NISA INVESTMENT ADVISORS, LLC

2018 NDT Survey

NISA

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INTRODUCTION

NISA Investment Advisors, LLC (NISA) is pleased to present the 16th edition of the biennial Survey of Nuclear Decommissioning Trust (NDT) Sponsors. This report is published as a resource for, and service to, the NDT community. It is intended to provide insight into investment activities and trends within the NDT industry. Information contained herein has many potential uses and a variety of audiences, including trust sponsors, federal and state regulatory bodies, trust custodians, and investment managers.

INDUSTRY HIGHLIGHTS

- The U.S. Nuclear Regulatory Commission (NRC) has issued combined licenses (COL) representing eight new units and is reviewing one COL application for two new units.
- Two new nuclear power plant units are under construction in Georgia.
- There are currently 97 operating nuclear power plant reactors with 32 boiling water reactors (BWRs) and 65 pressurized water reactors (PWRs). There are 80 individual plant owners and 20 plant operators. Investor-owned Utilities (IOUs) represent approximately 80% of operating megawatt capacity.
- The NRC approved 94 units for license renewal, extending plant life from 40 to 60 years, with three more units expected to apply. Many plants are expected to seek a second license renewal (SLR) to extend their license another 20 years. There were three shutdowns since the last survey and another 10 units have announced shutdowns over the next five years, primarily due to market-related pressures.
- Currently, 21 power reactors are in the decommissioning process, including the recently closed Oyster Creek and Pilgrim, with Three Mile Island scheduled to close soon, but not including those that are ISFSI-only or have had their license terminated.

U.S. OPERATING COMMERCIAL NUCLEAR POWER REACTORS

Arkansas Nuclear 1, 2
Beaver Valley 1, 2
Braidwood 1, 2
Browns Ferry 1, 2, 3
Brunswick 1, 2
Byron 1, 2
Callaway
Calvert Cliffs 1, 2
Catawba 1, 2
Clinton
Columbia Generating Station
Comanche Peak 1, 2
Cooper
D.C. Cook 1, 2
Davis-Besse
Diablo Canyon 1, 2
Dresden 2, 3
Duane Arnold
Farley 1, 2
Fermi 2
FitzPatrick
Ginna
Grand Gulf 1
Hatch 1, 2
Hope Creek 1
Indian Point 2, 3
La Salle 1, 2
Limerick 1, 2
McGuire 1, 2
Millstone 2, 3
Monticello
Nine Mile Point 1, 2
North Anna 1, 2
Oconee 1, 2, 3
Palisades
Palo Verde 1, 2, 3
Peach Bottom 2, 3
Perry 1
Point Beach 1, 2
Prairie Island 1, 2
Quad Cities 1, 2
River Bend 1
Robinson 2
Saint Lucie 1, 2
Salem 1, 2
Seabrook 1
Sequoyah 1, 2
Shearon Harris 1
South Texas 1, 2
Summer
Surry 1, 2
Susquehanna 1, 2
Three Mile Island 1
Turkey Point 3, 4
Vogtle 1, 2
Waterford 3
Watts Bar 1, 2
Wolf Creek 1

NUCLEAR DECOMMISSIONING TRUSTS

ESTIMATED ASSETS

The total estimated market value of NDT assets grew to $74 billion, an increase of over $8 billion. Assets held by IOUs grew to over $66 billion and assets held by Public Power Authorities (PPAs), Municipalities, and Cooperatives grew to almost $8 billion. Qualified Trust assets increased more than 10% for the fifth consecutive survey. Non-qualified Trust assets increased in line with Qualified Trusts. The discrepancy in asset changes was due to variations in asset allocation within each trust type, costs associated with various plant shutdowns, previously returned and unreturned surveys, as well as contributions.

Information as of December 31, 2018 was requested from IOUs and several PPAs. Surveys were sent to owners/operators of nuclear plants. Twenty three sponsors completed surveys, representing over 75% of total IOU megawatt capacity and 69% of total megawatt capacity. Unless otherwise noted, averages are calculated based on the number of responses.

EXPECTED CONTRIBUTIONS

Total expected contributions continued their longer-term trend of declining in this survey. Three sponsors had cumulative estimated contributions totaling approximately $320 million in 2017, those three combined for projected contributions of only $42 million in 2019. Projected 2019 contributions are $173 million, with $164 million allocated to Qualified Trusts and only $9 million to Non-qualified and Non-taxable Trusts. While only two Public Power respondents indicated projected contributions in 2019, NRC filing data shows one sponsor (who did not respond to the survey) currently undergoing decommissioning with estimated contributions near $150 million per year over the next several years.

ESTIMATED DECOMMISSIONING COSTS

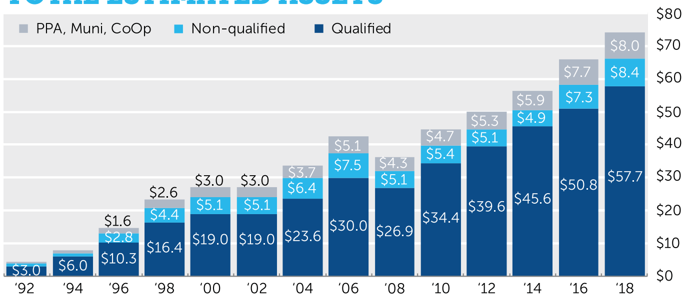
Based on survey responses, the total IOU and PPA 2018 estimated decommissioning costs were $100 billion. The 2018 decommissioning estimate increased 9.2% from the 2016 survey, a similar percentage increase as the prior two surveys. The annualized cost escalation rate for the 22-year period from 1996 to 2018 was approximately 3.8%.

The estimated costs shown below represent the greater of NRC-filing or site-specific costs provided by respondents. Based on individual survey responses, NRC costs were, on average, approximately 60% of site-specific costs, no change from the prior survey.

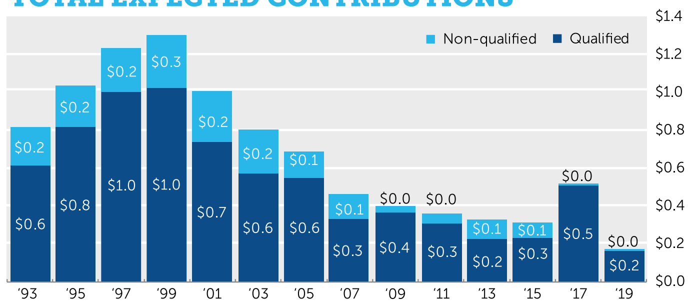
NRC FILING DATA

Selected asset and cost data from publicly available decommissioning financial assurance filings, as of December 31, 2018, were compared to survey data as a reasonableness check. Survey and NRC differences appear to result primarily from assets and costs attributable to non-radiological decommissioning, spent fuel storage, and site-specific vs. CFR 50.75 methodologies as well as a high ratio of assets to megawatt capacity for a number of the PPAs not included in the survey results. The data in the table below were estimated based on NRC filings.

