



The Department of Energy's Project Reporting and Assessment System (PARS)

PARS Empower Analyze Variance, Module 4 PARS User Advanced Training

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Welcome to the fourth of eight sessions which comprise the Department of Energy's Project Reporting and Assessment System advanced user training. The analysis and reporting capabilities of PARS provide decisions makers at all levels to best manage these projects over their lifecycle. In this course we will look at the Analyzing Variances in the Earned Value Management System and Project Analyst Standard Operating Procedure (EPASOP). Unlike the basic user course where the EPASOP and PARS were introduced, the focus here will be on looking at data in PARS and using this data for analysis.

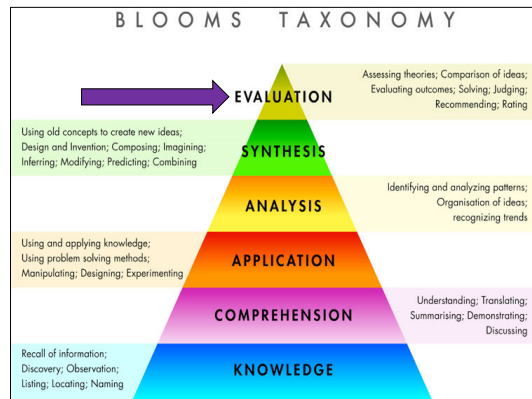


Training Objectives

- **Assess which Empower and PARS tools and capabilities to use in analyzing projects.**
- **Apply DOE EVMS and Project Analysis Standard Operation Procedure to projects**
- **Evaluate Projects using appropriate dashboards, views, charts, and reports information**
- Assess data provided to DOE through the use of EVMS metric tests and data quality reports
- **Building advanced pre-filters in Empower**

AT COMPLETION - EARN 8 CEU/PDUS

- Federal Employees – Will be added to CHRIS
- Contractor Employees – ???



This third session will continue to focus on the first three training objectives. The course looks at using the tools for data analysis, and project evaluation.

This course has a pre-requisite of the PARS User Basic Course along with the EVMS 24X7 course, the EVMS 24X7 course can be waived if a user has comparable knowledge ([PLACE link to a synopsis of each course here](#)).

I would like to thank the Federal Project Directors providing material for the is course, Pam Marks from Salt Waste Processing Facility, Janelle Armijo from Safety Significant Confinement Ventilation System, and Janet Diediker from Tank-Side Cesium Removal System Demonstration Subproject. You will see material from their projects throughout the course.



Variance Analysis Dashboard

- To analyze the approved baseline plan against the current executed forecast
- Identify the top Variance drivers – Cost and Schedule
- Some additional capabilities is not referenced in the EPA SOP
 - Variance identification by Element of Cost (if provided) - Labor, Material, ODC...
 - Supporting EOC Charts and Report provide greater visibility into what EOC drives the Variance
 - Variance slip of Activities that were forecast to finish
- External hard copy Narratives will need to be reviewed
- Drill down and filters will be needed since top level variances mask lower level variances

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By definition, a Variance is a deviation from the baseline plan. This will mean that you must have a baseline and forecast (current plan) in place so that a variance can be measured. These Variances are captured in the 'Dollars' perspective, ie what are the cost and schedule variance with regards to Dollar values. In future session we will the variances with a time perspective. Within each project, you will experience Variances, no plan is ever perfect; they can be positive or negative variances. In addition, there will be certain elements that have a greater variance that others, these are called 'drivers'. Program have lots of data, identifying what are the drivers is very important, we call that "management by exception". That means you will need to filter out data (advanced session 1) to focus on elements that are driving variance cost.

In the EPA SOP, it talks about doing a Sort on Cost Variance (CV) based on a % value. That will provide variance as a percent vs variance in a Dollars. This is useful, since \$1M element my have a variance of \$1K, that would be 10%. On the other hand, a \$250K element by have a variance of \$50, that is a 20% variance. You can see that % is value in measure % variance regardless of the size on the Budget.

There are items not specifically address in the EP SOP that will introduce in this

session. One them is the identification of what Elements of Cost are driving the variance. Typically, most projects have four EOC,: Labor, Material, ODC and Subcontract, if the data is provided. Identifying which EOC will help in looking at language in the VAR Narrative to see if those were identified as key drivers, and not just “total dollars”.

If the data exists, we will also look at what Activities in the schedule are slipping, or which activities should have finish but did not.

The ability to drill down from a top level variance is great feature that Empower has. Typically, some variances as ‘masked’ at top level, since they can roll up positive and negative and offset each other, but as you drill down you may be surprise at how certain elements or EOC may be masking variances at the reporting or top levels.

