, respectively.

7.2.2.2 Alternative Scenarios #2a, #2b, and #2c

Alternative scenarios #2a, #2b, and #2c analyze IP1, IP2, and IP3, respectively. These three HDI scenarios are based on the amounts of money in the IP1, IP2, and IP3 DTFs on December 31, 2018, less the same pre-closure deductions assumed by HDI. The December 31, 2018 date was selected because the respective DTF holdings on that date were available from reports that Entergy had submitted to the NRC. The dollar amounts in the IP1, IP2, and IP3 DTFS on December 31, 2018, less pre-closure costs, were $411,900,000, $583,262,000, and $765,443,000, respectively. All three of these scenarios are failure scenarios because their DTFs become insolvent prior to 2062.

One-to-one detailed comparisons can be made between the HDI based #1a, #1b, and #1c scenarios and the #2a, #2b, and #2c scenarios to provide assessments of the impacts of selecting a different start date than the one HDI chose. For case #2a on IP1, the impact of moving the start date from 10/31/2019 to 12/31/2018, just 10 months earlier, resulted in a successful scenario becoming a failure scenario with the IPI DTF becoming insolvent in 2031. Instead of the $20.0 million dollar surplus that HDI calculated, this earlier date would have produced a $139.9 million dollar deficit, a swing of $159.9 million dollars.

For the scenario #2b analysis of IP2, its DTF would become insolvent in 2043 with this change in start dates. Compared to the HDI analysis, instead of a surplus for IP2 of $72.7 million dollars, there would be a deficit of $45 million, a swing of $117.7 million dollars.

For IP3, as analyzed by scenario #2c, the IP3 DTF would become insolvent in 2054 creating a deficit of $115.7 million dollars and a swing from the HDI calculations of $286.3 million dollars.

The total swing for the IPEC site by choosing an earlier start date of 12/31/2018 would be $563.9 million dollars. This total swing is larger than the whole IP1 DTF on 10/31/2019. After decades of saving and investing to implement decommissioning, a change in start dates less than one year apart is sufficient to cause three success scenarios to become failure scenarios and to shift surpluses to deficits in the amount of $563.9 million dollars, if one accepts the HDI methodology. Yet the 12/31/2018 date is not remarkable, with total DTFs about 16% smaller than the total DTFs on 10/31/2019. 16% is less than HDI's Contingency Allowance of 18% and far less than the 32% to 36% declines in the market during the COVID pandemic that the SE has pointed out.

The HDI financial model creates a situation where any shortfall in <u>any</u> year is reflected in reducing DTF holdings in every subsequent year, further magnified by reduced earnings in the trust fund, year-after-year. The HDI financial model structure is very sensitive to market levels at the start dates and also to market levels even after the start date. Whereas the NRC's SE makes a point of the variability (fluctuations) of the stock market and therefore the DTFs, the HDI financial model structure does not begin to capture this reality.

7.2.2.3 Alternative Scenarios #3a and #3b

The purpose of these two scenarios is to estimate what decrease in the initial funding for IP2 would prevent the completion of the final radiological decommissioning tasks, i.e., the IP2 DTF would become insolvent before 2062. An initial estimate, scenario #3a, of $618,700,000, or 5.4% less than the HDI number was selected. With this assumption the IP2 DTF was calculated to become insolvent around 2059 with a shortfall of $11.8 million dollars. To gain further precision a second estimate, scenario #3b, was calculated assuming an initial DTF of $627,915,000 or 4% less than the HDI initial DTF. This resulted in a calculated surplus of $20.8 million dollars. These results were cross plotted and a decrease of around 4.8% of the initial HDI DTF would result in a zero dollar DTF balance. This meant that for IP2 any event or combination of events that led to an initial IP2 DTF smaller than the HDI DTF by 4.8% or more, would result in the IP2 becoming insolvent before 2062.

One immediate application of this 4.8% figure is to develop a sense of how many days in 2019 and 2020 might produce IP2 DTFs with insufficient funds. This is discussed later in this critique, in Section 7.4.4 Market Effects. Another use of these analyses can be found in scenario #3a. For example, if one compares the year 2025 HDI DTF level of $380,777,000 dollars to the alternative scenario #3a, the DTF for 2025 is $343,150,000, a difference of $37,627,000 dollars. However, if there was a three year long event for 2022, 2023, and 2024 that depleted the DTFs in each of these three years by one third of $37,627,000 dollars, or $12,542,000 dollars, year 2025 in the HDI would also be around $343,150,000. From year 2025 onward the HDI financial analysis and the alternative scenario financial analysis would be the same. The average DTF for years 2022-2024 is $501,009,000 dollars. $12,542,000 represents just 2.5%/year of this three year average value

and would be sufficient to convert HDI's success scenario for IP2 to a projected failure scenario. This small decrease of 2.5% over each of these three years takes on special importance in Part Two of this critique. If HDI's assumed savings over this three year period by gains in efficiency, is in error by a cumulative amount of $37,627,000 dollars, the IP2 DTF would eventually become insolvent. Once again, small differences can lead to very different end points, i.e., insolvency before the radiological decommissioning is completed.

Similar alternative scenarios could readily be made for IP1 and IP3 about minimum initial DTF levels that are needed to prevent their DTFs from becoming insolvent. IP1 and IP3 can also be analyzed to determine the size of the decrease in the DTF during 2022 to 2024 that would cause IP1 and IP3 to become insolvent. The point here is that even if the USA avoids a recession in the next few years, small DTF reductions, on the order of a few percent, for just a few years could lead to all the IPEC units eventually becoming insolvent. **Based on the HDI methodology, neither a full scale depression nor a recession is needed to turn the IPEC decommissioning into failure sequences; just an economic slowdown over a few years might do this as well.**

Neither HDI nor the NRC staff has expressed this observation, likely because they did not generate these alternative scenarios.

7.2.2.4 Alternative Scenarios #4a, #4b, and #4c

In Scenarios #3a and #3b, changes in the DTF levels were only made to the first year. In Scenarios #4a,#4b, and #4c it was assumed that a fixed percentage, 5% or 10%, higher withdrawal costs were used year-by-year than what HDI calculated. These percentages are less than the 18% Contingency Allowance that HDI claims it is using. These analyses are useful in evaluating systemic problems that create higher costs than those considered by HDI. For example, HDI does not account for a systemic issue like inflation or the rising price of goods and services over the course of the decommissioning project. A comparison of Scenario #4b to #4c showed that IP2 is more likely to become a failure scenario than IP3 is. Even with a 10% increase each year in withdrawal rate, IP3 is calculated to still have a surplus of $9.2 million dollars. A 10% annual increase in the annual withdrawal rate for IP2 would leave a calculated deficit of $49.6 million dollars and unfinished radiological decommissioning tasks. Scenario #4a, combined with surplus results from Scenarios #1c and #4b, indicates that IP3 would need an annual increase in withdrawal rate close to 11% before in might become a failure scenario. The lower resilience of IP2 is likely due to the fact that its DTF is considerably smaller than IP3's.

7.2.2.5 Alternative Scenario #5

HDI claims that it can decommission IP2 for about $301 million dollars less than it takes to decommission sister plant IP3. The purpose of alternative Scenario #5 is to estimate the impact of IP2 having withdrawal rates equal to those HDI used for IP3. This alternative scenario repeats the HDI scenario in HDI Table 5-1b, but inserts the IP3 withdrawal rate from HDI Table 5-1c. If IP2 decommissioning costs are the same as those for IP3, the IP2 DTF would become insolvent by 2031, leaving a deficit of about $298.6 million dollars in unfinished decommissioning tasks. Because such large sums of money are involved as well as the failure to complete radiological decommissioning, HDI's claim of very large savings for IP2 relative to IP3 is examined in Part Two of this critique.

7.2.2.6 Alternative Scenario #6

All the previous alternative scenarios examined just one event at a time, like a change in the start date. However, there are multiple events that are independent of one another and could happen simultaneously. Alternative Scenario #6 examines one such possibility, IP2 experiencing withdrawal rates equal to that of IP3 and a DTF equivalent to that of a start date of 12/31/2018. This combination of events is calculated to cause the IP2 DTF to become insolvent in 2029 with $375 million dollars of unfinished decommissioning tasks. No estimate has been made on further expenses for IP1 and IP3 that an insolvent IP2 might cause schedule slippage in IP1 and/or IP3.

7.2.2.7 Alternative Scenario #7

This scenario estimated the impact of possible inflation on IP2 to provide some guidance since HDI did not consider the effects of inflation. While future inflation rates are unknown some guidance can be gained from historical values. More details are provided in Section 7.4.2. Including estimates of future inflation rates leads to the conclusion that inflation is an important consideration. In Scenario #7, inflation reduced the HDI projected surplus for IP2 from $72.7 million dollars down to around $7.1 million dollars. One important lesson from Scenario #7 was, when the effects of inflation are considered, a failure scenario can occur with just a small further financial effect. Stated differently, even with a modest assumed inflation rate, IP2's DTF is likely to become insolvent with any other event that depletes the DTF beyond the numbers that HDI presented for IP2 in its PSDAR Table 5-1b.

7.2.3 Results From the HDI and Alternative Sequences

TABLE A-3 provides the results of the HDI and alternative scenarios. Specific alternative scenario analyses are provided in the Appendix.

TABLE A-3 Results of HDI and Alternative Scenarios

Scenario	IP Unit(s)	Input Conditions	DTF Depletion Date	Surplus/ Shortfall $Millions	Radiological Decommissioning Obtained?
#1a #1b #1c	IP1 IP2 IP3	Analyses as per Tables 5-1a, 5-1b, and 5-1c in HDI PSDAR	> 2062 > 2062 > 2062	+20.0, +72.7, +170.6	Yes Yes Yes
#2a #2b #2c	IP1 IP2 IP3	Impact of changing initial DTF from that on 10/31/2019 to DTF on 12/31/2018. No change in withdrawal rates.	2031 2043 2054	-139.9 -45.0 -115.7	No No No
   #3a #3b	 IP2 IP2	Finding the IP2 initial DTF that turns the HDI IP2 results from success to failure. Initial DTF=$618,670,000 (5.4% less) Initial DTF=$627,915,000 (4.0% less)	 2059 >2062	 -11.8 +20.8	 No Yes
  #4a #4b #4c	 IP3 IP3 IP2	Impact of Higher Withdrawal Rates, Year-After-Year 5% Increase in IP3 Withdrawal Rate 10% Increase in IP3 Withdrawal Rate 10% Increase in IP2 Withdrawal Rate	 >2062 >2062 2043	 +81.6 +9.2 -49.6	 Yes Yes, barely No
#5	IP2	IP2 Withdrawals = IP3 Withdrawals IP2 DTF as of 10/31/2019, but with IP3 10/31/2019 Withdrawal Rate	2031	-298.6	No
#6	IP2	Combination of two effects IP2 DTF as of 12/31/2018, but with IP3 10/31/2019 Withdrawal Rate	2029	-375.0	No
#7	IP2	Effects of Inflation	>2062	7.1	Yes

7.3 General Observations About the HDI methodology

7.3.1 The HDI Analysis is Incomplete

One of the major flaws in the HDI analysis, and in the NRC's review of the HDI submittals, is that the HDI analysis relies on a specialized success scenario, keyed to a single calendar date, whereas a more comprehensive multi-scenario process that examines both success and failure scenarios over long periods of time is necessary.

It is now common practice to solve multi-scenario situations. The NRC itself deals with multiple scenarios in its probabilistic risk analyses to determine if an operating nuclear power plant presents an acceptably low level of risk to the public. Investment firms routinely provide financial forecasting services where large numbers of scenarios are considered and outcome distributions are presented that can form the basis for financial decision making.

In fact, HDI is capable of analyzing multi-scenario situations. It did exactly this in its justification for using 18% as its Contingency Allowance and it evaluated Discrete Risk Events (See pages 93-95 of HDI's PSDAR).

The NRC recognized that different stock market conditions affect the amounts of money in the DTFs. As spelled out on page 14 of the Safety Evaluation (SE), "equity markets fluctuate with time". Also stated in the SE "equity markets declined by 32 to 36 percent between mid-February to mid -March 2020". The SE also points out equity markets can rise, as they have in recent times, giving the example of a 13.2 percent rise between September 2019 and September 2020.

While the SE recognized market fluctuations, which would continuously affect the amounts of money in the DTFs over the long course of the decommissioning process, it appears that the staff did not act on this observation. It appears that the staff did not search for those fluctuation situations that would lead to failure scenarios. Yet failure scenarios are far more important then success scenarios. It is failure scenarios that prevent the completion of all the radiological decommissioning tasks. It is failure scenarios that place the public at financial risk. Instead, the staff's conclusion of reasonable assurance seems to be based on a single successful, static HDI analysis. The dynamic fluctuating market conditions model the SE refers to is the opposite of the model used by HDI to produce Tables 5-1a, 5-1b, and 5-1c which the NRC staff relied upon.

Market fluctuations are not the only pathway to an insolvent DTF. There may be cost overruns due to discrete risk events. Further, the HDI methodology does not account for inflation or the escalation of the price of goods and services over the course of the project. Based on data found in Entergy reports, the cost for labor increased by about 9% between 2015 and 2018. What are the long term effects of not estimating the effects of inflation or the escalation of the price for goods and services on a DTF becoming insolvent?