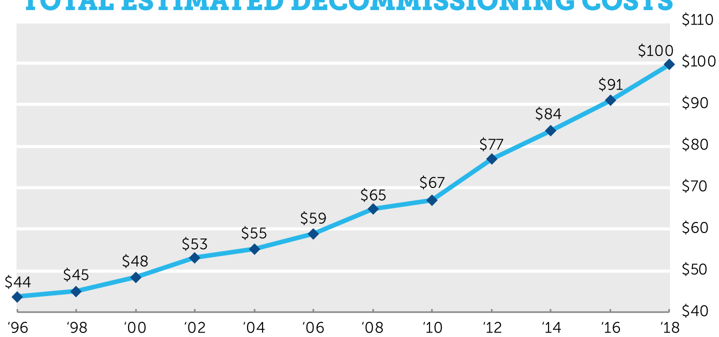
TOTAL ESTIMATED ASSETS[1]



TOTAL EXPECTED CONTRIBUTIONS[1]



TOTAL ESTIMATED DECOMMISSIONING COSTS[1]



	NRC[1] Cost	NRC[1] Assets
OPERATIONAL		
Investor-owned Utilities	$49.4	$50.7[2]
Non-investor-owned Utilities	$11.2	$9.0
TOTAL	**$60.6**	**$59.7**

Approximately 60% of respondents with Qualified Trusts indicated continued contributions to that Trust, with the majority of contributions being under $10 million per year.

[1] $ billions.
[2] After-tax.

QUALIFIED NDT

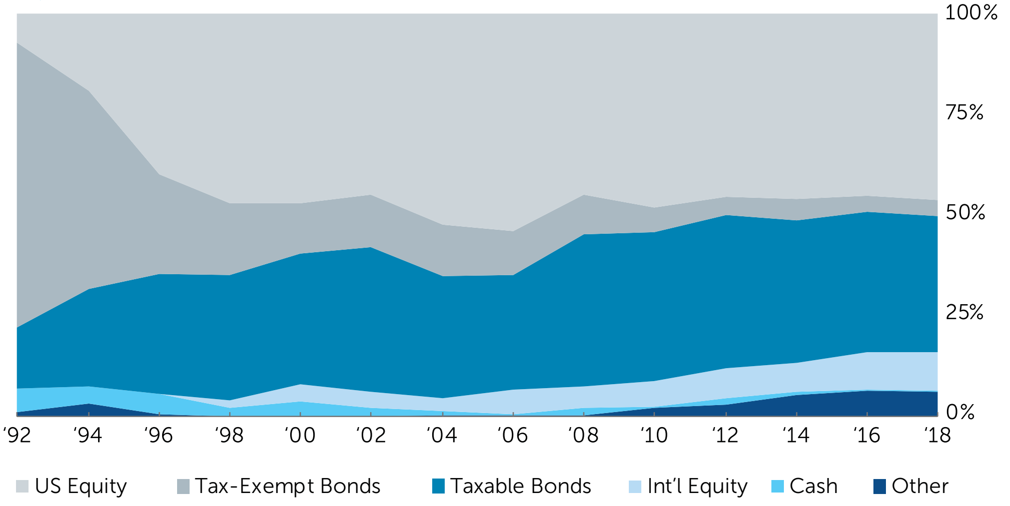
HISTORICAL ASSET ALLOCATION

Despite several significant equity market movements, a record-long economic expansion and periods of high volatility over the past 20 years, asset allocations have remained fairly constant. The average Qualified Trust equity allocation remained at 56% in 2018. The Other category declined for the first time since resurfacing in 2006, (primarily hedge funds, private equity and debt, and real estate), and fell to under 4% of total Qualified Trust assets. About 30% of sponsors indicated a target allocation to alternative asset strategies; the average target allocation of those sponsors is just under 15%. Taxable fixed income allocations rose for the first time in a decade, increasing 3% to 39% of Qualified Trust Assets.

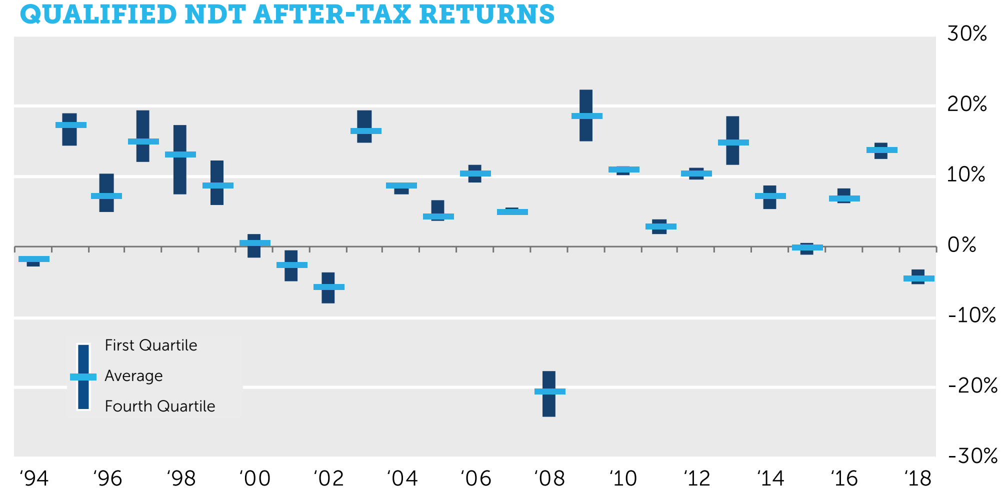
HISTORICAL AFTER-TAX RETURNS

Qualified Trust average performance posted double-digit returns in 2017, then followed that by having a negative return for only the second time in 16 years during 2018. The average trust return has been flat or positive for 20 of the 25 years shown in the graph. The average annual after-tax return for the 25-year period was 6.3%.

