Insurance Appraisals & Replacement Cost New Development

Clayton T. Baumann, PE, CCP, ASA
Principal – evcValuation LLC

David F. Chavenson
VP Business Development – evcValuation LLC

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Overview

- Importance of Current and Accurate Insurance Appraisals
- Insurance Appraisal Process
- Detailed Replacement Cost New Example – Complex Refinery
- Renewables & Wind Farm RCN Considerations
- Takeaways and Reoccurring Issues
- How to Identify Qualified Appraisers

Importance of Current and Accurate Appraisals

- Many insureds simply do not understand their values and frequently are underinsured
  - In 2017 a record number of catastrophic weather events occurred in the U.S. and across the globe resulting in an estimated $330 billion in related losses, of which 60% were estimated to be uninsured.[1]
  - Per a study by Marshall & Swift, it is estimated that 75% of commercial businesses are underinsured by 40% or more.[2]

[1] Michelle Kerr, "The Growing Insurance Gap Is A Serious Threat to Us All," *Risk and Insurance*, April 9, 2018, https://riskandinsurance.com/critical-coverage-gap/

[2] "Keeping insurance values up to date," *The Travelers Indemnity Company* (2013). https://www.travelers.com/iw-documents/business-insurance/national-property-ITV-CP-6487.pdf

Importance of Current and Accurate Appraisals (cont.)

- Risk associated with inaccurate insurable values
  - Insureds could carry too much insurance and pay unnecessary premiums
  - Insureds could carry too little insurance and expose them to significant financial risk if a limits loss occurs
  - Large and limit losses unfortunately do occur with some regularity
    - Willis Towers Watson Energy Market Review
    - Allianz Global Claims Report
  - Recent issues we see revolve around regional cost disparities, tariff impacts, and technological changes

Importance of Current and Accurate Appraisals (cont.)

- Frequent updates may be required
  - Insureds must be aware of changes in material and construction costs in their area to determine the need for a current insurance appraisal
  - In times of highly volatile material and construction costs annual updates may be needed
  - In times of stagnant material and construction cost it may be acceptable to obtain an update every 2 to 3 years
  - Technological changes can drive the need for an update

Insurance Appraisal Process

- Determine Scope
- Request for Information
- Site Inspection
- RCN Analysis
- Report Development

Appraisal Process – Determining Scope

- What are the actual assets to be appraised?
  - Identify any assets not owned or leased to be excluded
  - Identify typical exclusions of owned assets per the policy
    - Demolition, debris removal, excavation, filling
    - Foundations and other below grade assets
    - Indirect costs during construction including interest, insurance, and property taxes
    - Land
    - Intangible assets and working capital
    - Licensed vehicles
    - Consumable supplies
    - Chemicals, raw materials, and/or finished product inventories
    - Spare parts
    - Company records

Appraisal Process – Determining Scope (cont.)

- What is the definition of value to be employed?

  - Replacement Cost New ("RCN")

    Considered to be synonymous with reproduction cost new for insurance purposes, defined as "*the cost of reproducing a new replica of a property on the basis of current prices with the same or closely similar materials, as of a specific date*." [1]

  - Actual Cash Value ("ACV")

    "*the cost to repair or replace the damaged property with materials of like kind and quality, less depreciation of the damaged property*." [2]

[1] American Society of Appraisers, *Valuing Machinery and Equipment: The Fundamentals of Appraising Machinery and Technical Assets*, 3rd edition (2011), 506.
[2] Ibid., 505.

Appraisal Process – Determining Scope (cont.)

- What is the reporting requirement?
  - Level of detail in narrative report
  - Required schedules and level of detail
    - Minimum dollar threshold for asset breakout?
    - Major M&E only?
    - Breakout of individual buildings, tanks, etc. ?

Appraisal Process – Request for Information

- Current statements of insurable values
- Machinery and equipment lists
- Electrical one-line diagrams
- Process and instrumentation diagrams (“P&ID”)
- Plot plans
- Building and structural drawings
- Fixed asset listings
- Recent cost records for capital upgrades
- Construction cost quotes from vendors and OEMs

Appraisal Process – Site Inspection

- Ideally completed once bulk of information is received
- Verify assets in place, locations, and accuracy of diagrams and drawings
- Verify manufacturer, ratings, and capacities of major M&E
- Verify construction quality and dimensions of major buildings and structures
- Conduct discussions with engineering, operations, and maintenance personnel
- Take pictures for future reference

Appraisal Process – RCN Analysis

- What is the appropriate replacement of the subject assets?
  - Material, technology, configuration?
  - Are the same or similar materials and M&E still manufactured ?
  - Is it physically possible to install more modern functionally equivalent assets at the site?
  - Are there new or near new assets available on the secondary market?