Even without a sophisticated multi-scenario computer program, the NRC staff could have generated simple alternative analyses as was done here. Had this been done the staff might have noticed that perturbations of the HDI analysis that lead to failure scenarios are typically smaller than HDI's 18% Contingency Allowance and much smaller than the fluctuations the staff observed in the market place. The staff might have noticed that combinations of two or more very small perturbations could lead to a failure scenario. Having identified multiple pathways to failure scenarios through the use of a small set of alternative scenarios, would the staff conclude that the single successful scenario that HDI provided was sufficiently complete to support a conclusion of Reasonable Assurance?

Another area where the HDI analysis is incomplete relates to the much smaller costs to decommission IP2 compared to IP3. One of the explanations for this lower cost at IP2 is a HDI claim of greater efficiency in that there would be "lessons learned" from observing the decommissioning of IP3 which, in most cases, precedes the decommissioning of IP2. However, year-after-year the

cost to decommission IP2 is lower than the cost to decommission IP3. HDI must describe those specific actions that it claims lead to cost savings each year and explain how the savings from these specific actions were translated into dollars saved. This is especially important in the 2047 to 2061 time frame. Even though IP1, IP2, and IP3 would have long been demolished by 2047 with very few people left at the IP site, HDI's analyses indicate that decommissioning IP2 would cost about $170.1 million dollars less than IP3 for this time period.

The HDI analysis of the money in the Contingency Allowance also is incomplete. A constant Contingency Allowance of 18% is assumed over all three plants over a 40 year time span. Even though the tasks to be completed in the first 12 years or so are very different from the tasks to be completed in the last 12 years, the same 18% is assumed. But events that might cause cost increases to be covered by the Contingency Allowance differ from one time period to another and from IP1 to IP2 or to IP3. The only way a flat rate contingency allowance might work for the benefit of the public is to return all unused portions of a task based Contingency Allowance back to the DTF. However, HDI did not propose this and did not provide any pathway for an unused portion of the Contingency Allowance to be returned to the DTF (the people's money) from which it had originally come. HDI, instead claimed that all of the Contingency allowance would be fully consumed. That works against the best interests of the people.

7.3.2 The HDI Analysis is Unrealistic

The HDI PSDAR analysis starts with the DTF funding level that occurred on a single day, October 31, 2019 selected by HDI. If a different start date had been selected, particularly a day between mid-February to mid-March, 2020, the HDI PSDAR would have shown completely different results. The only time the HDI model is influenced by market conditions is the DTF level on the selected single first day. This means that year-after-year through 2062, the projected amounts of money in the Indian Point DTFs are not influenced by market conditions. Yet, even out to 2062, DTF funding levels are directly influenced by the selection of a single first day's DTF. The HDI computer model generates nine place numbers of the amounts of money in DTFs without accounting for any future effects from the market and without providing any kind of uncertainty analysis.

Subsequent days and years beyond the first starting day and first year may experience significant market downturns, large enough to cause the DTFs to become insolvent then or at a later date as funds continue to be withdrawn from the DTF. Does anyone really know if present severe economic conditions in the United States won't result in downturns or even recessions in 2021, 2022, or beyond?

It is unrealistic for the HDI financial analysis to first put so much emphasis on the market condition for a single day then ignore the impact of the market during the next 40 years. It is unrealistic for the NRC staff to come to a conclusion of reasonable assurance based on an unrealistic HDI financial model based on a single day's favorable market.

It is unrealistic for HDI to project years ahead what cost savings might accrue to IP2 from learning from the execution of IP3 tasks that precede the same tasks at IP2. If HDI can identify and quantify more efficient money saving methods that might benefit IP2, why wouldn't these same more economical insights be applied to IP3 first?

It is unrealistic for HDI to ignore the effects of inflation, the increasing costs for goods and services, the impacts of discrete risk events, or assume that the same Contingency Allowance applies to all tasks over several decades, and equally for IP1 as it does for IP2 and IP3.

It is noted that all these unrealistic assumptions or unrealistic methods benefit HDI.

7.3.3 The HDI Analysis is Unstable

As described before, a system is unstable if a small perturbation can lead to a large change in outcome. In the HDI methodology there are many different sources of small perturbations that can lead to large changes in the outcome. The HDI computer model predicts a combined surplus of $263 million dollars from the three Indian Point units at the end of the decommissioning process, assuming a start date of October 31, 2019. Change the start date to 12/31/2018, ten months earlier, and there would be a combined shortfall of $299.7 million dollars. This represents a total shift of $563 million dollars which is very close to the total amount of money in the IP1 DTF, which has taken decades to accumulate.These large swings from surpluses to deficits caused by a small change in the start date meets the definition of instability. Increase the IP3 withdrawal rate by 5%/year and the HDI projected surplus would shrink from $170.6 million dollars down to $81.6 million dollars. Note that this 5%/year figure is smaller than HDI's 18% Contingency Allowance figure which is supposed to account for a range of possible perturbations. In another scenario, a 10%/year increase in IP2's withdrawal rate would cause its DTF to become insolvent by 2043. Instead of a surplus of $72.7 million dollars that HDI estimated for IP2, a 10% increase in the withdrawal rate would cause a $49.6 million dollar deficit. The total surplus to deficit shift for a 10% increase in the IP2 withdrawal rate is $122.3 million dollars.

Not only can many small perturbations result in large shifts between surpluses and deficits, they also can convert success scenarios into failure scenarios where radiological decommissioning would not be completed.

Calculated financial difficulties can occur in other ways besides variations in the DTFs caused by fluctuations in the market place. Discrete risk events, discussed later, could be large enough to push a DTF into insolvency. Discrete risk events that cause the annual IP3 withdrawal rate to be larger by10% would cause the IP3 DTF to become insolvent before 2062. An increase in the withdrawal rate at Indian Point need not come from a single event. There can be combinations of smaller events, like a change in market conditions coinciding with a small discrete risk event like a schedule slip, which together could lead to a failure scenario. One severe combination of events that was investigated was a situation where the costs to decommission IP2 matched those of IP3 and the money in the IP2 DTF matched that on 12/31/2018. This combination of events led to a calculated $375 million dollar shortfall to complete the IP2 decommissioning with the IP2 DTF becoming insolvent in 2029.

In another analysis presented in Section 7.2.2.3 an increase in withdrawal rates of only 2.5% for three consecutive years would be sufficient to bring IP2 to the brink of insolvency.

7.4 DTFs, Inflation, Goods and Services, and the Market

7.4.1 Introduction

The outcomes of the financial scenarios examined in the HDI PSDAR and in the alternative scenarios presented in this critique are dependent of the dollar levels in a nuclear unit's DTF. Decreases in the market can reduce the dollar value of a DTF. Increases in the amounts of money needed to complete specific decommissioning costs that are not accounted for by the Contingency Allowance (Section 7.5.5.1) also decrease a DTF beyond what had been planned for. Using IP2 as a case study, Scenarios #3a and #3b show that a decrease above 4.8% just in the first year's DTF could prevent the final radiological decommissioning steps from being completed. Such a small decrease in the DTF could be the result of a decrease in the market. Even if there were no market declines, a limited annual increase in the amounts of money that would be withdrawn to execute the decommissioning process can cause the DTFs to become insolvent. This annual additional cost issue was examined in Scenarios #4a,#4b, and #4c.

It is not necessary to have market declines or even annual increases in the withdrawal rate to prevent the radiological decommissioning of IP2. Analyses, described in Section 7.2.2.3, show that an increase around 2.5% for just three years in a row early in the decommissioning process for IP2 could be sufficient to turn the IP2 success scenario into a failure scenario.

Page 95 of HDI's PSDAR states *"Contingency does not account for inflation or escalation of the price of goods and services over the course of the project."* A limited review was conducted as to the potential impact of inflation, goods and services, and of the sensitivity of the DTFs to changes in the market, discussed below.

7.4.2 Inflation

The HDI analysis for Indian Point does not account for inflation which is unrealistic. It is also inconsistent with Entergy's recognition of the importance of inflation. In its analysis of its ISFSI obligation, Entergy escalated costs at 3% per annum[6] to account for inflation. As the SE points out, the bulk of the IPEC decommissioning expenditures would occur between 2021 and 2033, a 12 year span of time. While the inflation rate in the next 12 years is unknown, looking back on the last 12 years is instructive. An item costing $10,000 in 2007 would in 2019, some 12 years later, would cost $12,450 dollars based on consumer price index data.The average inflation rate over this time period was 1.84% per year. This 1.84%/year is close to the 2.5%/year which was shown elsewhere in this critique as sufficient to turn the IP2 success scenario into a failure scenario if this 2.5% increase persisted for just three consecutive years. HDI also assumed a 2% inflation in its Oyster Creek and Pilgrim decommissioning cost estimates.[7]

An estimate of the effect of inflation on IP2 was made in Scenario #7 in Section 9.12 in the Appendix. The HDI withdrawal rate as taken from Table 5-1b of the HDI PSDAR was increased

[6] Entergy letter CNRO2020-00002, March 26, 2020, to the NRC, Enclosure 2, page 1.

[7] GreenbergTrauig e-mail to Honorable Michelle Phillips, January 11, 2021, Enclosure 1, page E1-3 and Enclosure 2, page E2-3.

by the recorded past inflation rates. For 2020 the increase in inflation was 1.2%. Since the HDI DTFs use a start date of 10/31/2019 but decommissioning expenses would start in 2021, at the earliest, the withdrawal rate for 2021 was set at 1.012 time the HDI withdrawal rate for 2021. During the years 2022 to 2033 it was assumed that the annual increase matched that of the recorded increases in the previous years, reaching back the same number of years as the financial analyses calculated costs, going forward. For example, for 2022 the assumed inflation rate was increased by the recorded amount in 2019; for 2023 the assumed inflation rate was increased by the same amount recorded in 2018 and so forth. Starting in 2034, the incremental increase in costs due to inflation was assumed to be just 1.00%/year until 2062, well below historical inflation rates and well below Entergy's 3%/year rate. These modest rates are likely to underestimate the full effects of inflation.

Even with this modest inflation rate the calculated IP2 surplus by 2061 was $7.1 million dollars in Scenario #7, down from the $72.7 million surplus estimated by HDI for IP2 in Scenario #1b which did not account for inflation. It is clear if Scenario #7 assumed inflation rates closer to 1.84%/year or Entergy's 3%/year, these inflation rates would convert HDI's IP2 success scenario into a failure scenario.

7.4.3 Goods and Services

The NRC recognizes that goods and services become more expensive over time. Because prices escalate license holders like Entergy have to account for this in the periodic filing with NRC on the status of the DTFs of the nuclear units they own. Entergy filed such a report to the NRC on March 26, 2020.[8] Enclosure 4 of this letter is a discussion of the escalation factor which has the purpose of accounting for the changing costs for labor, energy, and waste burial, items that could be considered goods and services. For Indian Point 2 and Indian Point 3 the calculated escalation factor for the 33 years from 1986 through 2019 was calculated to be 5.10838. It is possible to calculate an annual average increase percentage for this combination of labor, energy, and waste burial using the formula $5.10838 = (1+x)^{33}$ where x is an annual average increase in cost for these three goods and services. Solving this equation one gets x = 0.05357 or ~5.4%. This is interpreted to mean that these goods and services might average an increase about 5.4% per year. Consequently the assumed inflation rate used in TABLE A-16 could be too low. HDI calculated an IP2 surplus of $72.7 million dollars by 2062 assuming no inflation. a modest inflation rate was assumed in TABLE A-16 which reduced the surplus to $7.1 million dollars.A somewhat larger inflation rate than the one used in TABLE A-16, but not as large as the 5.4% /year rate above, would likely cause the IP2 to become insolvent.

7.4.4 Market Effects

The HDI treatment of market effects is unrealistic and incomplete.

The NRC recognized that different stock market conditions affect the amounts of money in the DTFs. As spelled out on page 14 of the Safety Evaluation (SE) "equity markets fluctuate with

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[8] CNRO02020-00002 "Decommissioning Funding Status Report per 10CFR 50.75(f)(1) and 10 CFR 50.82(a)(8)(v).

time". Also stated in the SE "equity markets declined by 32 to 36 percent between mid-February to mid-March 2020". The SE also points out equity markets can rise, as they have in recent times, giving the example of a 13.2 percent rise between September 2019 and September 2020.

While the SE recognized market fluctuations would affect the amounts of money in the DTFs during the long course of the decommissioning process, it appears that the staff did not act upon this observation. The SE does not mention any NRC staff search for market situations that would lead to failure scenarios.

For example, alternative Scenarios #3a and #3b show that for IP2 a 4.8% decrease in the DTF on 10/31/2019 would change the HDI IP2 scenario in the PSDAR Table 5-1b from success to failure.

Figure A-2 is a plot of the DJA during 2019 and 2020. October 31, 2019 is shown as a single red dot in Figure A-2 It is obvious that there are many success scenarios and many failure scenarios in just this two year span both before and after the date selected by HDI. The HDI analysis choice of a single success day is far from a complete presentation. As presented elsewhere in this critique, if the HDI analysis started with the DTFs on 12/31/2018 (effectively, 01/01/2019) IP1, IP2, and IP3 would all be calculated to become insolvent prior to completing all radiological decommissioning tasks and leaving shortfalls that might become burdens to the public. Further, Figure A-2 shows that there is nothing extreme about 12/31/2018. There were many days after HDI's 10/31/2019 where the market was lower that HDI's selected date and even lower than the DJA on 12/31/2018.