QUALIFIED NDT AVERAGE TRUST ALLOCATIONS



QUALIFIED NDT AFTER-TAX RETURNS



NON-QUALIFIED NDT

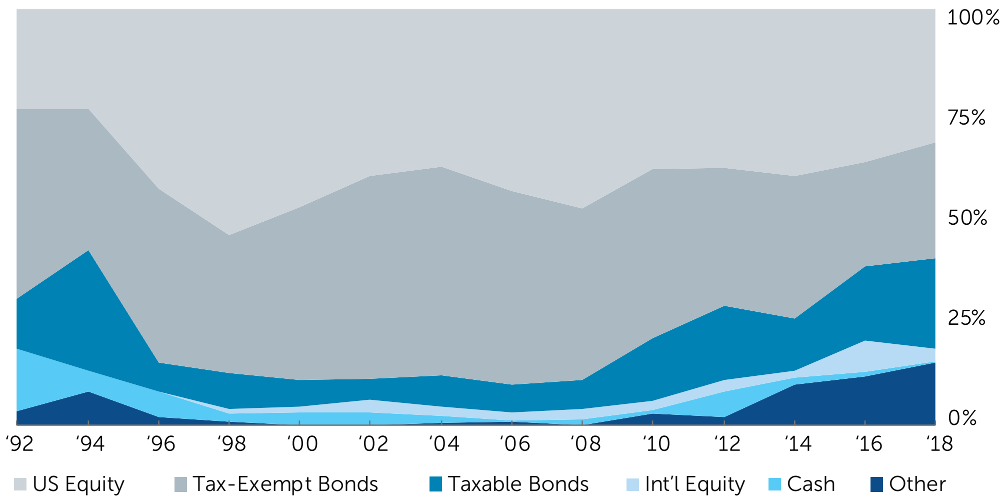
HISTORICAL ASSET ALLOCATION

Non-qualified Trust assets remained near 10% of total NDT assets in 2018. Of the respondents, 12 sponsors reported having Non-qualified Trust assets. Several Non-qualified Trusts have 100% allocations to a specific asset class. The Other category remained outsized when compared to Qualified Trusts or PPA asset allocations due to one sponsor holding the majority of their Non-qualified assets in private equity and private debt. Public equity dropped to its lowest allocation since 1994, at 35%. Despite the drop in federal corporate tax rates, the allocation to municipal bonds actually increased since the previous survey.

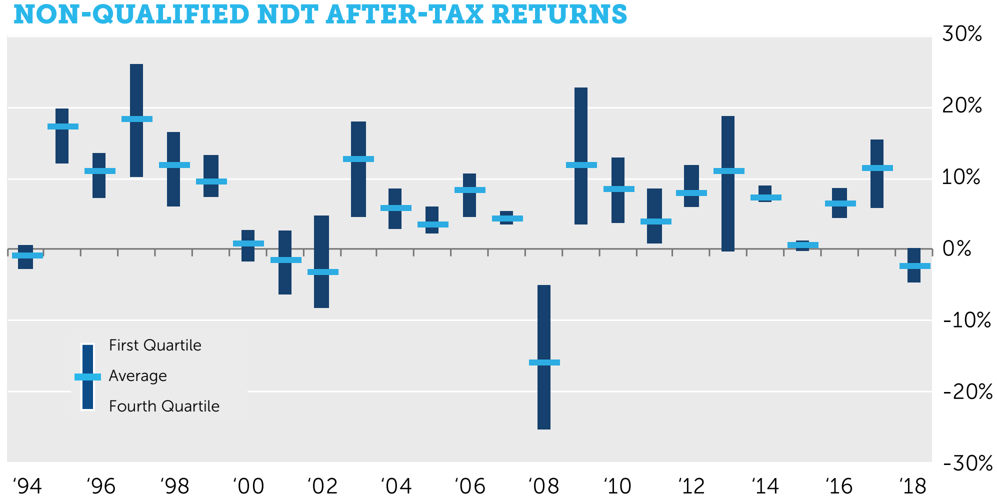
HISTORICAL AFTER-TAX RETURNS

The average Non-qualified Trust after-tax total return for the two-year period since the last survey was 8.9%. The pre-tax total returns of the S&P 500 Index and Bloomberg Barclays Full Municipal Bond Index over the same period were 16.5% and 6.8%, respectively. The average annualized after-tax return for the 25 years displayed was 6.0%, which compares favorably with the after-tax return assumptions for the same period.