Appraisal Process – RCN Analysis (cont.)

- Real World Example
  - Subject facility
    - Natural gas-fired 2 x 1 CCGT Plant, 553 MW
    - Located in Georgia, built in 2003
    - GE 7FA.03 combustion turbine ("CT") technology
    - GE D-11 steam turbine ("ST") technology
  - What is the likely replacement technology and configuration?
  - Verified through industry engineers that GE 7FA.03 CT and D-11 ST were no longer mass produced by GE as of late 2018
  - Most current equivalent technologies – CT: GE 7FA.05 ; ST: GE STF-D series
  - Possible to replace with older GE 7FA.03 CT and D-11 ST technology?

Appraisal Process – RCN Analysis (cont.)

- Real World Example (cont.)
  - Verified with turbine brokers that new GE 7FA.03 CTs and GE D-11 STs existed on the secondary market
  - Utilized information from brokers and several other cost sources to develop RCN
  - Clients current policy had an RCN that was 17% ($87MM) lower!!

Description	Base Replacement Cost New ($)	Exclusions ($)	Replacement Cost New Net of Exclusions ($)
Unit 1 Combustion Turbine, Generator, and Accessories	129,776,676	441,241	129,335,435
Unit 2 Combustion Turbine, Generator, and Accessories	129,776,676	441,241	129,335,435
Steam Turbine, Generator, and Accessories	70,087,552	1,317,646	68,769,906
Unit 1 Heat Recovery Steam Generator, Ducting, and Stack	36,347,873	537,949	35,809,924
Unit 2 Heat Recovery Steam Generator, Ducting, and Stack	36,347,873	537,949	35,809,924
Cooling Tower and Circulating Water System	18,236,329	723,982	17,512,347
Accessory Electrical Equipment	45,533,212	6,356,436	39,176,776
Instrumentation and Controls	14,885,762	455,504	14,430,258
Feedwater and Water Treatment Systems	12,255,658	2,530,793	9,724,865
Fuel Handling Equipment	10,938,746	6,627,786	4,310,960
Chemical Feed and Storage Systems	1,213,283	-	1,213,283
General Plant Equipment	1,340,015	-	1,340,015
Buildings, Structures, and Site Improvements	26,089,943	5,231,034	20,858,909
Plant Total	**532,829,598**	**25,201,561**	**507,628,037**

Notes:

(a) Exclusions shown represent common assets, site work, and certain below grade assets.

Appraisal Process – RCN Analysis (cont.)

- Sources of Cost Information
  - *IHS* (formerly *SRI*) Process Economics Program ("PEP")
  - *Richardson Cost Engineering* Manuals
  - *Hydrocarbon Processing*
  - *Oil and Gas Journal*
  - *Compass International* Estimating Yearbooks
  - *RSMeans* Cost Manuals
  - *Nelson-Farrar* Cost Indexes
  - Commercial Databases (Turner, Mason & Company, Baker & O'Brien, Solomon Associates)
  - *Engineering News Record*
  - *Marshal & Swift*
  - Industry specific textbooks
  - *Gas Turbine World*
  - Government sources (EIA, DOE studies)
  - Manufacturer, broker, & vendor quotes
  - Client cost records
  - Asset Listings
  - Industry contractors (Burns McDonnell, Black & Veatch, etc.)

Appraisal Process – RCN Analysis (cont.)