The SE conclusion of reasonable assurance is unsupportable when it is based on such incomplete information and a lack of analysis of the impacts of other possible start dates. Also missing is any description of how the NRC staff would reach a determination of reasonable assurance when it has to consider a large number of scenarios, some being success scenarios and others being failure scenarios.

FIGURE A-3 Dow Jones Daily Average During 01/01/2019-12/31/2020

It is possible to obtain an approximation of how sensitive each of the three IPEC DTFs is to market changes. What is known is the DJA on 10/31/2019 and on 12/31/2018. Also known are the DTF levels for all three units on the Indian Point site on both of these dates. For each nuclear unit the percent change in DTFs for a one percent change in the DJA can be estimated. This was done and the results were that a one percent decrease in the DJA would cause a 1.49% decrease in the DTF of IP1, a 0.77% decrease in the DTF for IP2, and a 1.18% decrease in the DTF of IP3. A one percent decrease in the market would have reduced the IPEC DTFs by about $25 million dollars.

7.5 Other Issues of Interest

7.5.1 Compensatory Actions

The SE recognizes the possibility of needing additional sources of funds beyond the monies held in the DTFs on page 16 when it discusses *"positive ending balances in the IP1, IP2, and IP3 DTFs at license termination."* However positive ending balances only occur for successful scenarios when they would not be needed. Failure scenarios when you do need other sources of money, do not have positive ending balances. So this SE solution to times when additional sources of funds is unworkable Additionally, it is poor practice to wait many years for a possible positive ending balance. As discussed in Part Three of this critique, cost overruns need to be addressed year-by-year and task-by-task.

The SE, on page 16, stated *"Additionally, Holtec IP2 and Holtec IP3 expect to recover from the DOE through litigation or settlement of their claims the spent fuel management costs that they will incur as a result of the DOE's breach of its obligations under the standard contacts."* The SE went on to say *"Therefore the NRC staff concludes that DOE reimbursements provide a reasonable source of funds to cover spent fuel management costs at the IPEC"*.

Using future DOE reimbursements to cover spent fuel management costs does not address cost overruns. As shown in the alternative scenarios cost overruns vary in amount and in timing, as shown in TABLE A-3. The SE does not discuss the dollar amount of the DOE reimbursements or how this compares to the sizes of these cost overruns or the timing of these reimbursements. More fundamentally, the purpose of these reimbursements is to compensate for delays in the removal of spent fuel from the site and they could not be applied to any other use. The treatment of DOE reimbursements, in the form of Treasury payments, is discussed in the Section 7.5.4 on Treasury Payments.

Any DOE reimbursements should go directly in the IPEC DTFs without any control over this money by HDI. There is no basis for HDI to possibly profit from DOE reimbursements. HDI has not added funds to the DTFs and has no money of its own at risk in this project. Therefore HDI has no standing when it comes to how DOE reimbursements are to be distributed.

HDI assumes that DOE will remove the spent fuel from the site by around 2030. Assuming that happens, any decommissioning shortfalls after 2030 could not be compensated by DOE reimbursements.

7.5.2 Financial Surpluses

Decommissioning success scenarios project surpluses at their end. Since neither Entergy nor HDI has contributed to the DTFs these surpluses, should they occur, belong to the rate payers. The applicants should send a letter to the NY State Public Service Commission clarifying that all surpluses will be remitted to NY State, which would then be required to return this money to the ratepayers.

7.5.3 Major Decommissioning Periods

On page 11 of the SE there is a discussion of the NRC staff's review of the five major periods of decommissioning with special emphasis on Period 4, the dismantlement period. The staff calculates that 96 percent, 92 percent, and 95 percent of the estimated radiological decommissioning expenses at IP1, IP2, and IP3 would have been expended by the completion of Period 4. However, these figures are only true for the single success scenario submitted by HDI. Different scenarios will show different expenses over time. Even if the dismantlement period is completed, adequate funding to complete the final radiological tasks must be available. If there are any of the financial perturbations as discussed before, these percentages may not be reached. During most of the decommissioning process there are radiological decommissioning tasks and non-radiological tasks, both of which draw money from the DTFs at the same time. If there is a cost overrun, even in a non-radiological task, this might prevent the completion of a later radiological decommissioning task because of insufficient funds. While the NRC is just responsible for radiological decommissioning, it must be mindful of all mechanisms, including non-radiological ones, that affect the DTFs.

To amplify the above paragraph, the chart on page 15 of the SE shows that spent fuel management costs plus site restoration costs, the very areas where HDI has sought exemptions from the NRC, represent one third of the total IPEC decommissioning costs. An overrun in costs in these non-radiological areas would deplete the money in the DTFs needed for radiological decommissioning. In order to assure that adequate funds are available for radiological decommissioning, the NRC has to prevent unacceptable depletions from the DTFs regardless of whether they are radiological related expenses or not.

Even though the NRC staff claims that it is only responsible for radiological decommissioning, implementing this responsibility may require the NRC staff to take actions if there are non-radiological activities that might deplete the DTF to the point that some radiological tasks may become underfunded. The NRC staff may have to revisit its position on the scope of its responsibilities in circumstances where actions of a non-radiological manner might affect the money available to carry out radiological decommissioning tasks.

7.5.4 Treasury Payments

The SE discussion of Treasury payments to HDI because of DOE not meeting its contractual nuclear waste removal obligations raises important issues. The DOE is obliged to remove the radioactive wastes from nuclear plant sites. Removal of radioactive wastes from nuclear sites like IPEC is a key part of the decommissioning process. Any past reimbursements from the Treasury or DOE related to decommissioning actions should be placed into the IPEC DTFs, less verifiable expenses incurred by Entergy. These reimbursements are the "people's money". Entergy should not profit from DOE's failure to meet its contractual obligations. Any future reimbursements from the Treasury or DOE because of a failure to remove radioactive wastes should go directly into the IPEC DTFs.

7.5.5 Contingency Allowance and Discrete Risk Events

7.5.5.1 Contingency Allowance

HDI has made very detailed cost analyses for IP1, IP2, and IP3. These cost analyses were presented in several ways, such as year-by-year data for each nuclear unit which were then inserted into HDI Tables 5-1a, 5-1b and 5-1c. Cost figures per nuclear unit were also listed according to tasks identified by specific WBS code numbers, and aggregate amounts were presented for different time periods. Section 4.1 of the PSDAR provides a long list of actions that HDI took to generate these cost estimates. Standing behind all of these cost figures is HDI’s claimed expertise in the PSDAR, pages 90-92, reproduced in Section 9.14 in the Appendix. Therefore, in estimating the cost to complete a specific decommissioning task, this extensive capability would produce a “best estimate”.

However, HDI recognized that in spite of all its expertise “Any project has inherent uncertainty in the estimated quantities, unit rates, productivity, pricing, and schedule durations” (HDI PSDAR, page 93). The PSDAR goes on to list a number of contributors to this uncertainty:

- Expected site conditions (physical and radiological)
- Decommissioning processes and tools
- New and/or non-familiar technology
- Complexity
- Labor skills and productivity
- Stakeholder/regulatory requirements
- Quality of cost estimating assumptions and data
- Experience and skill level of the estimator
- Pricing
- Estimating techniques
- Time and level of effort allowed to prepare the cost estimate and schedule

There are two different actions being considered here. The first action uses HDI’s existing expertise to arrive at its best estimate to complete a specific task. The second action is to deal with inherent uncertainty. **These two actions serve different goals and one is not a substitute for the other.**

Using a sophisticated mathematical program, HDI analyzed the above contributors to the overall uncertainty and concluded that an 18% contingency allowance, at an 85% level of confidence, was appropriate for IPEC. This level of confidence is interpreted to mean that 85% of the effects of uncertainty contributors, or combinations thereof, are at or below 18% of the best estimate.

Since the level of confidence is 85%, most of the time these contributors to the uncertainty will not need to consume all 18% of the Contingency Allowance.

The HDI PSDAR, page 95, stated *"The Contingency Allowance is an integral part of the cost to complete the IPEC decommissioning and is expected to be fully consumed."* Both statements, that the Contingency Allowance being an integral part of the cost to complete the IPEC decommissioning and the statement of expecting the Contingency Allowance to be fully consumed, are wrong. As stated above, there are two separate actions going on and they serve different purposes. One action is to use HDI expertise to come up with a best estimate to complete a specific task. The second action is to deal with inherent uncertainties and the money set aside in the Contingency Allowance is meant to deal with this uncertainty. So the Contingency Allowance is not an integral part of the cost estimate to complete a task, but stands apart to handle uncertain costs. With regard to the expectation that the Contingency Allowance would be fully consumed, there is no way for HDI to know on December 19, 2019 what the costs will be years into the future from uncertain events. In fact, the very nature of these uncertain events would change over the long time period from 2021 to 2061. The earlier years are very active with segmentation, dismantlement, and demolition. The later years, from about 2047 onward are very quiet, limited to actions like site surveying, report writing, etc. The uncertainty components that the Contingency Allowance is designed to cope with differ dramatically over this 40 year time period. The HDI statement that it expects the Contingency Allowance to be fully consumed is in conflict with HDI's description of the derivation of the 18% Contingency Allowance. HDI reports that it used a sophisticated mathemetical analysis to derive the 18% figure and that this figure has an 85% confidence level. However, at an 85% confidence level, 85%, or most of the time, the costs or uncertain events is less than 18%. About 15% of the time the costs for dealing with uncertain events would exceed 18%, according to HDI. Only 15% of the time would the Contingency Allowance be fully consumed. The majority of the time there would be, task by task, money left over in a task's Contingency Allowance. This unused money should be returned to the DTF from which it came. This unused money does not belong to HDI.

Figure A-3 was generated to further examine the meaning of the above HDI statement. The striped area represents the 18% contingency allowance. AREA A in Figure A-3 represents this best estimate cost. Area B shows the Contingency Allowance as an integral part of the cost to complete the IPEC decommissioning. Areas A and B are drawn to be the same size, i.e., they both have the same cost to complete the task at hand. However, unless one assumes that the Contingency Allowance was set to zero, i.e, did not exist, AREA B is unworkable. AREA B is unworkable because in order to make the Contingency Allowance and integral part of the cost, the best estimate part would have to shrink. But there cannot be two different best estimates. If AREAS A and B are the same size, then HDI's statement about the Contingency Allowance being an integral part of the cost appears to be illogical.

Area C shows from the best estimate dollars as in AREA A and then adds 18% to it for the Contingency Allowance, outside of AREA A. This would raise the total cost to complete tasks by 18% if the HDI statement that the Contingency Allowance is used. But there is no basis to expect that the Contingency Allowance would be fully consumed. As stated before, most of the time uncertainty issues would have impacts less than 18%. Further, HDI cannot know in advance which contributors to a myriad of different tasks will consume all of the 18% of the Contingency Allowance.

While the 18% Contingency Allowance analysis seems reasonable, HDI's application of this analysis does not. As presently applied as an integral part of the costs, the Contingency Allowance appears to be effectively zero.

From a public protection point of view it would be prudent to assume that the Contingency Allowance is best represented by Area C where the Contingency Allowance lies outside of the best estimate and is available to deal with the inherent uncertainties HDI describes, and that all unused money is returned to the sponsoring DTF once the task is completed. TABLE A-4 lists the dollar impact of having an 18% Contingency Allowance to supplement the best cost estimate.

FIGURE A-4 Contingency Allowances

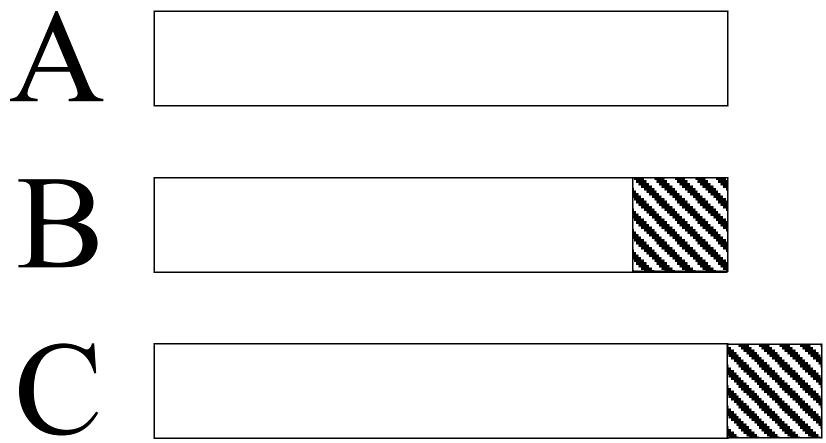


TABLE A-4 External Contingency Allowances

Plant	Decommissioning Cost	External 18% Contingency Allowance
IP1	$598,184,000	$107,673,120
IP2	$701,822,000	$126,327,960
IP3	$1,002,378,000	$180,428,040
Total	N/A	$414,429,120

7.5.5.2 Discrete Risk Events

Section 4.5 of the HDI PSDAR discussed Discrete Risk Events. As reported by HDI, *"Discrete risk events are considered a threat when the risk event may negatively impact the project baseline objectives, such as schedule delays and cost increases."* As in the case of establishing the Contingency Allowance, sophisticated mathematical tools were used to analyze discrete risk events. This process eventually led to the creation of Risk Allowances. As HDI stated *"Risk allowance is funds added to the baseline schedule and estimate to account for discrete risk events (both threats and opportunities) that may or may not occur during the decommissioning project life cycle."* Since all funds that HDI plans to use come from the DTFs, then these Risk Allowances would also have to be drawn from the DTFs (the people's money).