NON-QUALIFIED NDT AVERAGE TRUST ALLOCATIONS



NON-QUALIFIED NDT AFTER-TAX RETURNS



TOTAL NDT

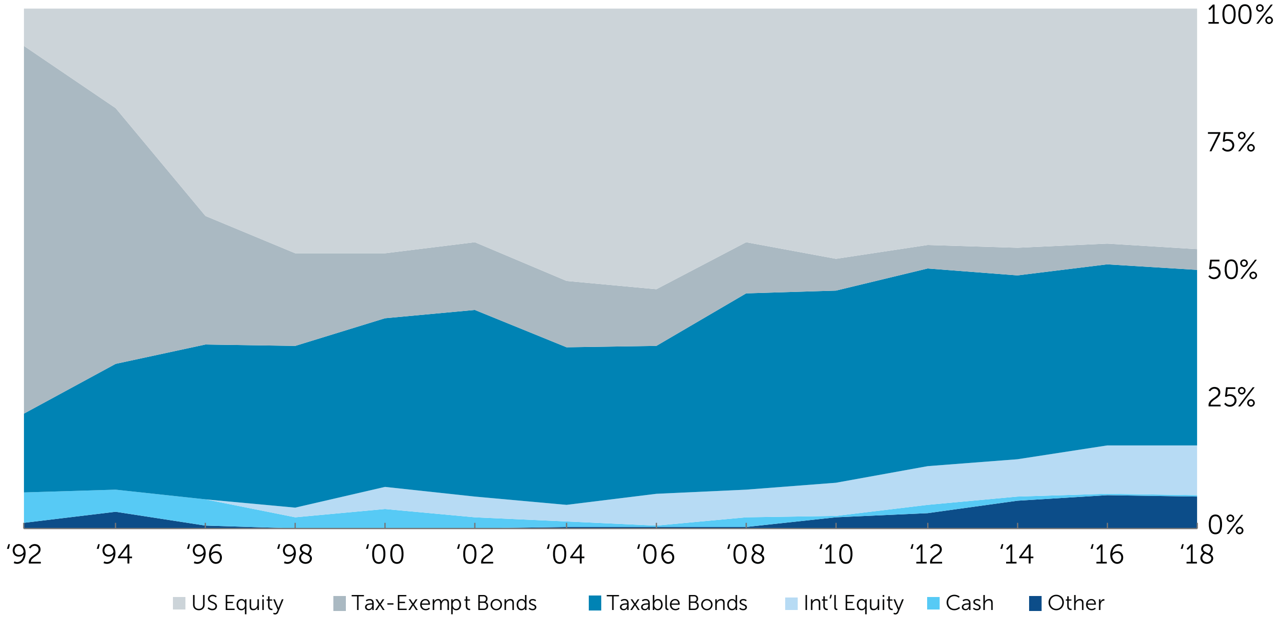
HISTORICAL ASSET ALLOCATION

The graph below shows average actual allocations to major asset classes since 1992. Overall, asset allocations remained steady once again from the prior survey. In fact, only two of the shown asset allocations moved at all, with taxable bonds decreasing by 1% and domestic equity increasing by 1%. All other asset allocations moved less than 1% in the two years ending December 31, 2018.

The overall target allocation for equity increased by 3% to near 60% and the fixed income target allocation dropped 2% to 38% in 2018, not far off from their actual allocations.

Approximately 1/3 of respondents indicated an allocation to alternative asset strategies resulting in the 6% allocation to the Other asset class. For those that targeted an allocation to alternatives, the average was 14%, with a maximum target of 20% and a minimum target of 1%.

AVERAGE TRUST ALLOCATIONS



Sponsors remain satisfied with their current asset class lineup. Only 30% of sponsors indicated other asset classes were being considered that were not currently being utilized. International equity and real estate led the choices, with three sponsors each. No sponsors cited they were considering MLPs, international fixed income, ARS, or domestic small/ micro-cap equity if not currently in their asset lineup.

ASSET ALLOCATIONS

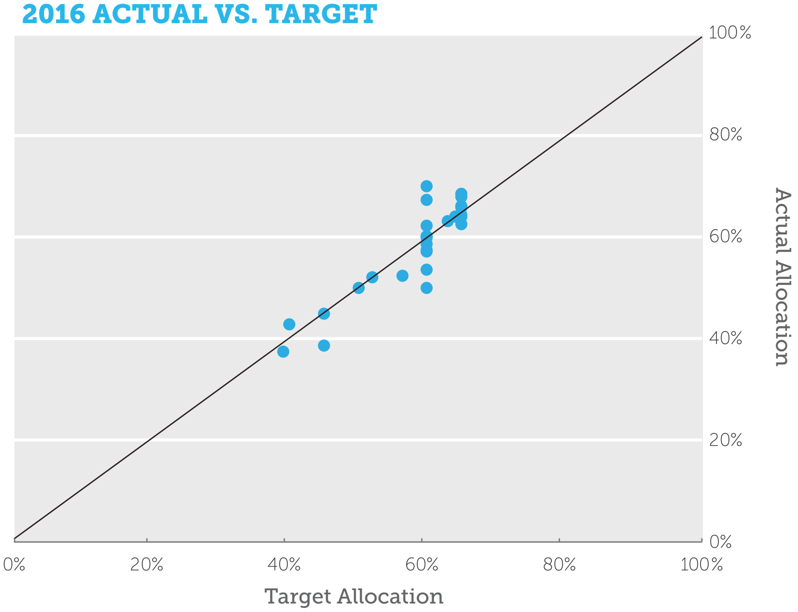
EQUITY ALLOCATIONS

The chart below shows each trust's actual equity allocation relative to its target allocation for December 31, 2018. Observations below the diagonal reflect equity allocations which are below their targets, while those above the diagonal reflect allocations above their targets.

NDT VS. DEFINED BENEFIT

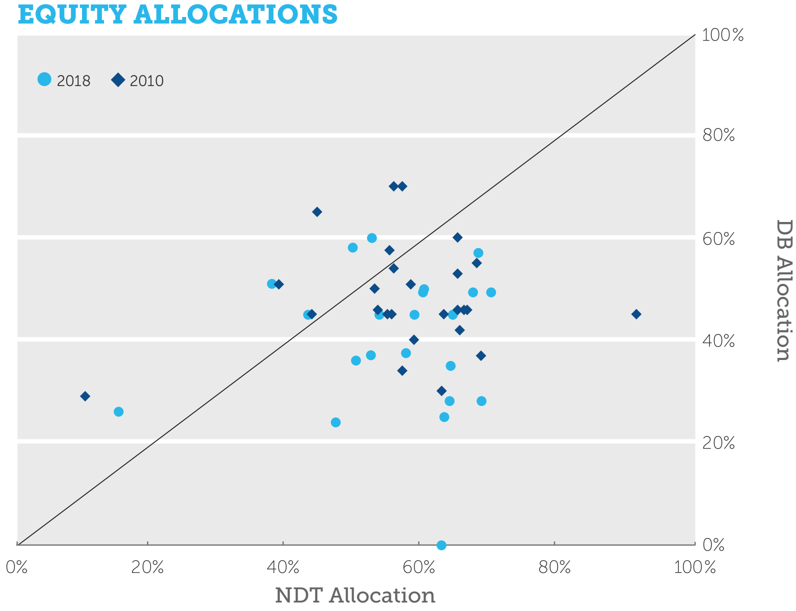
The chart below shows the relationship of each sponsor's NDT equity allocation relative to its Defined Benefit (DB) equity allocation. Observations above the diagonal indicate a larger equity allocation in the DB plan relative to the NDT. Survey responses indicated that the average NDT had a 17% larger allocation to the U.S. equity asset class than did the average DB plan. The shift in DB equity assets has primarily occurred over the past eight years. The overwhelming majority of DB fixed income assets were in longer duration strategies, while no sponsors indicated an allocation to long duration fixed income strategies in their NDTs. DBs also indicated an almost 20% targeted allocation to the Other category.

2016 ACTUAL VS. TARGET



For the 2018 survey, the average actual equity allocation was within 2% of the target equity allocation for the fifth consecutive survey.

EQUITY ALLOCATIONS



Based on survey responses, the average overweight was +3% and the average underweight was -3%. One standard deviation around the mean was under 4%.