- RCN Methodologies
  - Cost-to-Capacity Method
  - Process Cost Function Methods (Refineries)
  - Complexity Factor Method (Refineries)
  - Trending Method
  - Quantity Survey/Direct Cost Method

Appraisal Process – Report Development

- Issue initial draft report to client of record
- Work through questions and comments
- Issue additional drafts at request of client
- Issue final report

RCN Example – Complex Refinery

- 225,000 BPSD Refinery
- Gulf Coast, PADD 3
- Processes lighter, sweeter crude (Average API 38.0, 0.65% sulfur)

Process Unit Description	Capacity	Complexity Factor [(a)]	Equivalent Distillation Capacity ("EDC")
	BPSD		
Atmospheric Crude Distillation	225,000	1.0	225,000
Vacuum Distillation	71,500	2.0	143,000
Thermal Operations (Delayed Coking)	30,000	6.0	180,000
Fluid Catalytic Cracker ("FCC")	55,000	6.0	330,000
Catalytic Reforming	80,500	5.0	402,500
Hydrocracking	30,000	6.0	180,000
Hydrotreating	192,000	2.0	384,000
Alkylation ("HF")	12,500	10.0	125,000
Aromatics Extraction	6,400	15.0	96,000
Isomerization	16,000	15.0	240,000
Sulfur (LT/D)	202	220.0	44,440
Total			**2,349,940**

Refinery Complexity:	**10.4**

(Total EDC / Crude Unit Capacity) ==> (2,349,940 / 225,000) = 10.4

(a) Sources: Mark J. Kaiser, *A review of refinery complexity applications*, (2016), 185.
Oil & Gas Journal, Dec. 30, 1985, 145.

RCN Example – Complex Refinery (cont.)

- Detailed Unit Summary

Process Unit Description	Capacity BPSD
Atmospheric Crude Distillation Unit	225,000
Vacuum Unit	71,500
Delayed Coker	30,000
Fluid Catalytic Cracker ("FCC")	55,000
Hydrocracker	30,000
Low-Sulfur Naptha Hydrotreater	67,000
Gasoline Hydrotreater	45,000
Distillate Hydrotreater	80,000
Catalytic Reformer	80,500
Isomerization Unit	16,000
Alkylation Unit (HF)	12,500
Benzene Extraction Unit	6,400
Sulfur Plant (LT/D)	220
Merox and Merichem Treaters	83,500

RCN Example – Complex Refinery (cont.)

- Methodology Employed
  - Cost-to-Capacity Method (Utilizing IHS/SRI PEP Cost Data)
  - Process Cost Function Method
  - Trending Method

RCN Example – Complex Refinery (cont.)

- Cost-to-Capacity Method
  - Universal cost equation
  - Utilizes known costs for similar facilities/machinery and equipment
  - Cost is a function of capacity or size raised to an exponent (scale factor)

$$\frac{C_2}{C_1} = \left(\frac{Q_2}{Q_1}\right)^x$$

C_2 = Cost of Facility 2 to be estimated (or Piece of M&E 2), with known capacity Q_2
C_1 = Known cost of Facility 1 (or Piece of M&E 1), with capacity Q_1
Q_2 = Known capacity of Facility 2 (or Piece of M&E 2)
Q_1 = Known capacity of Facility 1 (or Piece of M&E 1)
x = Scale factor for technology of Facility 2 and 1 (or Pieces of M&E 2 and 1)

RCN Example – Complex Refinery (cont.)

- Process Unit Cost Functions Method
  - Based on past project costs for refinery process units
  - Developed by exponential regression analyses by industry experts
  - $2005 U.S. Gulf Coast Cost Basis – ISBL Costs Only

$$\text{Process Unit Cost} = \alpha\ (\text{Capacity, MBPSD})^{\beta}$$

Process Unit Cost Functions[(1)]: Cost ($ million) = α (Capacity)$^{\beta}$

Process Unit	α	β	Capacity Unit
Desalter	0.44	0.555	MBPSD
Atmospheric distillation	8.20	0.510	MBPSD
Vacuum distillation	8.34	0.493	MBPSD
Delayed coking	24.42	0.644	MBPSD
Fluid catalytic cracking	24.67	0.461	MBPSD
Catalytic hydrocracking	26.18	0.714	MBPSD
Catalytic hydrotreating - Naphtha	4.96	0.524	MBPSD
Catalytic hydrotreating - Distillate	8.62	0.576	MBPSD
Catalytic reforming - continuous	12.19	0.547	MBPSD
Isomerization (C5/C6)	6.17	0.599	MBPSD
Alkylation (HF)	12.19	0.606	MBPSD
Gas processing	4.38	0.593	MMCFPD
Sulfur recovery	2.84	0.412	Long tons per day

(1) Cost basis $2005 for U.S. Gulf Coast region.