No further information is provided by HDI on Risk Allowances. How much money will there be in the Risk Allowances for IP1, IP2, and IP3? Do the annual DTFs in HDI's Tables 5-1a, 5-1b, and 5-1c reflect withdrawals for Risk Allowances? If the discrete risk events used by HDI to generate the Risk Allowances do not happen, will there be surpluses to be returned to the DTFs? Unlike Table A-4 where HDI provided its contributors to the 18% Contingency Allowance, there is no information in the HDI PSDAR available to estimate the magnitude of these Risk Allowances.

Tables 3-2a, 3-2b, and 3-2c in the HDI PSDAR gives very detailed cost figures for IP1, IP2, and IP3. There are 43 WBS code entries for each of these plants. There is no entry for Risk Allowances. Where are the funds for the Risk Allowances?

Had the NRC staff reviewed the HDI PSDAR prior to issuing the SE it might have noticed that there is no description of the amounts of money in these Risk Allowances and they are not accounted for in the detailed cost accounting HDI put forth. Yet market fluctuations appears to be an example which fits the description of a discrete risk event.

7.5.6 Transmission Lines

There are very expensive transmission lines that connect the Indian Point site to the rest of the grid. In the highly congested area of the lower Hudson Valley such transmission lines are very valuable. However, neither the HDI PSDAR nor the NRC staff's SE mentions these transmission lines and their impact on the cost for decommissioning the Indian Point site. If these transmission lines are to be torn down because Indian Point no longer uses them, who pays for this? If these transmission lines are not torn down who pays the present owner (Likely Consolidated Edison) to maintain them for some yet undescribed future use?

These transmission lines represent an unexplored potential liability for HDI and their future cost impact should be determined immediately.

8.0 PART FOUR - Protecting the Public

8.1 Introduction

This critique shows that there are many defects in the HDI methodology and results. Similarly, the NRC staff in its Safety Evaluation has not justified its conclusion of Reasonable Assurance. The basic safety practice in risk analysis, both radiological risk analysis and financial risk analysis, is to search for possible failure scenarios and then quantify their likelihood and their potential consequences, should these scenarios happen. This has not taken place. The SE makes no mention of searching for possible failure scenarios, but seems to rely exclusively on the one scenario selected by HDI. As a result of this very limited scope of the SE, the people of New York have been put at risk.

However, it has become clear that even if HDI and the NRC staff greatly improved their methodologies to the standards used by the NRC and the nuclear industry in radiological risk analysis, there would still be a very wide set of possible end states, i.e. a wide uncertainty band. Resolving how to proceed with such a wide financial uncertainty band in a relatively new technology, decommissioning of large nuclear facilities, might be a very lengthy process.

The most desirable solution to this situation would be for the NRC to withdraw its Safety Evaluation. If this is not to happen then it is recommended that a combination of quantitative and qualitative actions be taken to protect the public. The first line of defense would be quantitative. Use would be made of this critique to estimate the amount of money that would be provided by Entergy and placed into some high quality Financial Assurance Mechanism (FAM) and retained by a well regarded financial institution, to be drawn upon year-by-year and task-by-task if there are cost overruns that exceed the funds from the DTFs allotted to pay for these decommissioning tasks.

The need for additional decommissioning financial assurance is recognized by HDI in its Pilgrim Nuclear Power Station report.[9] As Section G, Decommissioning Financial Assurance, stated *"Financial assurance for decommissioning is provided by the prepayment method,* ***coupled with an external trust fund,*** *in accordance with 10 CFR 50.75(e)(1)(i) and 10 CFR 72.30(e)(1) as approved by the NRC in their approval of the license transfer to Holtec Pilgrim, LLC and HDI."* (emphasis added)

There is no guarantee that the amount of money in this FAM would be sufficient. If decommissioning went according to plan, then any money left over in this would be returned to Entergy. On the other hand, if the amount of money in this FAM turned out to be insufficient, then, in keeping with the principal of using Defense-in-Depth, a contract signed between Entergy and NY State would state that the people of New York would remain financially risk free under all circumstances, that all radiological and non-radiological tasks at IPEC would be completed in a timely manner, and that all applicable Federal, State, and local regulations would be met. Entergy would be responsible for full implementation of this contract. The NRC and NY State would be responsible to assure that these contractual obligations are met. To control the costs and quality of this

9 ibid, Enclosure 2, page E2-3, Section G, Decommissioning Financial Assurance.

very large project, NY State, with NRC input, would have to approve projected expenditures on a year-by-year basis. Once approved by NY State, funds would be withdrawn from the specific unit DTFs. If problems arise requiring additional funds, NY State would withdraw monies from the FAM, if it has determined that such a withdrawal is appropriate. All the DTFs would be held by NY State and subject to NY State audit requirements. These DTFs are not to be used for any other purpose than decommissioning the specific units for which they have been accumulated. If a specific task is completed under budget, the unused funds would be returned to the unit's DTF at the completion of the specific task. If there is money left over in the DTFs after the completion of all radiological and non-radiological tasks, this money will be returned to the rate payers.

8.2 Establishing the Initial Funds in the FAM

The following estimate of the amount of money that should be placed into a FAM, assumes that all previous payments to Entergy because the Department of Energy (DOE) has not removed the spent reactor fuel from the IPEC site, have been placed into the DTFs, less verifiable expenses. Any subsequent payments by DOE to HDI would be fully transferred to the DTFs in proportion to the tonnage of the spent fuel generated by the specific units.

TABLE A-5 Estimated Initial Funds in a FAM

Basis	**Reference**	**Estimated Amount, Millions**
IPI Shortfall Relative to NRC Cost Estimate, Radiological Decommissioning Only	Section 7.1.1.2	$112.0
IP2 Decommissioning Costs Match IP3 Decommissioning Costs	TABLE A-3, Scenario #5	$298.6
Impact of Variable Market Forces	TABLE A-3 Scenarios #2a, #2b, and #2c	$300.6
External 18% Contingency Allowance, TABLE A-4	Section 7.5.5.1	$414.4
Inflation, Goods and Services, Discrete Events	TABLE A-16, Section 7.4.2, Section 7.5.5.2	$74.4
Total	N/A	$1,200.0

9.0 Appendix

9.1 Scenarios #1a, #1b, and #1c

See HDI PSDAR, Tables 5-1a, 5-1b, and 5-1c for IP1, IP2, and IP3, respectively.

9.2 Scenario #2a: Impact of Shifting the IP1 Starting Date on the IP1 Initial DTF

Table 5-1a of HDI's PSADAR is a decommissioning financial analysis of IP1 where the assumed starting date was October 31, 2019 and where the funds in IP1's DTF were those at that particular date. However, a different date, December 31, 2018 was examined in Scenario #2a to see how changing the starting date might affect IP1's decommissioning financial analysis. The reason the December 31, 2018 date was selected was because Entergy had reported to the NRC what the DTFs of IP1, IP2, and IP3 were on that particular date. Other than having the specific IP1, IP2 and IP3 DTF levels from Entergy, 12/31/2018 is just an ordinary date.

On 10/31/2019 the IP1 DTF held $533.5 million dollars and on 12/31/2018 IP1's DTF held $471.9 million dollars. The analysis presented in TABLE A-3 started with the 12/31/2018 DTF of $471.9 minus HDI's pre-closure deductions of $59.3 million dollars. All other aspects of the HDI analysis in its Table 5-1a, such as the withdrawal rates, were the same. The calculation of the money earned by the DTF during the long decommissioning process in TABLE A-6, below, matched the same percentage increases that HDI's Table 5-1a used year-by-year. All other HDI assumptions, such as no increase in the cost of labor or services during the long decommissioning process, were retained.

The HDI PSDAR analysis of IP1 was a success scenario, funds were sufficient to complete radiological decommissioning and a surplus of $20.0 million dollars was calculated. With a start date of 12/31/2018 the outcome is a failure. The IP1 DTF becomes insolvent by 2031 and the shortfall is calculated to be $139.9 million dollars. Shifting the HDI start date to 12/31/2018 resulted in an overall shift of $159.9 million dollars.

TABLE A-6 IP1, 12/31/2018 DTF, HDI IP1 Withdrawal Rate, $ in Thousands

Year	Startofyear, Trust Fund Balance HDI PSDAR Table 5-1a	With-drawal Rate HDI PSDAR Table 5-1a	Trust Fund Earnings HDI PSDAR Table 5-1a	Year End Trust Fund Balance HDI PSDAR Table 5-1a	Start of year Trust Fund Balance Starting with 12/31/2018 Balance	Trust Fund Earn-ings	Year End Trust Fund Bal-ance
2021	533,532	-32,617	5,844	506,759	411,900	8,238	387,521
2022	506,759	-32,183	9,492	484,068	387,521	7,750	363,088
2023	484,068	-57,397	8,533	435,204	363,088	7,261	312,952
2024	435,204	-71,547	7,273	370,930	312,952	6,259	247,662
2025	370,930	-28,992	6,839	348,777	247,662	4,953	223,623
2026	348,777	-32,586	6,324	322,515	223,623	4,472	195,509
2027	322,515	-40,615	5,638	287,538	195,509	3,910	158,804
2028	287,538	-37,287	5,005	255,256	158,804	3,176	124,693
2029	255,256	-29,410	4,517	230,363	124,693	2,494	97,777
2030	230,363	-53,727	3,533	180,169	97,777	1,956	46,005
2031	180,169	-78,112	2,041	104,097	46,005	920	-31,187
2032	104,097	-49,944	1,183	60,366	-31,187	0	-81,131
2033	60,336	-6,631	1,074	54,779	-81,131	0	-87,762
2034	54,779	-2,870	1,038	52,948	-87,762	0	-90,632
2035	52,948	- 2,870	1,002	51,079	-90,632	0	-93,502
2036	51,079	-2,875	964	49,169	-93,502	0	-96,337
2037	49,169	-2,870	926	47,225	-96,337	0	-99,247
2038	47,225	-2,870	887	45,242	-99,247	0	-102,117
2039	45,242	-2,870	847	43,220	-102,117	0	-104,987
2040	43,220	-2,875	807	41,152	-104,987	0	-107,862
2041	41,152	-2,870	766	39,048	-107,862	0	-110,732
2042	39,048	-2,870	724	36,902	-110,732	0	-113,602
2043	36,902	-2,870	681	34,713	-113,602	0	-116,472
2044	34,713	-2,875	637	32,474	-116,472	0	-119,347
2045	32,474	-2,870	592	30,197	-119,347	0	-122,217
2046	30,197	-5,162	501	25,536	-122,217	0	-127,379
2047	25,536	-4,488	421	21,468	-127,379	0	-131,867
2048	21,468	-386	422	21,503	-131,867	0	-132,253

Year	Startofyear, Trust Fund Balance HDI PSDAR Table 5-1a	With-drawal Rate HDI PSDAR Table 5-1a	Trust Fund Earnings HDI PSDAR Table 5-1a	Year End Trust Fund Balance HDI PSDAR Table 5-1a	Start of year Trust Fund Balance Starting with 12/31/2018 Balance	Trust Fund Earn-ings	Year End Trust Fund Bal-ance
2049	21,503	-386	422	21,539	-132,253	0	-132,639
2050	21,539	-386	423	21,576	-132,639	0	-133,025
2051	21,576	-386	424	21,613	-133,025	0	-133,411
2052	21,613	-386	425	21,651	-133,411	0	-133,797
2053	21,651	-386	425	21,690	-133,797	0	-134,183
2054	21,690	-386	426	21,730	-134,183	0	-134,569
2055	21,730	-714	420	21,436	-134,569	0	-135,283
2056	21,436	-715	414	21,136	-135,283	0	-135,998
2057	21,136	-715	408	20,829	-135,998	0	-135,713
2058	20,829	-715	402	20,516	-135,713	0	-137,428
2059	20,516	-715	396	20,197	-137,428	0	-138,143
2060	20,197	-715	390	19,871	-138,143	0	-138,858
2061	19,871	-715	383	19,539	-138,858	0	-139,573
2062	19,539	-323	384	19,601	-139,573	0	-139,896

9.3 Scenario #2b: Impact of Shifting the IP2 Starting Date on the IP2 Initial DTF

TABLE A-7 is an analysis of replacing HDI's IP2 10/31/2019 DTF of $654.1 million dollars with the IP2 12/31/2018 DTF of $598.4 million dollars, less pre-closure deductions of $15.15 million dollars, while keeping the same withdrawal rate as in HDI's Table 5-1b. The HDI PSDAR analysis of IP2 was a success scenario; funds were sufficient to complete radiological decommissioning and a surplus of $72.7 million dollars was calculated. With an IP2 start date of 12/31/2018 the outcome is a failure. The IP2 DTF becomes insolvent by 2043 and the shortfall is calculated to be $45.0 million dollars, an overall shift of $117.7 dollars.