EQUITY

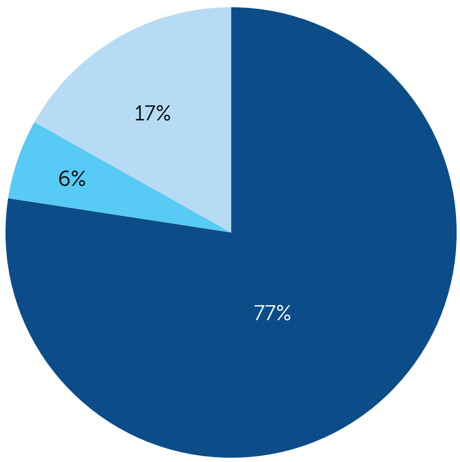
STYLE ALLOCATIONS

The estimated total equity allocation was $32.3 billion for Qualified Trusts, $2.9 billion for Non-qualified Trusts, and $4.8 billion for PPAs, Municipalities, and Cooperatives. Outside of the last survey, large cap equity styles in Non-qualified Trusts dominated the overall equity allocation, potentially due to the divided-received-deduction (DRD). That trend reverted back to the norm in the 2018 survey. International equity allocations remained relatively stable in Qualified Trusts and PPAs/Cooperatives while plummeting in Non-qualified Trusts. The S&P 500, S&P 400, S&P 600, and MSCI All World-Ex U.S. (USD) had total returns, as reported by the index providers, of 16.5%, 3.3%, 3.5%, and 9.1%, respectively, for the two-year period ending December 31, 2018.

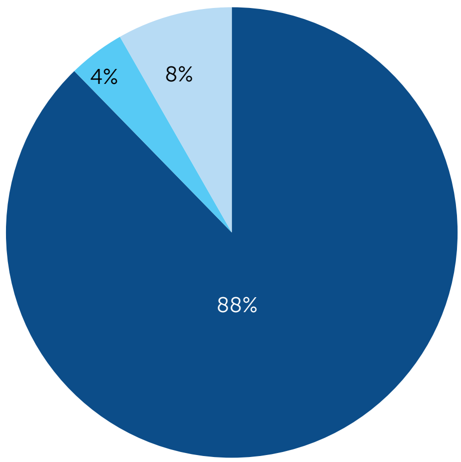
MAXIMUM ALLOCATIONS

The average maximum equity allocation remained at 69% in 2018 when compared to the last survey, but is still down from 74% a decade ago. The average actual equity allocation was approximately 13% below the average maximum allowed. A number of respondents were nearing their maximum equity allocation, while three respondents exceeded the maximum.