Within PARS, you will have access to hardcopy Narratives, these narratives should align with the variances and EOC variances identified by this exercise (Session 4)



DOE Variance Analysis Dashboard

- Variance Analysis View
 - Cumulative and Current values with associated Variances
 - Percent and Dollar Variances
 - Color performance and Trending arrows
 - % Complete and % Spent
- Dual axis Variance Analysis Chart
 - Trending Variance Dollar
 - Trending Variance % values
- Six Period Summary Report
 - Tabular performance data for the last six periods
 - Numerous Variance, Cum/Cur and Dollar/% values

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We have provided various Dashboard the PARS Empower environment that you can select and use to conduct analysis. One of them is the D-004 DOE Variance Analysis Dashboard. This dashboard can be used as your initial launching point to conduct Variance Analysis.

Let's start with the Variance Analysis View, it is the top part of the Tri Pane of Empower. It looks and feels a lot like Excel but has a dataset to draw it's data from. It is rich with various types of Variance, percent to dollars, to Current and Cumulative, to trending the visual representation. If you scroll to the right, you will see some very interesting ETC to ACWP current comparisons and deltas. We will talk about each in the coming slides.

On the bottom left you will see a Dual axis variance analysis chart. This is also rich with information and tells large picture of the current period state of the variance to include color code if you so choose to select it. This chart will mostly display the Variance is Dollar on one axis (left) and the % Variance on the right axis.

On the bottom right is the Six Period Summary Chart. This charts has been around for many years, back from the early 90's. The new and improve chart has additional

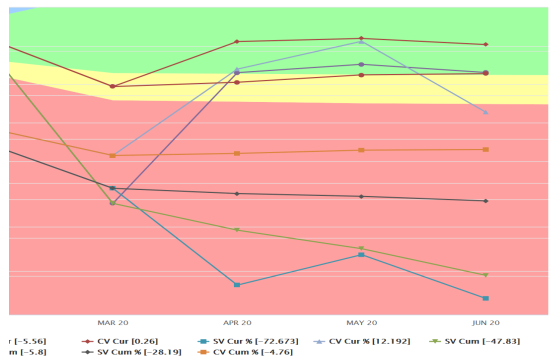
data that has been incorporated. Since Empower has schedule data, this chart has several more rows of data from its predecessor. As the name of the report says, it provides a tabular performance data for the last six periods, data will range most for Dollars, current and cumulative to Dollars and % Values. Although this chart has lots of other data, for the purpose of this session, we will focus on the Variance data.



DOE Variance Analysis Dashboard

DESCRIPTION	B/L Incomp Tasks	CAM	Element Type	EVM	DQI	VAR	SV Cur Trend	SV Cur Percent	SV Cur Trend	CV Cur	CV Cur Percent	SV Cum Trend	SV Cum Percent	CV Cum Trend	CV Cum Percent	ETC for Prior Period
TRU WASTE	532		WBS	NA	ESL	scSV	↓	-5,564,231	-72.67	↓	255,084	12.19	↓	-47,831,429	-28.19	12,065,469
New Underground Ventila	518		WBS	NA	ESL	scSV	↓	-5,564,231	-72.67	↓	255,084	12.19	↓	-47,831,429	-28.19	12,065,469
Safety Significant Confine	518		WBS	NA	ESL	scSV	↓	-5,564,231	-72.67	↓	255,084	12.19	↓	-47,831,429	-28.19	12,065,469
PVS Other Project Costs	0		WBS	NA	ESL	scSV	↓	0	0.00	↓	0	0.00	↓	0	0.00	0

City Significant Confinement Ventilation System JUN 20 WBS Dollars [01.08.01 : Safety Significant Confinement Ventilation System (15-D-411)]
C-004 DOE Variance Analysis (Millions)



1024 - Safety Significant Confinement Ventilation System JUN 20 WBS Dollars [01.08.01 : Safety Significant Confinement Ventilation System (15-D-411)]
Six Period Summary

ITEM	JUL 18	MAR 20	APR 21
BCWS_c	29,979,263	146,295,621	8,392,200
BCWP_c	29,318,193	113,466,705	2,806,850
ACWP_c	27,868,021	121,954,258	1,912,100
SCH VAR_c	-661,070	-32,828,916	-5,585,341
SCH VAR %_c	-2.21	-22.44	-66.51
SPI_c	0.978	0.776	0.330
CEI	0.000	0.000	0.231
COST VAR_c	1,450,172	-8,487,553	694,750
COST VAR %_c	4.95	-7.48	31.81
CPI_c	1.052	0.930	1.468
BCWS	29,979,263	146,295,621	154,687,820
BCWP	29,318,193	113,466,705	116,273,550
ACWP	27,868,021	121,954,258	123,866,360
SCH VAR	-661,070	-32,828,916	-38,414,260
SCH VAR %	-2.21	-22.44	-24.81
SPI	0.978	0.776	0.750
BEI	0.977	0.878	0.868
TOTAL FLOAT	-4.00	-144.00	-197.00
COST VAR	1,450,172	-8,487,553	-7,592,800
COST VAR %	4.95	-7.48	-6.50
CPI	1.052	0.930	0.931
TCPI-BAC	0.993	1.062	1.054
TCPI-EAC	0.993	0.857	0.841