TABLE A-7 IP2, 12/31/2018 DTF, HDI IP2 Withdrawal Rate, $ in Thousands

Year	Beginning of year, Trust Fund Balance HDI PSDAR Table 5-1b	Withdrawal Rate HDI PSDAR Table 5-1b	Trust Fund Earnings HDI PSDAR Table 5-1b	Year Ending Trust Fund Balance HDI PSDAR Table 5-1b	Start of year Trust Fund Balance Starting with 12/31/2018 Balance	Trust Fund Earnings	Year Ending Trust Fund Balance
2021	654,078	-70,024	6,814	590,868	583,262	11,665	524,903
2022	590,868	-105,834	9,701	494,735	524,093	10,498	428,757
2023	494,735	-85,496	8,185	417,424	428,757	8,575	351,836
2024	417,424	-44,113	7,466	380,777	351,836	7,037	314,760
2025	380,777	-43,993	6,736	343,520	314,760	6,295	277,062
2026	343,520	-40,373	6,063	309,210	277,062	5,541	242,230
2027	309,210	-39,697	5,390	274,903	242,230	4,845	207,378
2028	274,903	-55,164	4,395	224,134	207,378	4,147	156,361
2029	224,134	-53,960	3,403	173,577	156,361	3,127	105,528
2030	173,577	-15,449	3,163	161,291	105,528	2,110	92,190
2031	161,291	-15,449	2,917	148,758	92,190	1,844	78,585
2032	148,758	-18,646	2,602	132,714	78,585	1,572	61,510
2033	132,714	-9,623	2,462	125,553	61,510	1,230	53,117
2034	125,553	-5,990	2,391	121,954	53,117	1,062	48,189
2035	121,954	-6,000	2,319	118,274	48,189	964	43,152
2036	118,274	-6,014	2,245	114,505	43,152	863	38,001
2037	114,505	-6,000	2,170	110,675	38,001	760	32,761
2038	110,675	-5,990	2,094	106,779	32,761	665	27,426
2039	106,779	-6,000	2,016	102,795	27,426	549	21,975

Year	Begin-ning of year, Trust Fund Balance HDI PSDAR Table 5-1b	With-drawal Rate HDI PSDAR Table 5-1b	Trust Fund Earnings HDI PSDAR Table 5-1b	Year Ending Trust Fund Balance HDI PSDAR Table 5-1b	Start of year Trust Fund Balance Starting with 12/31/2018 Balance	Trust Fund Earnings	Year Ending Trust Fund Balance
2040	102,795	-6,005	1,936	98,725	21,975	439	16,409
2041	98,725	-6,000	1,855	94,580	16,409	328	10,737
2042	94,580	-6,000	1,772	90,352	10,737	215	4,952
2043	90,352	-6,000	1,687	86,040	4,952	99	-949
2044	86,040	-6,005	1,601	81,636	-949	0	-6,949
2045	81,636	-5,990	1,513	77,158	-6,949		-12,954
2046	77, 158	-3,152	1,480	75,486	-12,954	0	-16,106
2047	75,486	-894	1,482	76,084	-16,106	0	-17,000
2048	76,084	-386	1,514	77,212	-17,000	0	-17,386
2049	77,212	-386	1,537	78,362	-17,386	0	-17,772
2050	78,362	-386	1,560	79,535	-17,772	0	-18,158
2051	79,535	-386	1,583	80,731	-18,158	0	-18,544
2052	80,731	-386	1,607	81,952	-18,544	0	-18,930
2053	81,952	-386	1,631	83,196	-18,930	0	-19,316
2054	83,196	-386	1,656	84,446	-19,316	0	-19,702
2055	84,446	-3,274	1,624	82,816	-19,702	0	-22.976
2056	82,816	-3,285	1,591	81,121	-22.976	0	-26,261
2057	81,121	-3,285	1,557	79,393	-26,261	0	-29,546
2058	79,393	-3,285	1,522	77,629	-29,546	0	-32,831
2059	77,629	-3,285	1,487	75,831	-32,831	0	-36,116
2060	75,831	-3,285	1,451	73,996	-36,116	0	-39,401
2061	73,996	-3,285	1,414	72,125	-39,401	0	-42,866
2062	72,125	-2,270	1,397	71,252	-42,866	0	-44,956

9.4 Scenario #2c: Impact of Shifting the IP3 Starting Date on the IP3 Initial DTF

TABLE A-8 is an analysis of replacing IP3's 10/31/2019 DTF of $916.1 million dollars with the IP3 12/31/2018 DTF of $780.6 million dollars, less pre-closure costs of $15.15 dollars, while keeping the same withdrawal rate as in HDI's Table 5-1c. The HDI analysis of IP3 was a success scenario; funds were sufficient to complete radiological decommissioning and a surplus of $170.6 million dollars was calculated. With a start date of 12/31/2018 the outcome is a failure. The IP3 DTF becomes insolvent by 2054 and the shortfall is calculated to be $115.7 million dollars. Just moving the start dates for IP3 resulted in a shift of $286.3 million dollars.

TABLE A-8 IP3, 12/31/2018 DTF, HDI IP3 Withdrawal Rate, $ in Thousands

Year	Beginning of Year Trust Fund Balance HDI PSDAR Table 5-1c	Withdrawal Rate HDI PSDAR Table 5-1c	Trust Fund Earnings Holtec HDI PSDAR Table 5-1c	Year Ending Trust Fund Balance HDI PSDAR Table 5-1c	Start of year Trust Fund Balance Starting with 12/31/2018 Balance	Trust Fund Earnings	Year Ending Trust Fund Balance
2021	916,100	-110,773	9,395	814,722	765,443	15,309	669,979
2022	814,722	-124,235	13,810	704,297	669,979	13,340	559,144
2023	704,297	-107,740	11,391	608,488	559,114	11,183	462,587
2024	608,488	-85,924	10,451	533,016	462,587	9,252	385,915
2025	533,016	-54,171	9,577	488,421	385,915	7,718	339,462
2026	488,421	-57,084	8,627	439,964	339,462	6,789	289,167
2027	439,964	-48,119	7,837	399,682	289,167	5,783	246,831
2028	399,682	-32,164	7,350	374,868	246,831	4,937	219,625
2029	374,868	-32,142	6,855	349,581	219,625	4,393	191,880
2030	349,581	-32,138	6,349	323,792	191,880	3,838	163,570
2031	323,792	-32,138	5,833	297,487	163,570	3,271	134,703
2032	297,487	-31,679	5,316	271,124	134,703	2,694	105,718
2033	271,124	-7,343	5,276	269,057	105,718	2,114	100,490
2034	269,057	-3,607	5,309	270, 759	100,479	2,009	98,881
2035	270,759	-3,607	5,343	272,494	98,881	1,978	97,251
2036	272,494	-3,612	5,378	274,260	97,251	1,945	95,584
2037	274,260	-3,607	5,413	276,066	95,584	1,911	93,888
2038	276,066	-3,607	5,449	277,907	93,888	1,878	92,159
2039	277,907	-3,607	5,486	279,786	92,159	1,843	90,395

Year	Beginning of Year Trust Fund Balance HDI PSDAR Table 5-1c	Withdrawal Rate HDI PSDAR Table 5-1c	Trust Fund Earnings Holtec HDI PSDAR Table 5-1c	Year Ending Trust Fund Balance HDI PSDAR Table 5-1c	Start of year Trust Fund Balance Starting with 12/31/2018 Balance	Trust Fund Earnings	Year Ending Trust Fund Balance
2040	279,786	-3,612	5,523	281,697	90,395	1,808	88,890
2041	281,697	-3,607	5,562	283,652	88,890	1,772	87,055
2042	283,652	-3,607	5,601	285,646	87,055	1,741	85,189
2043	285,646	-3,607	5,641	287,679	85,189	1,704	83,286
2044	287,679	-3,612	5,681	289,748	83,286	1,666	81,340
2045	289,748	-3,607	5,723	291,864	81,340	1,627	79,360
2046	291,864	-4,433	5,749	293,179	79,360	1,587	76,514
2047	293,179	-7,453	5,715	291,441	76,514	1,530	70,591
2048	291,441	-11,953	5,590	285,078	70,591	1,412	60,050
2049	285,078	-11,917	5,463	278,624	60,050	1,201	49,334
2050	278,624	-11,927	5,334	272,030	49,334	987	38,393
2051	272,030	-11,917	5,202	265,315	38,393	768	27,244
2052	265,315	-11,953	5,067	258,429	27,224	545	15,816
2053	258,429	-11,927	4,930	251,432	15,816	316	4,205
2054	251,432	-11,927	4,790	244,294	4,205	84	-7,638
2055	244,294	-14,805	4,590	234,079	-7,638	0	-22,443
2056	234,079	-14,842	4,385	223,622	-22,443	0	-37,285
2057	223,622	-14,826	4,176	212,972	-37,285	0	-52,111
2058	212,972	-14,826	4,393	202,198	-52,111	0	-66,937
2059	202,198	-14,826	3,746	191,028	-66,937	0	-81,763
2060	191,028	-14,842	3,524	179,709	-81,763	0	-96,605
2061	179,709	-14,811	3,298	168,196	-96,605	0	-111,416
2062	168,196	-4,238	3,279	167,237	-111,416	0	-115,654
2063	167,237	0	3,345		-115,654	0	

9.5 Scenario #3a: Finding the IP2 DTF Level That Turns Success into Failure

The purpose of this analysis is to estimate at what dollar level initially in the IP2 DTF would turn the HDI analysis of IP2 from success into a failure scenario. Failure is defined as not having enough money in the DTF to complete all the radiological decommissioning tasks, some of which occur at the very end of decommissioning around 2062. Therefore, any time the IP2 DTF runs out of money prior to 2062, is a failure scenario.

There are multiple ways that the IP DTF could become insolvent. This analysis examines just one of these failure modes, having too small an initial DTF. An initial estimate used to start this analysis was $618,670,000 dollars, a $35,400,000 dollars or 5.4% difference from HDI's Table 5-1b starting amount of $654,078,000.This initial estimate turned out to be very close as DTF funds lasted through 2059 with a shortfall of $11.8 million dollars. A somewhat larger initial DTF, around $627,915,000, was then examined in Scenario 3b. Scenario 3b is $26,163,000 dollars, or 4%, less than the HDI IP2 DTF as presented in Table 5-1b of the PSDAR.

The HDI analysis of IP2 resulted in a surplus of $72.7 million dollars. If the initial amount of money in the IP2 DTF was 4% less than what HDI used, the IP2 surplus would be reduced to $20.8 million dollars. If the initial amount of money in the IP2 DTF was 5.4% less than what HDI used, the IP2 DTF would be calculated to be insolvent with a shortfall of $11.8 million dollars. Interpolating these results, any initial amount of money in the IP2 DTF more than 4.8% smaller than HDI's initial number would convert the HDI scenario for IP2 from success to failure. The HDI financial model is very sensitive to small changes in the input numbers. It only took a 5.4% difference in the initial amount of money in IP2's DTF to cause a calculated shift of $72.7 +$11.8 = $84.5 million dollars. It only takes a 4.8% decrease in the IP2 <u>initial</u> DTF to turn this sequence from a success sequence to a failure sequence.

TABLE A-9 Initial IP2 DTF Level 5.4% Less, $ in Thousands

Year	Begin-ning of year, Trust Fund Balance, PSDAR Table 5-1b	Withdraw PSDAR Table 5-1b	Trust Fund Earnings PSDAR Table 5-1b	Year Ending Trust Fund Balance, PSDAR Table 5-1b	Begin-ning of year Trust Fund Balance	Trust Fund Earnings	Year Ending Trust Fund Balance
2021	654,078	-70,024	6,814	590,868	618,670	6,445	555,091
2022	590,868	-105,834	9,701	494,735	555,091	9,113	458,371
2023	494,735	-85,496	8,185	417,424	458,371	7,583	380,458
2024	417,424	-44,113	7,466	380,777	380,458	6,804	343,150
2025	380,777	-43,993	6,736	343,520	343,150	6,070	305,227
2026	343,520	-40,373	6,063	309,210	305,227	5,387	270,241
2027	309,210	-39,697	5,390	274,903	270,241	4,711	235,254
2028	274,903	-55,164	4,395	224,134	235,224	3,761	183,821
2029	224,134	-53,960	3,403	173,577	183,821	2,791	132,652
2030	173,577	-15,449	3,163	161,291	132,652	2,417	119,620
2031	161,291	-15,449	2,917	148,758	119,662	2,163	106,376
2032	148,758	-18,646	2,602	132,714	106,376	1,860	85,591
2033	132,714	-9,623	2,462	125,553	85,591	1,588	77,556
2034	125,553	-5,990	2,391	121,954	77,556	1,472	73,038
2035	121,954	-6,000	2,319	118,274	73,038	1,389	68,427
2036	118,274	-6,014	2,245	114,505	68,427	1,299	63,712
2037	114,505	-6,000	2,170	110,675	63,712	1,207	58,919
2038	110,675	-5,990	2,094	106,779	58.919	1,115	54,043
2039	106,779	-6,000	2,016	102,795	54,043	1,020	49,063
2040	102,795	-6,005	1,936	98,725	49,063	924	43,982
2041	98,725	-6,000	1,855	94,580	43,982	826	38,808
2042	94,580	-6,000	1,772	90,352	38,808	727	33,535
2043	90,352	-6,000	1,687	86,040	33,535	626	28,161
2044	86,040	-6,005	1,601	81,636	28,161	524	22,680
2045	81,636	-5,990	1,513	77,158	22,680	420	17,110
2046	77, 158	-3,152	1,480	75,486	17,110	328	14,286
2047	75,486	-894	1,482	76,084	14,286	280	13,672
2048	76,084	-386	1,514	77,212	13,672	272	13,558