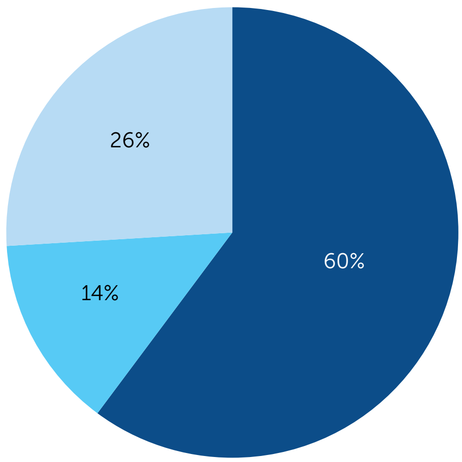
2018 QUALIFIED TRUSTS



2018 NON-QUALIFIED TRUSTS

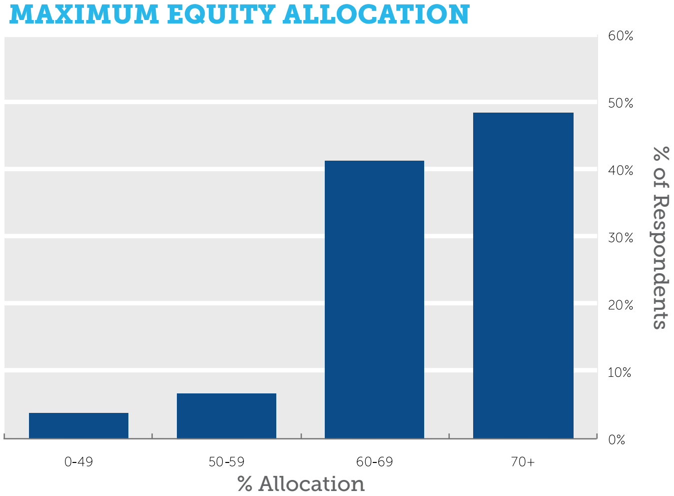


2018 PPAS/CO-OPS

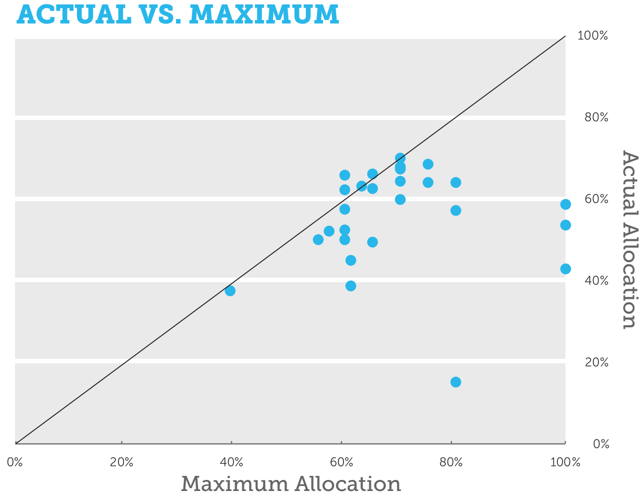


Large Cap   Mid/Small Cap   International

MAXIMUM EQUITY ALLOCATION



ACTUAL VS. MAXIMUM



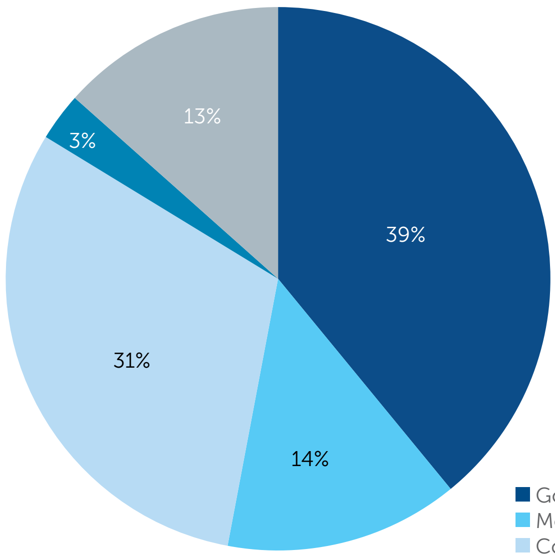
FIXED INCOME

SECTOR ALLOCATIONS

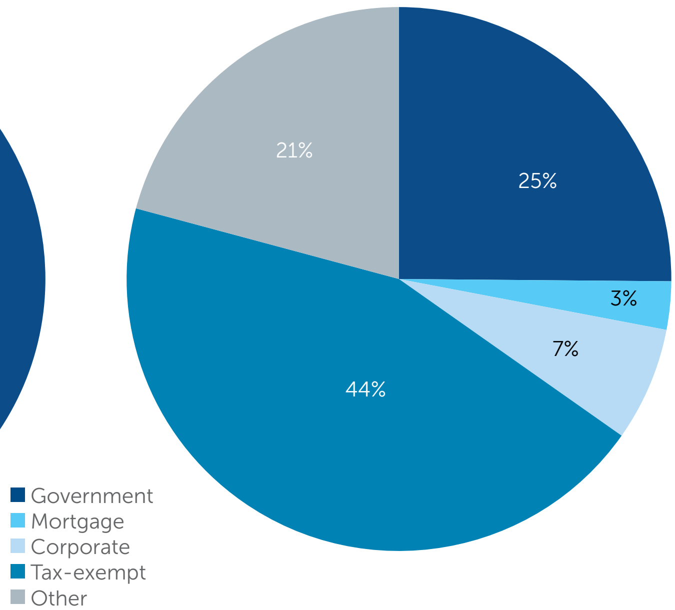
The estimated total fixed income allocation was $23.2 billion for Qualified Trusts, $5.2 billion for Non-qualified Trusts, and $2.6 billion for PPAs, Municipalities, and Cooperatives.

Tax-exempt bonds remain the largest fixed income asset class in Non-qualified Trusts, however their share has declined significantly over the years due to an increase in government bonds and private credit/debt. The Other category, which primarily consists of private credit/debt, rose to over 20% of Non-qualified fixed income for the first time in survey history. PPA Trusts remained primarily a mix of Credit and Government securities. All Trust sector allocations in the chart below reflect the mix of fixed income benchmarks (Aggregate, Government/Credit, etc.).

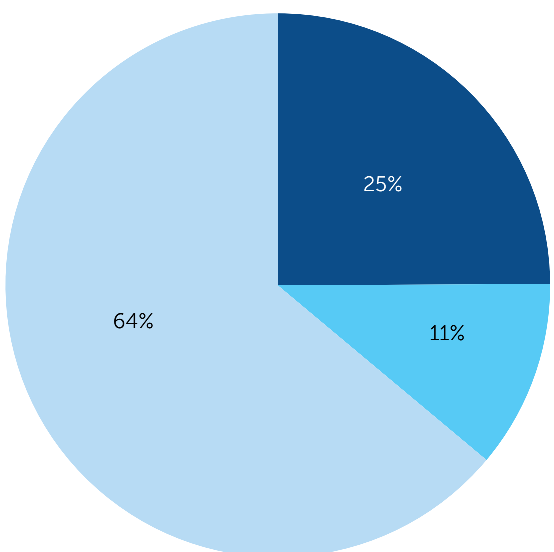
2018 QUALIFIED TRUSTS



2018 NON-QUALIFIED TRUSTS



2018 PPAs/CO-OPs



Despite the increase in the Other category, only one respondent indicated it was considering emerging market, international, or high-yield debt that is not currently utilizing any of the three.

ASSET RETURN ASSUMPTIONS

AFTER-TAX RETURN ASSUMPTIONS: QUALIFIED TRUST

The Qualified Trust average after-tax return assumption dropped again to its lowest level in survey history, well below peak levels of the late 1990's. This is likely due to interest rates remaining at historical lows and tapered expectations of a continued equity run. Based on each respondent's target asset allocations and expected returns for each asset class, the median after-tax return assumption was 4.8% and the average after-tax return assumption was 5.0%.

AFTER-TAX RETURN ASSUMPTIONS: NON-QUALIFIED TRUST

The Non-qualified Trust average after-tax return assumption fell along with its Qualified counterpart, hitting levels last seen in 2014. Based on each respondent's target asset allocations and expected return for each asset class, the median after-tax return assumption was 5.4% and average after-tax return assumption was 4.8%. Non-qualified and Qualified Trust average after-tax return expectations are now much more in line than in prior surveys. This is likely due to the current similar federal tax rates on both Qualified and Non-qualified Trusts.

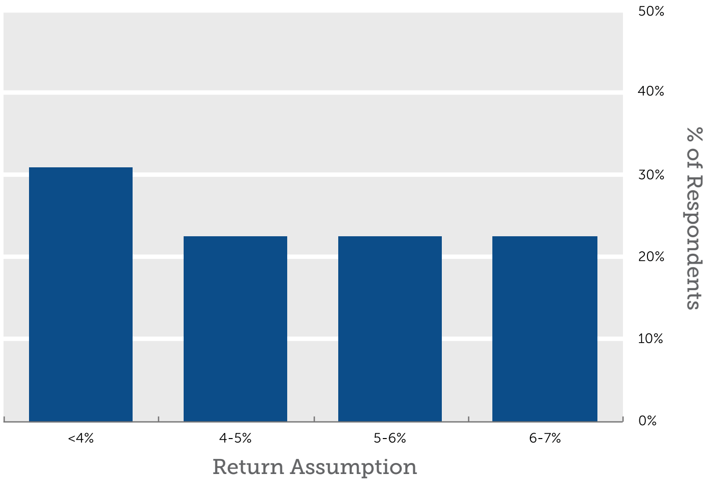
COST INFLATION ASSUMPTIONS

Inflation assumptions have a prevailing influence on estimating decommissioning liabilities and determining implied after-tax real rates of return. The average composite cost inflation assumption decreased by 20 basis points from the 2016 survey to an all-time survey low. 65% of respondents now have a cost inflation estimate less than 3% compared to less than 40% in the 2016 survey. Cost Inflation estimates have averaged approximately 100 basis points over CPI forecasts over the past six surveys. Estimates ranged from 2.0% to 5.9%.