Source: Gary, J.H., Kariser, M.J. *A Review of Refinery Markets and Cost Estimation*, January 2013.

RCN Example – Complex Refinery (cont.)

- Trending Method
  - Utilized cost indices to develop and apply trend factors to known historical costs
  - Historical cost is defined as the cost "of a property when it was first placed into service by its first owner."[1]
  - Has tendency to be less reliable the older the assets become

$$C_2 = C_1 \left(\frac{\text{Index}_2}{\text{Index}_1}\right)$$

C_2 = Required cost of facility (or M&E) in required year
C_1 = Known historical cost of facility (or M&E) in reference year
Index_2 = Required year cost index
Index_1 = Reference year cost index

[1] American Society of Appraisers, *Valuing Machinery and Equipment: The Fundamentals of Appraising Machinery and Technical Assets*, 3rd edition (2011), 531.

RCN Example – Complex Refinery (cont.)

- Atmospheric Crude Unit – 225,000 BPSD
- Originally constructed in 1969
- Cost-to-Capacity Method
  - ISBL (IHS/SRI Cost Data adjusted to Q3 $2018)
  - Includes Desalter Unit Costs

$$\frac{C_2}{C_1} = \left(\frac{Q_2}{Q_1}\right)^x$$

$$\frac{\text{Crude Unit Cost}}{\$183.30\text{ MM}} = \left(\frac{225{,}000\text{ BPSD}}{192{,}400\text{ BPSD}}\right)^{0.70}$$

$$\text{Crude Unit Cost} = \$183.30\text{ MM x }\left(\frac{225{,}000\text{ BPSD}}{192{,}400\text{ BPSD}}\right)^{0.70}$$

$$\text{Crude Unit Cost} = \$204.5\text{ MM}$$

RCN Example – Complex Refinery (cont.)

- Atmospheric Crude Unit – 225,000 BPSD
- <u>Process Unit Cost Function Method</u>
  - ISBL ($2005)
  - Crude Unit and Desalter Unit each have cost functions

α β

$$\text{Crude Unit Cost} = 8.20\,(225)^{0.510}$$

$$\text{Crude Unit Cost} = \$129.8\text{ MM}, (2005\text{ dollars})$$

$$\text{Desalter Unit Cost} = 0.44\,(225)^{0.555}$$

$$\text{Desalter Unit Cost} = \$8.9\text{ MM}, (2005\text{ dollars})$$

$$\text{Crude Unit} + \text{Desalter Unit Cost} = \$138.7\text{ MM}, (2005\text{ dollars})$$

Nelson Farrar Indices

$$\text{Crude Unit} + \text{Desalter Unit Cost (Q3 \$2018)} = \$138.7\text{ MM}\left(\frac{2833.3}{1918.8}\right)$$

$$\text{Crude Unit} + \text{Desalter Unit Cost (Q3 \$2018)} = \$204.9\text{MM}$$

RCN Example – Complex Refinery (cont.)

- Atmospheric Crude Unit – 225,000 BPSD
- <u>Trending Method</u>
  - $28.4 MM, 1969 Dollars
  - Crude Unit cost includes Desalter Unit

$$C_2 = C_1 \left(\frac{\text{Index}_2}{\text{Index}_1}\right)$$

Nelson Farrar Indices

$$\text{Crude Unit (Q3 \$2018)} = \$28.4\text{MM}\left(\frac{2833.3}{329.0}\right)$$

$$\text{Crude Unit (Q3 \$2018)} = \$244.6\text{MM}$$

RCN Example – Complex Refinery (cont.)

- Crude Unit - RCN Results Summary
  - Cost-to-Capacity Method (Utilizing IHS/SRI PEP Cost Data): $204.5MM
  - Process Cost Function Method: $204.9MM
  - Trending Method: $244.6MM – **20% Higher**

RCN Example – Complex Refinery (cont.)

- Hydrocracker – 30,000 BPSD
- Originally constructed in 1969
  - Cost-to-Capacity Method (Utilizing IHS/SRI Cost Data PEP): $355.5MM
  - Process Cost Function Method: $353.3MM
  - Trending Method: $403.0MM – **13% to 14% Higher**

RCN Example – Complex Refinery (cont.)