Year	Beginning of year, Trust Fund Balance, PSDAR Table 5-1b	Withdraw PSDAR Table 5-1b	Trust Fund Earnings PSDAR Table 5-1b	Year Ending Trust Fund Balance, PSDAR Table 5-1b	Beginning of year Trust Fund Balance	Trust Fund Earnings	Year Ending Trust Fund Balance
2049	77,212	-386	1,537	78,362	13,558	270	13,442
2050	78,362	-386	1,560	79,535	13,442	268	13,324
2051	79,535	-386	1,583	80,731	13,324	265	13,203
2052	80,731	-386	1,607	81,952	13,203	263	13,080
2053	81,952	-386	1,631	83,196	13,080	260	12,954
2054	83,196	-386	1,656	84,446	12,954	258	12,826
2055	84,446	-3,274	1,624	82,816	12,826	247	9,799
2056	82,816	-3,285	1,591	81,121	9,799	188	6,702
2057	81,121	-3,285	1,557	79,393	6,702	129	3,546
2058	79,393	-3,285	1,522	77,629	3,546	68	328
2059	77,629	-3,285	1,487	75,831	328	6	-2,951
2060	75,831	-3,285	1,451	73,996	-2,951	0	-6,236
2061	73,996	-3,285	1,414	72,125	-6,236	0	-9521
2062	72,125	-2,270	1,397	71,252	-9,521	0	-11,791

9.6 Scenario #3b: Finding Initial IP2 DTF Level That Turns Success into Failure, 4.0% Change

TABLE A-10 Initial IP2 DTF Level 4.0% Less, $ in Thousands

Year	Begin-ning of year Trust Fund Balance, PSDAR Table 5-1b	Withdraw PSDAR Table 5-1b	Trust Fund Earnings PSDAR Table 5-1b	Year Ending Trust Fund Balance PSDAR Table 5-1b	Begin-ning of year Trust Fund Balance	Trust Fund Earnings	Year Ending Trust Fund Balance
2021	654,078	-70,024	6,814	590,868	627,915	6,541	564,432
2022	590,868	-105,834	9,701	494,735	564,432	9,539	468,137
2023	494,735	-85,496	8,185	417,424	468,137	7,911	390,553
2024	417,424	-44,113	7,466	380,777	390,553	6,718	353,158
2025	380,777	-43,993	6,736	343,520	353,158	6,342	315,508
2026	343,520	-40,373	6,063	309,210	315,508	5,584	280,719
2027	309,210	-39,697	5,390	274,903	280,719	4,997	246,019
2028	274,903	-55,164	4,395	224,134	246,019	4,527	195,382
2029	224,134	-53,960	3,403	173,577	195,382	3,475	144,897
2030	173,577	-15,449	3,163	161,291	144,897	2,637	132,085
2031	161,291	-15,449	2,917	148,758	132,085	2,378	119,014
2032	148,758	-18,646	2,602	132,714	119,014	2,130	102,498
2033	132,714	-9,623	2,462	125,553	102,498	2,050	94,925
2034	125,553	-5,990	2,391	121,954	94,925	1,898	90,833
2035	121,954	-6,000	2,319	118,274	90,833	1817	86,650
2036	118,274	-6,014	2,245	114,505	86,650	1,733	82,369
2037	114,505	-6,000	2,170	110,675	82,369	1,647	78,016
2038	110,675	-5,990	2,094	106,779	78,016	1,560	73,586
2039	106,779	-6,000	2,016	102,795	73,586	1,472	69,058
2040	102,795	-6,005	1,936	98,725	69,058	1,381	64,434
2041	98,725	-6,000	1,855	94,580	64,434	1,289	59,723
2042	94,580	-6,000	1,772	90,352	59,723	1,194	54,917
2043	90,352	-6,000	1,687	86,040	54,917	1,098	50,015
2044	86,040	-6,005	1,601	81,636	50,015	1,000	45,010
2045	81,636	-5,990	1,513	77,158	45,010	900	39,920

Year	Begin-ning of year Trust Fund Balance, PSDAR Table 5-1b	Withdraw PSDAR Table 5-1b	Trust Fund Earnings PSDAR Table 5-1b	Year Ending Trust Fund Balance PSDAR Table 5-1b	Begin-ning of year Trust Fund Balance	Trust Fund Earnings	Year Ending Trust Fund Balance
2046	77, 158	-3,152	1,480	75,486	39,920	798	37,566
2047	75,486	-894	1,482	76,084	37,556	751	37,413
2048	76,084	-386	1,514	77,212	37,413	748	38,161
2049	77,212	-386	1,537	78,362	38,161	763	38,538
2050	78,362	-386	1,560	79,535	38,538	770	38,923
2051	79,535	-386	1,583	80,731	38,923	778	39,701
2052	80,731	-386	1,607	81,952	39,701	794	40,109
2053	81,952	-386	1,631	83,196	40,109	802	40,525
2054	83,196	-386	1,656	84,446	40,525	811	40,950
2055	84,446	-3,274	1,624	82,816	40,950	819	38,495
2056	82,816	-3,285	1,591	81,121	38,495	770	35,980
2057	81,121	-3,285	1,557	79,393	35,980	720	33,415
2058	79,393	-3,285	1,522	77,629	33,415	668	30,798
2059	77,629	-3,285	1,487	75,831	30,798	616	28,129
2060	75,831	-3,285	1,451	73,996	28,129	562	25,407
2061	73,996	-3,285	1,414	72,125	25,407	508	22,630
2062	72,125	-2,270	1,397	71,252	22,630	453	20,8135

9.7 Scenario #4a: Impact of an Annual 5% Increase in IP3's Withdrawal Rate

TABLE A-11 5% Annual Increase in IP3's Withdrawal Rate, $ in Thousands

Year	IP3 Withdrawal Rate, PSDAR Table 5-1c	Withdrawal Rate X 1.05	Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019	Trust Fund Earnings	Year Ending Trust Fund Balance
2021	-110,773	-116,312	916,100	9,395	809,183
2022	-124,235	-130,446	809,183	13,675	692,412
2023	-107,740	-113,127	692,412	11,702	590,987
2024	-85,924	-90,220	590,987	10,165	510,932
2025	-54,171	-56,880	510,932	9,176	463,228
2026	-57,084	-59,938	463,228	8,199	411,489
2027	-48,119	-50,525	411,489	7,325	368,289
2028	-32,164	-33,772	368,289	6,777	341,294
2029	-32,142	-33,749	341,294	6,246	313,791
2030	-32,138	-33,745	313,791	5,711	285,757
2031	-32,138	-33,745	285,757	5,144	257,156
2032	-31,679	-33,263	257,156	4,603	228,496
2033	-7,343	-7,710	228,496	4,470	225,256
2034	-3,607	-3,787	225,256	4,505	225,974
2035	-3,607	-3,787	225,974	4,519	226,706
2036	-3,612	-3,793	226,706	4,534	227,447
2037	-3,607	-3,787	227,447	4,549	228,209
2038	-3,607	-3,787	228,209	4,564	228,986
2039	-3,607	-3,787	228,986	4,580	229,779
2040	-3,612	-3,793	229,779	4,596	230,582
2041	-3,607	-3,787	230,582	4,612	231,407
2042	-3,607	-3,787	231,407	4,628	232,248
2043	-3,607	-3,787	232,248	4,645	233,106
2044	-3,612	-3,793	233,106	4,662	233,795
2045	-3,607	-3,787	233,795	4,680	234,688
2046	-4,433	-4,655	234,688	4,694	234,727
2047	-7,453	-7,857	234,727	4,695	231,565
2048	-11,953	-12,551	231,565	4,631	223,654

Year	IP3 Withdrawal Rate, PSDAR Table 5-1c	Withdrawal Rate X 1.05	Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019	Trust Fund Earnings	Year Ending Trust Fund Balance
2049	-11,917	-12,513	223,654	4,473	215,614
2050	-11,927	-12,523	215,614	4,312	207,403
2051	-11,917	-12,513	207,403	4,148	199,038
2052	-11,953	-12,551	199,038	3,981	190,467
2053	-11,927	-12,524	190,467	3,809	181,752
2054	-11,927	-12,524	181,752	3,635	172,863
2055	-14,805	-15,545	172,863	3,457	160,775
2056	-14,842	-15,584	160,775	3,216	148,406
2057	-14,826	-15,567	148,406	2,968	135,807
2058	-14,826	-15, 567	135,807	2,716	122,956
2059	-14,826	-15, 567	122,956	2,459	109,848
2060	-14,842	-15, 584	109,848	2,197	96,461
2061	-14,811	-15,552	96,462	1,929	82,839
2062	-4,238	-4,450	82,839	1,657	80,045
2063	0	0	80,045	1,601	81,646

9.8 Scenario #4b: Impact of an Annual 10% Increase in IP3's Withdrawal Rate

TABLE A-12 10% Annual Increase in IP3's Withdrawal Rate, $ in Thousands

Year	IP3 Withdrawal Rate, PSDAR, Table 5-1c	IP3 Withdrawal Rate X 1.10	Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019	Trust Fund Earnings	Year Ending Trust Fund Balance
2021	-110,773	-121,850	916,100	9,395	803,645
2022	-124,235	-136,659	803,645	13,581	690,568
2023	-107,740	-118,514	690,568	11,671	583,725
2024	-85,924	-94,516	583,725	10,040	499,249
2025	-54,171	-59,588	499,249	8,967	448,628
2026	-57,084	-62,792	448,628	7,941	393,777
2027	-48,119	-52,931	393,777	7,009	347,855
2028	-32,164	-35,380	347,855	6,400	318,875
2029	-32,142	-35,362	318,875	5,835	289,348
2030	-32,138	-35,356	289,348	5,266	259,258
2031	-32,138	-35,352	259,258	4,640	228,546
2032	-31,679	-34,847	228,546	4,090	197,790
2033	-7,343	-8,077	197,790	3,956	193,669
2034	-3,607	-3,958	193,669	3,873	193,584
2035	-3,607	-3,968	193,584	3,872	193,488
2036	-3,612	-3,973	193,488	3,870	193,385
2037	-3,607	-3,968	193,385	3,868	193,285
2038	-3,607	-3,968	193,285	3,866	193,183
2039	-3,607	-3,968	193,183	3,864	193,079
2040	-3,612	-3,973	193,079	3,862	192,968
2041	-3,607	-3,968	192,968	3,859	192,859
2042	-3,607	-3,968	192,859	3,857	192,748
2043	-3,607	-3,968	192,748	3,855	192,635
2044	-3,612	-3,973	192,635	3,852	192,515
2045	-3,607	-3,968	192,515	3,850	192,397
2046	-4,433	-4,876	192,397	3,848	191,369
2047	-7,453	-8,198	191,369	3,827	186,998
2048	-11,953	-13,148	186,998	3,740	177,590

Year	IP3 Withdrawal Rate, PSDAR, Table 5-1c	IP3 Withdrawal Rate X 1.10	Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019	Trust Fund Earnings	Year Ending Trust Fund Balance
2049	-11,917	-13,109	177,590	3,552	168,032
2050	-11,927	-13,120	168,032	3,361	158,273
2051	-11,917	-13,109	158,273	3,165	148,329
2052	-11,953	-13,148	148,329	2,967	138,148
2053	-11,927	-13,120	138,148	2,763	127,790
2054	-11,927	-13,120	127,790	2,556	117,226
2055	-14,805	-16,286	117,226	2,345	103,285
2056	-14,842	-16,326	103,285	2,066	89,024
2057	-14,826	-16,309	89,024	1,780	74,495
2058	-14,826	-16,309	74,495	1,490	59,676
2059	-14,826	-16,309	59,676	1,194	44,561
2060	-14,842	-16,326	44,561	891	29,126
2061	-14,811	-16,292	29,126	583	13,416
2062	-4,238	-4,662	13, 416	268	9,022
2063	0	0	9,022	180	9,204

9.9 Scenario #4c: Impact of an Annual 10% Increase in the IP2 Withdrawal Rate

TABLE A-13 10% Annual Increase in IP2's Withdrawal Rate, $ in Thousands

Year	IP2 Withdrawal Rate From PSDAR Table 5-1b	IP2 Withdrawal Rate X 1.10	Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019	Trust Fund Earnings	Year Ending Trust Fund Balance
2021	-70,024	-77,026	654,078	6,814	583,866
2022	-105,834	-116,417	583,866	9,867	477,316
2023	-85,496	-94,046	477,316	8,067	391,336
2024	-44,113	-48,524	391,336	6,731	349,523
2025	-43,993	-48,392	349,523	6,278	307,408
2026	-40,373	-44,410	307,048	5,441	268,079
2027	-39,697	-43,667	268,079	4,772	229,183
2028	-55,164	-60,680	229,183	4,217	172,720
2029	-53,960	-59,356	172,720	3,160	116,524
2030	-15,449	-16,994	116,524	2,121	101,651
2031	-15,449	-16,994	101,651	1,830	86,487
2032	-18,646	-20,511	86,487	1,548	67,534
2033	-9,623	-10,585	67,524	1,350	58,289
2034	-5,990	-6,589	58,289	1,165	52,865
2035	-6,000	-6,600	52,865	1,057	47,322
2036	-6,014	-6,615	47,332	946	41,663
2037	-6,000	-6,600	41,663	833	35,896
2038	-5,990	-6,589	35,896	718	30,025
2039	-6,000	-6,600	30,025	600	24,025
2040	-6,005	-6,606	24,025	481	17,900
2041	-6,000	-6,600	17,900	358	11,658
2042	-6,000	-6,600	11,658	233	5,291
2043	-6,000	-6,600	5,291	106	-1,203
2044	-6,005	-6,606	-1,203	0	-7,809
2045	-5,990	-6,589	-7,809	0	-14,398
2046	-3,152	-3,467	-14,398	0	-17,865
2047	-894	-983	-17,865	0	-18,848
2048	-386	-425	-18,848	0	-19,273