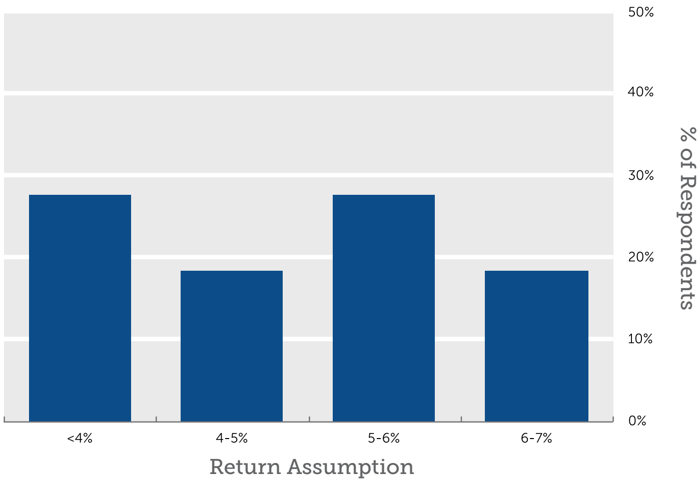
IMPLIED AFTER-TAX REAL RETURN ASSUMPTIONS

Implied after-tax real return assumptions were calculated based on each respondent's after-tax return and cost inflation assumptions. Qualified Trust implied after-tax return assumptions dropped below 2% for the first time since 2002 and Non-qualified Trust implied after-tax return assumptions decreased, albeit slightly, despite the drop in the federal tax rate. The horizontal line at 2% represents the allowable real return assumption permitted in 10 CFR §50.75 (e) (1) (ii). Weighting the 2016 Qualified, Non-qualified, and PPA Trusts' implied after-tax returns by their market values as shown on page 4 yields a total NDT average implied after-tax real return of 2.1%.