- Refinery RCN Summary: Cost-to-Capacity Method (IHS/SRI Data):

Process Units	Capacity	Replacement Cost New (RCN")
	BPSD	**$000,000**
Atmospheric Crude Distillation Unit	225,000	204.5
Vacuum Unit	71,500	135.6
Delayed Coker	30,000	183.4
Fluid Catalytic Cracker ("FCC")	55,000	330.3
Hydrocracker	30,000	355.5
Low-Sulfur Naptha Hydrotreater	67,000	73.6
Gasoline Hydrotreater	45,000	43.2
Distillate Hydrotreater	80,000	250.7
Catalytic Reformer	80,500	291.9
Isomerization Unit	16,000	70.1
Alkylation Unit (HF)	12,500	126.4
Benzene Extraction Unit	6,400	153.3
Sulfur Plant (LT/D)	220	22.8
Merox and Merichem Treaters	83,500	34.5
Process Unit Subtotal		**2,275.8**
Off-Sites		**1,377.3**
Process Units and Off-Sites		**3,653.1**

Notes:

1) Off-Sites include capital costs for tankage, buildings, steam, cooling water, water treatment, power distribution, compressed air, fire protection, and miscellaneous utility assets.
2) Replacement cost new figures include estimates of pre-startup and startup costs and owner's costs. Excludes interest, insurance, and property taxes during construction.

RCN Example – Complex Refinery (cont.)

- Do the results make sense?
  - Total Refinery RCN - 225,000 BBLS: $3,653.1 MM ~ $16,200/BBL
  - Reasonable Benchmarks for Comparison
    - Marathon 2009 Garyville, LA Refinery - 180,000 BBL Expansion: $3.2B; $17,800/BBL
    - Motiva: 2012 Port Arthur, TX - 325,000 BBL Expansion: $7.0B; $21,500/BBL

Renewables & Wind Farm RCN Considerations

- Rapidly Evolving Technologies: Wind, solar, storage, etc.
- Wind Farms
  - 2017 hub heights averaged 86 meters; 54% increase from 1999[1]
  - 2017 rotor diameters averaged 113 meters; 135% increase from 1999[1]
  - 2017 capacity of new turbines averaged 2.32 MW; 224% increase from 1999[1]
  - 2017 capacity weighted average installed cost = $1,610/kW; decrease of $795/kW from 2009/2010 costs[2]
- What is the appropriate replacement for older wind farms?
  - Can the foundations and/or towers support newer technology turbines?
  - Are you replacing existing assets with a functional equivalent?
- Conclusions on RCN Development: Case-by-Case Analysis
  - Requires an engineering exercise
  - Discussions with insureds and industry experts

1 U.S. Department of Energy, 2017 Wind Technologies Report (August 2018), viii.

2 Ibid., X.

Takeaways and Reoccurring Issues

- Utilizing multiple credible cost sources yields the most reliable RCN results
- Employing just a trending analysis can lead to unreliable results
  - Asset ledger cost information may not be recorded accurately
  - Recorded costs may not represent actual historical costs
  - Trending typically becomes less reliable the older the assets are
  - Indices may not appropriately capture regional cost disparities or advances in technologies
- The appraiser must understand the actual assets that are the subject of the analysis
- The appraiser must verify what are the appropriate replacement materials, technology, and configuration

How to Identify Qualified Appraisers?

- Technical or engineering educational background
- Experience in developing RCN estimates for similar assets
- Industry recognized costs estimating or appraisal credentials
  - Certified Cost Professional (“CCP”) – AACE[1] International
  - Professional Cost Estimator/Analyst (“PCEA”) – ICEAA[2]
  - Accredited Senior Appraiser (“ASA”) – American Society of Appraisers
  - State issued Professional Engineer (“PE”) licenses
- Employed by a reputable firm

[1] Association for the Advancement of Cost Engineering
[2] International Cost Estimating and Analysis Association

Thank you!

Questions?

Contact Information

Clayton T. Baumann, PE, CCP, ASA

Principal, evcValuation LLC
375 Bishops Way Suite 236
Brookfield, Wi 53005
Direct: 262.788.9332
Mobile: 262.719.3010
cbaumann@evcvaluation.com

David F. Chavenson

VP Business Development, evcValuation LLC
4417 Longfellow Drive
Plano, TX 75093
Mobile: 469.258.0358
dchavenson@evcvaluation.com