Year	IP2 Withdrawal Rate From PSDAR Table 5-1b	IP2 Withdrawal Rate X 1.10	Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019	Trust Fund Earnings	Year Ending Trust Fund Balance
2049	-386	-425	-19,273	0	-19,698
2050	-386	-425	-19,698	0	-20,123
2051	-386	-425	-20,123	0	-20,548
2052	-386	-425	-20,548	0	-20,973
2053	-386	-425	-20,973	0	-21,398
2054	-386	-425	-21,398	0	-21,823
2055	-3,274	-3,601	-21,823	0	-25,424
2056	-3,285	-3,614	-25,424	0	-29,038
2057	-3,285	-3,614	-29,038	0	-32,652
2058	-3,285	-3,614	-32,652	0	-36,266
2059	-3,285	-3,614	-36,266	0	-39,880
2060	-3,285	-3,614	-39,880	0	-43,494
2061	-3,285	-3,614	-43,494	0	-47,108
2062	-2,270	-2,497	-47,108	0	-49,605
2063	-0	-0	-49,605	0	

9.10 Scenario #5: IP2 with IP3 Withdrawal Rates

TABLE A-14 IP2, 10/31/2019 DTF, HDI's IP3 Withdrawal Rate, $ in Thousands

Year	Beginning of year, Trust Fund Balance, PSDAR Table 5-1c	Withdraw PSDAR Table 5-1c	Trust Fund Earnings PSDAR Table 5-1c	Year Ending Trust Fund Balance, PSDAR Table 5-1c	Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019	Trust Fund Earnings	Year Ending Trust Fund Balance
2021	916,100	-110,773	9,395	814,722	654,078	6,814	550,119
2022	814,722	-124,235	13,810	704,297	550,119	9,023	434,906
2023	704,297	-107,740	11,391	608,488	434,906	8,698	335,864
2024	608,488	-85,924	10,451	533,016	335,864	6,717	256,657
2025	533,016	-54,171	9,577	488,421	256,657	5,133	207,619
2026	488,421	-57,084	8,627	439,964	207,619	4,152	154,678
2027	439,964	-48,119	7,837	399,682	154.678	3,094	109,653
2028	399,682	-32,164	7,350	374,868	109,653	2,193	79,682
2029	374,868	-32,142	6,855	349,581	79,682	1,594	49,133
2030	349,581	-32,138	6,349	323,792	49,133	983	17,977
2031	323,792	-31,679	5,833	297,487	17,977	359	-12,832
2032	297,487	-31,679	5,316	271,124	-12,832	0	-44,511
2033	271,124	-7,343	5,276	269,057	-44,511	0	-51,854
2034	269,057	-3,607	5,309	270, 759	-51,854	0	-55,461
2035	270,759	-3,607	5,343	272,494	-55,461	0	-59,068
2036	272,494	-3,612	5,378	274,260	-59,068	0	-62,680
2037	274,260	-3,607	5,413	276,066	-62,680	0	-66,287
2038	276,066	-3,607	5,449	277,907	-66,287	0	-69,894
2039	277,907	-3,607	5,486	279,786	-69,894	0	-73,501
2040	279,786	-3,612	5,523	281,697	-73,501	0	-77,113
2041	281,697	-3,607	5,562	283,652	-77,113	0	-80,725
2042	283,652	-3,607	5,601	285,646	-80,725	0	-84,332
2043	285,646	-3,607	5,641	287,679	-84,332	0	-87,939

Year	Beginning of year, Trust Fund Balance, PSDAR Table 5-1c	Withdraw PSDAR Table 5-1c	Trust Fund Earnings PSDAR Table 5-1c	Year Ending Trust Fund Balance, PSDAR Table 5-1c	Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019	Trust Fund Earnings	Year Ending Trust Fund Balance
2044	287,679	-3,612	5,681	289,748	-87,939	0	-91,551
2045	289,748	-3,607	5,723	291,864	-91,551	0	-95,158
2046	291,864	-4,433	5,749	293,179	-95,158	0	-99,591
2047	293,179	-7,453	5,715	291,441	-99,591	0	-107,044
2048	291,441	-11,953	5,590	285,078	-107,044	0	-118,997
2049	285,078	-11,917	5,463	278,624	-118,997	0	-130,914
2050	278,624	-11,927	5,334	272,030	-130,914	0	-142,841
2051	272,030	-11,917	5,202	265,315	-142,841	0	-154,758
2052	265,315	-11,953	5,067	258,429	-154,758	0	-166,711
2053	258,429	-11,927	4,930	251,432	-166,711	0	-178,638
2054	251,432	-11,927	4,790	244,294	-178,638	0	-190,565
2055	244,294	-14,805	4,590	234,079	-190,565	0	-205,370
2056	234,079	-14,842	4,385	223,622	-205,370	0	-220,212
2057	223,622	-14,826	4,176	212,972	-220,212	0	-235,038
2058	212,972	-14,826	4,393	202,198	-235,038	0	-249,864
2059	202,198	-14,826	3,746	191,028	-249,864	0	-264,690
2060	191,028	-14,842	3,524	179,709	-264,690	0	-279,532
2061	179,709	-14,811	3,298	168,196	-279,532	0	-294,343
2062	168,196	-4,238	3,279	167,237	-294,343	0	-298,581

9.11 Scenario #6: Combination of Two Effects

Previous scenarios just examined the impact of a single variable such as the start date of the financial analysis, the impact of different initial amounts of money in the IP2 DTF, the determination of the DTF level that marks the point at which the HDI analysis would turn from being a success scenario to a failure scenario and the impact of using the IP3 withdrawal rate as the withdrawal rate for IP2. Scenario #6 describes the impact of having more than one variable affecting the decommissioning financial analysis. Many combinations of these single variables are possible. Two that were selected for this analysis is when the IP2 withdrawal rate equals that of IP3 and when the IP2 initial DTF matches the funding level that Entergy reported for 12/31/2018.

As expected, this combination is more severe than single variable analyses.

TABLE A-15 IP2, 12/31/2018 DTF, HDI's IP3 Withdrawal Rate, $ in Thousands

Year	**Begin-ning of year,Trust Fund Bal-ance PSDAR Table 5-1c**	**With-drawal Rate PSDAR Table 5-1c**	**Trust Fund Earnings PSDAR Table 5-1c**	**Year Ending Trust Fund Balance PSDAR Table 5-1c**	**Begin-ning of year Trust Fund Balance Start Date 12/31/2018**	**Trust Fund Earnings**	**Year Ending Trust Fund Balance**
2021	916,100	-110,773	9,395	814,722	583,262	11,665	484,154
2022	814,722	-124,235	13,810	704,297	484,154	9,683	369,602
2023	704,297	-107,740	11,391	608,488	369,602	7,392	269,254
2024	608,488	-85,924	10,451	533,016	269,254	5,385	188,715
2025	533,016	-54,171	9,577	488,421	188,715	3,774	138,318
2026	488,421	-57,084	8,627	439,964	138,318	2,766	84,000
2027	439,964	-48,119	7,837	399,682	84,000	1,680	37,561
2028	399,682	-32,164	7,350	374,868	37,561	751	6,170
2029	374,868	-32,142	6,855	349,581	6,170	123	-25,845
2030	349,581	-32,138	6,349	323,792	-25,845	0	-57,983
2031	323,792	-31,679	5,833	297,487	-57,983	0	-89,221
2032	297,487	-31,679	5,316	271,124	-89,221	0	-120,900
2033	271,124	-7,343	5,276	269,057	-120,900	0	-128,243
2034	269,057	-3,607	5,309	270, 759	-128,243	0	-131,850
2035	270,759	-3,607	5,343	272,494	-131,850	0	-135,457
2036	272,494	-3,612	5,378	274,260	-135,457	0	-139,069
2037	274,260	-3,607	5,413	276,066	-139,069	0	-142,676

Year	Begin-ning of year,Trust Fund Bal-ance PSDAR Table 5-1c	With-drawal Rate PSDAR Table 5-1c	Trust Fund Earnings PSDAR Table 5-1c	Year Ending Trust Fund Balance PSDAR Table 5-1c	Begin-ning of year Trust Fund Balance Start Date 12/31/2018	Trust Fund Earnings	Year Ending Trust Fund Balance
2038	276,066	-3,607	5,449	277,907	-142,676	0	-146,283
2039	277,907	-3,607	5,486	279,786	-146,283	0	-149,890
2040	279,786	-3,612	5,523	281,697	-149,890	0	-153,502
2041	281,697	-3,607	5,562	283,652	-153,502	0	-157,109
2042	283,652	-3,607	5,601	285,646	-157,109	0	-160,716
2043	285,646	-3,607	5,641	287,679	-160,716	0	-164,323
2044	287,679	-3,612	5,681	289,748	-164,323	0	-167,935
2045	289,748	-3,607	5,723	291,864	-167,935	0	-171,542
2046	291,864	-4,433	5,749	293,179	-171,542	0	-175,975
2047	293,179	-7,453	5,715	291,441	-175,075	0	-183,428
2048	291,441	-11,953	5,590	285,078	-183,428	0	-195,381
2049	285,078	-11,917	5,463	278,624	-195,381	0	-207,298
2050	278,624	-11,927	5,334	272,030	-207,298	0	-219,225
2051	272,030	-11,917	5,202	265,315	-219,225	0	-231,142
2052	265,315	-11,953	5,067	258,429	-231,142	0	-243,095
2053	258,429	-11,927	4,930	251,432	-243,095	0	-255,022
2054	251,432	-11,927	4,790	244,294	-255,022	0	-266,949
2055	244,294	-14,805	4,590	234,079	-266,949	0	-281,754
2056	234,079	-14,842	4,385	223,622	-281,754	0	-296,596
2057	223,622	-14,826	4,176	212,972	-296,596	0	-311,422
2058	212,972	-14,826	4,393	202,198	-311,422	0	-326,248
2059	202,198	-14,826	3,746	191,028	-326,248	0	-341,074
2060	191,028	-14,842	3,524	179,709	-341,074	0	-355,916
2061	179,709	-14,811	3,298	168,196	-355,916	0	-370,727
2062	168,196	-4,238	3,279	167,237	-370,727	0	-374,965

9.12 Scenario #7: Impact of Inflation on IP2

TABLE A-16 Impact of Inflation on IP2, $ in Thousands

Year	**IP2 With-drawal Rate From PSDAR Table 5-1b**	**Inflation Increment, Cumulative Multiplier**	**Inflation Adjusted With-drawal Rate**	**Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019**	**Trust Fund Earn-ings**	**Year End-ing Trust Fund Bal-ance**
2021	-70,024	.012, 1.012	-70,864	654,078	6,814	583,866
2022	-105,834	.018, 1.030	-109,001	583,866	9,867	522,869
2023	-85,496	.024, 1.054	-90,113	522,869	8,836	441,592
2024	-44,113	.021, 1.075	-47,421	441,592	7,595	401,323
2025	-43,993	.013, 1.088	-47,864	401,323	7,208	360,667
2026	-40,373	.001, 1.089	-43,996	360,667	6,384	323,055
2027	-39,697	.016, 1.105	-43,865	323,055	5,750	284,940
2028	-55,164	.015, 1.120	-61,874	284,940	5,243	228,309
2029	-53,960	.021, 1.141	-61,568	228,309	4,178	170,919
2030	-15,449	.032, 1.173	-18,122	170,919	3,111	155,908
2031	-15,449	.016, 1.189	-18,122	155,908	2,806	140,592
2032	-18,646	.004,1.185	-22,096	140,592	2,517	121,013
2033	-9,623	.038, 1.223	-11,769	121,013	2,420	111,664
2034	-5,990	.015, 1.238	-7,416	111,664	2,233	106,481
2035	-6,000	.015, 1.253	-7,518	106,481	2,120	101,093
2036	-6,014	.015, 1.268	-7,626	101,093	2,022	103,115
2037	-6,000	.015, 1.283	-7,698	103,115	2,062	97,479
2038	-5,990	.015, 1.298	-7,775	97,479	1,950	91,654
2039	-6,000	.015, 1.313	-7,878	91,654	1,833	85,609
2040	-6,005	.015, 1.328	-7,975	85,609	1,712	79,346
2041	-6,000	.015, 1.343	-8,058	79,346	1,587	72,875
2042	-6,000	.015, 1.358	-8,148	72,875	1,458	66,185
2043	-6,000	.015, 1.373	-8,238	66,185	1,323	59,270
2044	-6,005	.015, 1.388	-8,335	59,270	1,185	52,120
2045	-5,990	.015, 1.403	-8,404	52,120	1,042	44,758
2046	-3,152	.015, 1.418	-4,470	44,758	895	41,183

Year	**IP2 With-drawal Rate From PSDAR Table 5-1b**	**Inflation Increment, Cumulative Multiplier**	**Inflation Adjusted With-drawal Rate**	**Beginning of year Trust Fund Balance, First Year Equal to DTF on 10/31/2019**	**Trust Fund Earn-ings**	**Year End-ing Trust Fund Bal-ance**
2047	-894	.015, 1.433	-1,281	41,183	824	40,726
2048	-386	.015, 1.448	-559	40,726	815	40,981
2049	-386	.015, 1.463	-565	40,981	820	41,230
2050	-386	.015, 1.478	-571	41,230	825	41,483
2051	-386	.015, 1.493	-576	41,483	830	41,737
2052	-386	.015, 1.508	-582	41,737	835	41,990
2053	-386	.015, 1.523	-588	41,990	840	42,830
2054	-386	.015, 1.538	-594	42,830	857	43,093
2055	-3,274	.015, 1.553	-5,084	43,093	862	38,871
2056	-3,285	.015, 1.568	-5,151	38,871	777	34,497
2057	-3,285	.015, 1.583	-5,200	34,497	690	29,987
2058	-3,285	.015, 1.598	-5,249	29,987	600	25,338
2059	-3,285	.015, 1.613	-5,299	25,338	507	20,545
2060	-3,285	.015, 1.628	-5,348	20,545	411	15,608
2061	-3,285	.015, 1.643	-5,397	15,608	312	10,523
2062	-2,270	.015, 1.658	-3,764	10,523	210	6,969
2063	-0			6,969	139	7,108