AFTER-TAX RETURN ASSUMPTIONS: QUALIFIED TRUST

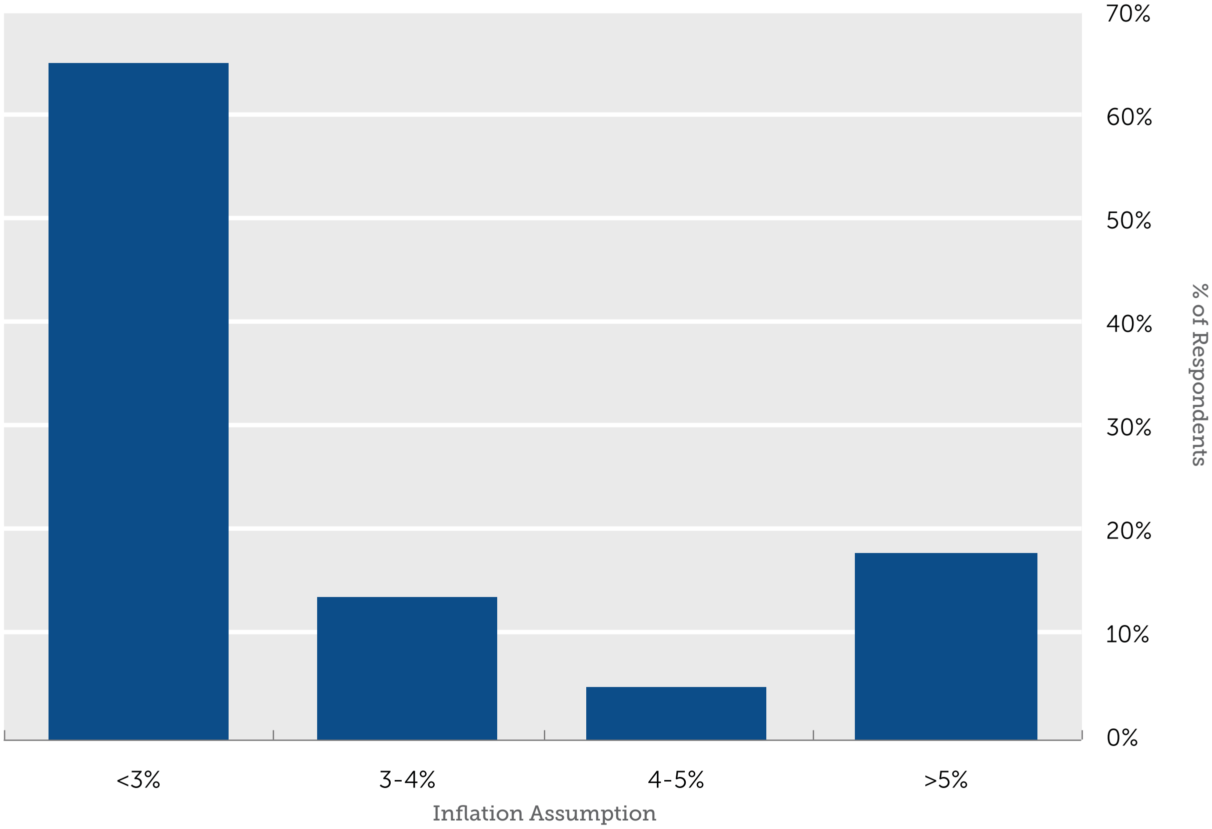


AFTER-TAX RETURN ASSUMPTIONS: NON-QUALIFIED TRUST

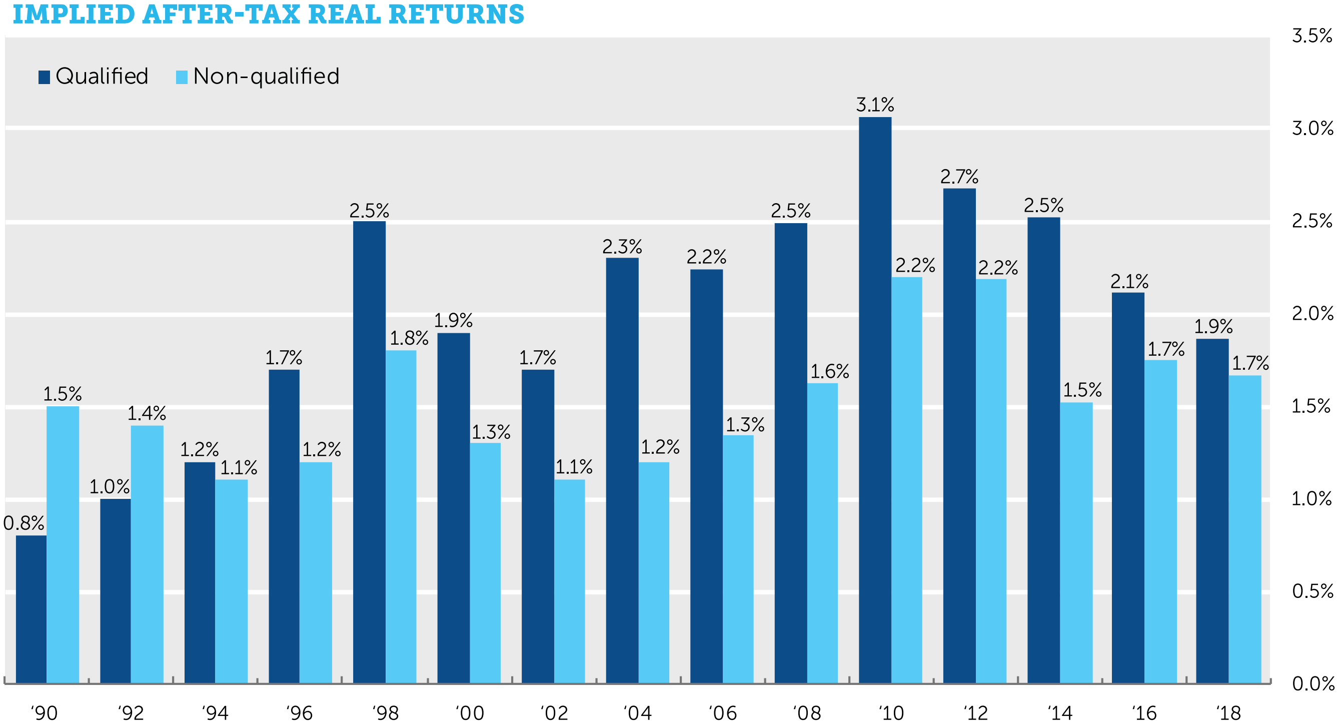


PPAs had an implied real return of 2.5% in 2018, up 20 basis points from the prior survey.

COST INFLATION ASSUMPTIONS



IMPLIED AFTER-TAX REAL RETURNS



NDT MANAGEMENT

A new question was posed to survey participants starting in 2014 that focused on risks to decommissioning funding adequacy going forward. All options again received numerous votes and some consistency has developed over the three surveys for each response. Many respondents marked multiple risks; the overall percentage for each option can be seen below. Three fourths of respondents see cost increases outpacing investment returns as a major issue and those that selected Other cited early shutdowns for economic reasons and insufficient funds due to the early shutdown.

One thing we attempted to extract from this round of surveys is a breakdown of asset values and allocations relative to remaining plant life and, furthermore, asset allocation depending on the decommissioning method chosen. While the majority of multi-unit and multi-site survey responses were returned aggregated as one survey, we were able to make the following observations:

- A number of sponsors with near-term planned plant shutdowns or early shutdowns with immediate costs have shortened the duration of a significant portion of their assets and have dialed down the equity risk in the total Trust, sometimes using derivatives.
- Despite the long duration of the decommissioning liability for the majority of operating plants, long duration fixed income remains virtually non-existent in plan sponsors asset allocations.
- Plants that have announced shutdown in the next decade are approximately 110% funded relative to the NRC 50.75 formula and approximately 60% funded based on their site specific studies.

Alternative/Absolute Return Strategies (ARS) are not being considered at this time by the majority of respondents. Of those respondents who are considering or have used ARS, private equity, hedge funds and real estate are the most popular asset classes, for the second consecutive survey. Return diversification remains a primary motivation for asset allocation policy changes.

While overall not looking at new asset classes, sponsors are making attempts to enhance returns within their current suite of assets. For instance, a number of sponsors lowered the quality constraint restrictions on individual issues and/or the total portfolio (e.g., AA to A). Also, the average maximum allocation for each asset class (equity, fixed income, and other) increased from the prior survey.

Rebalancing activity remains robust across trust sponsors for myriad reasons. More than half of respondents indicated they rebalanced the asset allocation in the past two years, with the majority of those citing it was an internally-driven decision as opposed to investment committee or regulatory driven. That number is actually down from the prior survey, likely due to equity returns in this surveys' time period lagging those of the prior survey. Some sponsors dialed down risk (equity allocations) due to pending early shutdowns or near-term funding needs. On the other hand, a number of sponsors cited revised risk parameters and made allocation changes in order to boost projected returns. Diversification remained the overall primary objective for revising asset allocations, as it was in the prior two surveys.

NDT/DB – When viewed from either the asset or liability side, NDTs, on average, are approximately half the size of DB plans for IOUs. Given the typical long term nature of both NDTs and DBs, one might surmise that similar allocations may be warranted. This remains far from the case. The average DB invests across a broader spectrum of investments and focuses on longer duration fixed income while the average NDT remains in a more traditional asset mix. For instance, sponsors reported a 30% allocation to long duration fixed income and a 19% allocation to the Other asset class in their DB plans while those numbers were 0% and 6% respectively in NDTs. There are many potential explanations for this including taxes, regulatory restrictions, the method of viewing the liability, and separate investment committees, among others.

	REGULATORY ISSUES	SPENT FUEL DISPOSAL	LOW-LEVEL RADIOACTIVE WASTE DISPOSAL	COST INCREASES OUTPACING INVESTMENT RETURNS	A "BLACK SWAN" EVENT	OTHER
2014	35%	54%	23%	69%	38%	8%
2016	50%	46%	19%	88%	38%	12%
2018	35%	58%	19%	74%	19%	6%

NISA'S NDT TEAM

NISA is a 100% employee-owned investment management firm based in St. Louis, Missouri. NISA has $211 billion* in physical assets under management for 209 clients including NDTs, defined benefit plans, defined contribution plans, and other institutional investors. NISA has managed assets for NDT clients since its inception in 1994 and is currently one of the largest NDT asset managers in the United States with $14 billion* in NDT assets under management for 14 utilities. NDT assets represent 82% of NISA's taxable assets under management.

NISA manages all portfolios with a team approach. A team of senior investment professionals services the NDT portfolios, supported by a staff of investment professionals. The Investment Committee (Jess Yawitz, Ken Lester, Joe Murphy, David Eichhorn, Daniel Scholz, Biswajit Bhattacharya, and Anthony Pope) has the primary responsibility for the overall NDT investment strategy.

Please contact Rusty Groth if you would like additional copies of this report or more information regarding NDT management services. This survey and prior year surveys are available at www.nisa.com.

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*As of June 30, 2019.

Thank you to our NDT sponsors for their participation in this survey.

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