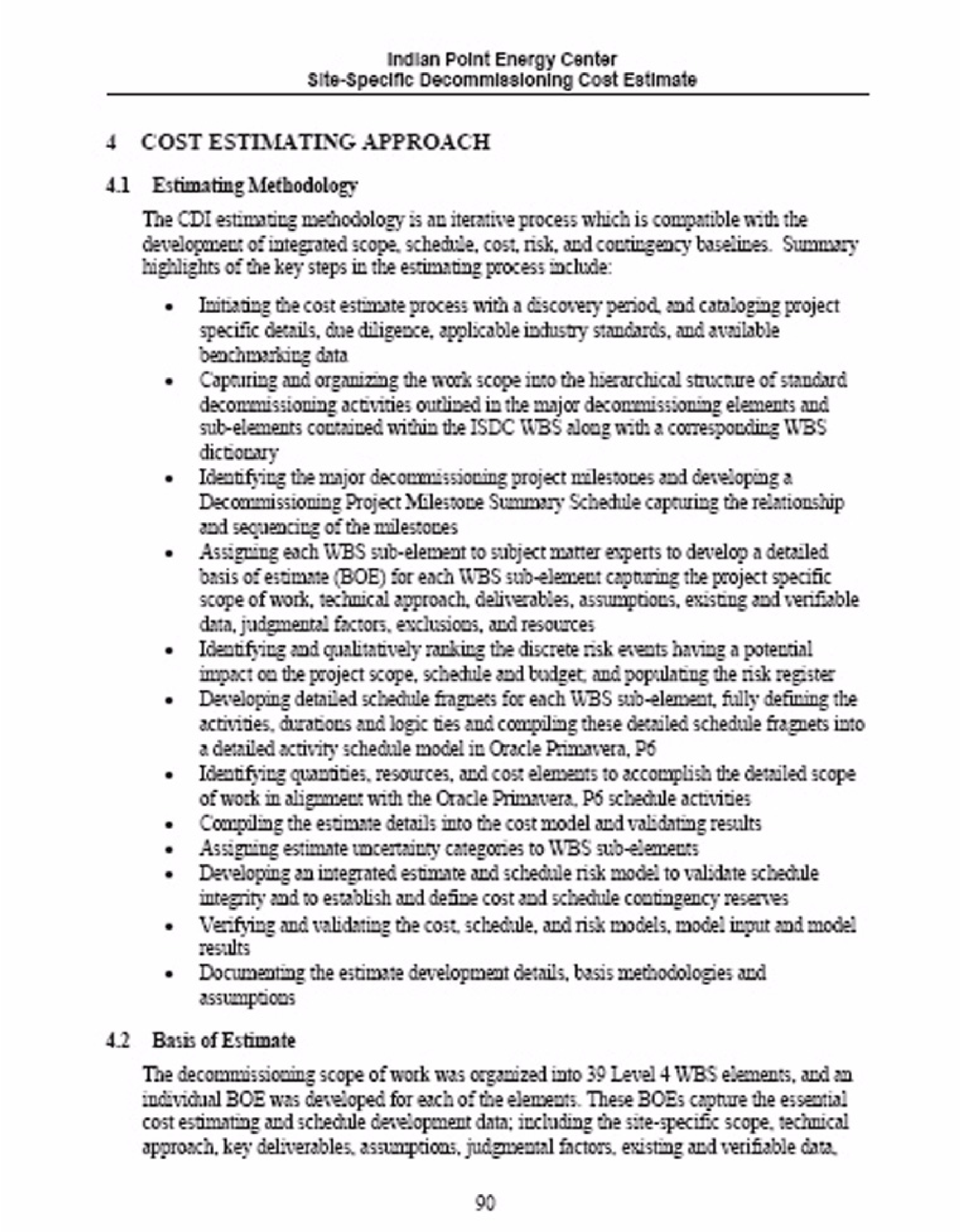
9.13 Analyzing HDI's Claim of $301 Million Dollars Less to Decommission IP2

TABLE A-17 Cumulative Savings at IP2 Based on HDI Data, $ in Thousands

Year	**IP3 With-drawal Rate PSDAR Table 5-1c**	**IP2 With-drawal Rate PSDAR Table 5-1b**	**Annual Savings at To IP2**	**Cumulative Savings, Years 2021-2029 $113,698,000**	**Cumulative Savings, Years 2030-2046 $16,727,000**	**Cumulative Savings, Years 2047-2062 $170,140,000**
2021	110,773	70,024	40,749	40,749		
2022	124,235	105,834	18,401	59,150		
2023	107,740	85,496	22,244	81,394		
2024	85,924	44,113	41,811	123,205		
2025	54,171	43,993	10,178	133,383		
2026	57,084	40,373	16,711	150,094		
2027	48,119	39,697	8,422	158,516		
2028	32,164	55,164	-23,000	135,516		
2029	32,142	53,960	-21,818	113,698		
2030	32,138	15,449	16,689		130,387	
2031	32,138	15,449	16,689		147,076	
2032	31,679	18,646	13,033		160,109	
2033	7,343	9,623	-2,280		157, 827	
2034	3,607	5,990	-2,383		155,444	
2035	3,607	6,000	-2,393		153,053	
2036	3,612	6,014	-2,402		150,651	
2037	3,607	6,000	-2,393		148,258	
2038	3,607	5,990	-2,383		145,875	
2039	3,607	6,000	-2,393		143,482	
2040	3,612	6,005	-2,393		141,089	
2041	3,607	6,000	-2,393		138,696	
2042	3,607	6,000	-2,393		136,303	
2043	3,607	6,000	-2,393		133,910	
2044	3,612	6,005	-2,393		131,517	
2045	3,607	5,990	-2,383		129,124	
2046	4,433	3,152	1,281		130,405	
2047	7,453	894	6,559			136,964

Year	IP3 With-drawal Rate PSDAR Table 5-1c	IP2 With-drawal Rate PSDAR Table 5-1b	Annual Savings at To IP2	Cumulative Savings, Years 2021-2029 $113,698,000	Cumulative Savings, Years 2030-2046 $16,727,000	Cumulative Savings, Years 2047-2062 $170,140,000
2048	11,953	386	11,567			148,551
2049	11,917	386	11,531			160,062
2050	11,927	386	11,541			171,613
2051	11,917	386	11,531			183,144
2052	11,953	386	11,567			194,711
2053	11,927	386	11,541			206,252
2054	11,927	386	11,541			217,793
2055	14,805	3,274	11,531			229,324
2056	14,842	3,285	11,557			240,881
2057	14,826	3,285	11,541			252,422
2058	14,826	3,285	11,541			263,963
2059	14,826	3,285	11,541			275,504
2060	14,842	3,285	11,557			287,061
2061	14,811	3,285	11,526			298,587
2062	4,238	2,270	1,968			300,555

9.14 HDI Cost Estimating Approach



Indian Point Energy Center
Site-Specific Decommissioning Cost Estimate

4 COST ESTIMATING APPROACH

4.1 Estimating Methodology

The CDI estimating methodology is an iterative process which is compatible with the development of integrated scope, schedule, cost, risk, and contingency baselines. Summary highlights of the key steps in the estimating process include:

- Initiating the cost estimate process with a discovery period, and cataloging project specific details, due diligence, applicable industry standards, and available benchmarking data
- Capturing and organizing the work scope into the hierarchical structure of standard decommissioning activities outlined in the major decommissioning elements and sub-elements contained within the ISDC WBS along with a corresponding WBS dictionary
- Identifying the major decommissioning project milestones and developing a Decommissioning Project Milestone Summary Schedule capturing the relationship and sequencing of the milestones
- Assigning each WBS sub-element to subject matter experts to develop a detailed basis of estimate (BOE) for each WBS sub-element capturing the project specific scope of work, technical approach, deliverables, assumptions, existing and verifiable data, judgmental factors, exclusions, and resources
- Identifying and qualitatively ranking the discrete risk events having a potential impact on the project scope, schedule and budget; and populating the risk register
- Developing detailed schedule fragnets for each WBS sub-element, fully defining the activities, durations and logic ties and compiling these detailed schedule fragnets into a detailed activity schedule model in Oracle Primavera, P6
- Identifying quantities, resources, and cost elements to accomplish the detailed scope of work in alignment with the Oracle Primavera, P6 schedule activities
- Compiling the estimate details into the cost model and validating results
- Assigning estimate uncertainty categories to WBS sub-elements
- Developing an integrated estimate and schedule risk model to validate schedule integrity and to establish and define cost and schedule contingency reserves
- Verifying and validating the cost, schedule, and risk models, model input and model results
- Documenting the estimate development details, basis methodologies and assumptions

4.2 Basis of Estimate

The decommissioning scope of work was organized into 39 Level 4 WBS elements, and an individual BOE was developed for each of the elements. These BOEs capture the essential cost estimating and schedule development data; including the site-specific scope, technical approach, key deliverables, assumptions, judgmental factors, existing and verifiable data,

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exclusions, and resources (quantities and pricing). Table 4-1 includes the 39 WBS elements for which the detailed BOEs were developed.

A site-specific detailed WBS and sequence of work was developed based on current plant commodities that will make up the decommissioning waste streams. The sequence of work was used to define the labor, material, equipment, energy resources and durations required for each activity. In the case of major components, individual work sequence activity analyses were performed based on the physical and radiological characteristics of the component, removal method, packaging requirements, modes of transportation and disposal location together with required system dependencies and logic ties.

In the case of structures, small components and equipment such as piping, pumps and tanks, the work durations and cost were calculated based a review of previous IP1, 2 & 3 decommissioning cost analyses, decommissioning experience, estimates from specialty subcontractors, information on the latest technology applicable to decommissioning, and engineering judgment. After the work activity durations were calculated for all distributed cost activities, a detailed schedule was developed. The DCE and schedule were prepared using information collected by HDI and CDI during the due diligence period in addition to the input and professional judgment of experienced SMEs. The schedule accounts for constraints such as spent fuel cooling periods and regulatory reviews.

The DCE and schedule took into consideration regulatory requirements, site conditions, basis of estimate assumptions, LLRW disposal standards, high-level radioactive waste management options, opportunities identified in walkdowns and site restoration requirements. Cost estimates were based on the professional judgment of experienced SMEs, considering the nature of the work, degree of scope definition, availability of quantifiable cost and pricing data, among other factors.

The estimates of costs associated with license termination in NUREG/CR-5884, "Revised Analyses of Decommissioning for the Reference Pressurized-Water Reactor Power Station," (Reference 7) were reviewed in order to evaluate the reasonableness of the CDI estimates. In addition, CDI compared the IP1, 2 & 3 decommissioning cost estimates for license termination, spent fuel management and site restoration activities to costs from similar activities from seven decommissioned pressurized water reactor nuclear power plants.

The estimates include provisions for storage of spent fuel and GTCC wastes at the on-site ISFSI until acceptance by the DOE. Escalation of future decommissioning costs over the remaining decommissioning project life-cycle are excluded.

4.3 Assumptions

Work planning, schedule development and cost estimating for the decommissioning rely on a set of assumptions regarding the type and quality of inputs and the nature of the work.

<u>Pre-Decommissioning Planning</u>

- Entergy has provided reasonable and accurate information in good faith regarding the history and current condition of the plants and site

- No decontamination efforts will be carried out to free release contaminated material
- In determining the waste management strategy and volume estimates, all contaminated material will be characterized as LLRW, or its respective waste classification
- Waste classification for transport will be supported by an initial site waste characterization effort

Facility Shutdown Activities

- All wastes and waste streams generated during decommissioning have a disposition path
- No orphan waste will be generated during decommissioning

Dismantling Activities within the Radiologically Controlled Area

- Local ventilation will be required for most tasks and building ventilation is adequate for these tasks and will not require upgrading or replacement
- The reactor building overhead crane will be available and has adequate lift capacity for casks containing RPV internals, water and the shielding cover
- The turbine building overhead crane has adequate lift capacity for the low-pressure turbines and the generator

Waste Processing, Storage and Disposal

- Transportation of waste offsite will include truck conveyance to rail
- No radioactive waste systems or processing areas will be refurbished or refit for use during decommissioning
- Waste sampling and data verification/validation is accomplished by a subcontractor

Site Infrastructure and Operation

- Existing site security is adequate for transition and CDI decommissioning activities
- The existing Operations and Maintenance (O&M) procedures are available and adequate for all active plant systems
- SMEs are available in the existing work force and a sufficient number will transition to CDI to support decommissioning

Project Management, Engineering, and Support

- The CDI project management team will mobilize to the site during the pre-decommissioning planning phase to be ready to begin decommissioning following the sale and transfer of the facility licenses

Fuel and Nuclear Material

- All plant systems required to carry out the spent fuel to ISFSI pad transfer campaign are operational