The Variance Analysis Dashboard will start with the project that you are on and open with the All Elements (all levels) on. You will need to select Dashboard > Global > and Select DOE Variance Analysis Dashboard and the following screen will open. Once you have done this, you can still use the interactive filters, sorting in the Sort window. Keep in mind a Dashboard will provide a preselected Views, Chart, Report and filters and sorting. Consider this your 'starting' point for analysis. So for example, if you want your starting point to be Level 3, go to type in Lvl = 3 in the Interactive Filter. If you wish to do a sort, you may do that at this time by sorting for any field that is displayed.

You may at this time select a different Element and will notice the chart and reports changed based on the element (row) you selected. This is called an "active element" in Empower, it drives chart and report. You will also see each chart and report has the name of the "active element" within the display data. This is also another way to let you know that a chart or report is rendering that data based on the active element.

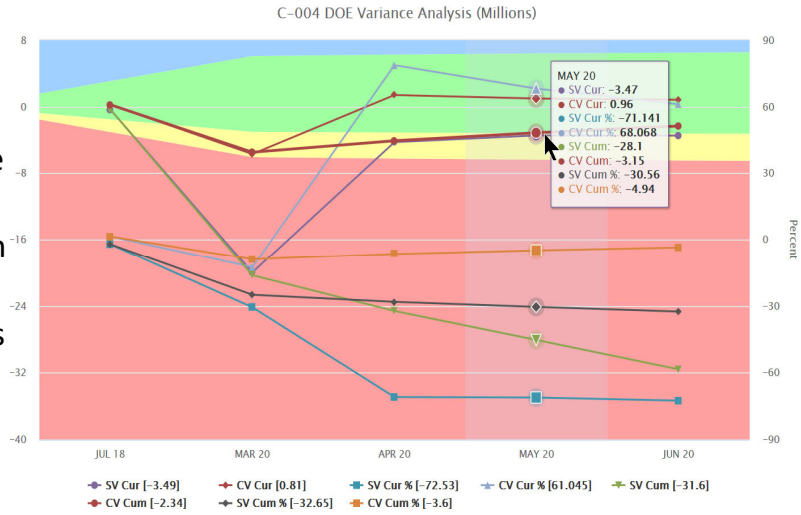
You will notice the bottom left has a chart with Color. We will go in detail soon on what the colors represent. But take some time to familiarize your self with the chart,

You We will go in greater detail of each of the tri panes. Also note, a use can change the Chart and Report to provide greater visibility into other variances such as EOC and Activities.



Variance Analysis Chart

- Color can be added by selecting Show in the Toolbar Chart
- Schedule and Cost Variance for Current and Cumulative
- Left axis represent values in Dollars
- Right axis represents values percent
- You can hide values by clicking them in the legend



The first thing you will notice is that my screen shows color and yours may not, do not worry, I do not have an advanced capability, I just know where to add the color. If you go to the toolbar and select the Chart tool, you will see show or hide, select Show. The colors help in addressing which Variance need to be addressed, specifically those towards the bottom of the chart, they have the worst variance in Dollars and % value.

The Left axis will show a zero "0" row, any items on this row will represent that no variance exist for the Active Element. Think of the data below or "down the chart" as it were, as downward performance indicator or trend. The opposite also exists, any data moving upward or on top has more positive and performance. Any data that does not have any vertical movement from period to period will be considered 'flat'. Also note that right axis represents Percent and the state of the condition here will represent the condition you will find in the sort window.

The various lines and their colors are presented in the legend section of the chart, down below. It is important to note, that if you see this chart to be very "busy", you may select the lines to hide them from analysis. For example, if you wish to hide any lines that have current period values, select each of the legend items that have 'cur'

at the end of the description.

You may also hover at any of the data period node to capture the values of each of the line. A little box will appear with all the values for that period, not just that line. In addition, if you want to Empower to highlight a particular line, go to the legend and hover over that legend description, you will notice all the other lines will go opaque and only one line will appear highlighted in bold.



Six Period Summary – Variance Analysis

- Up to Six Period of past data represented by period (column)
- Upper 'clear' section is the current period values
- Lower 'darken' section is the cumulative period values
- Highlighted in red the Variance rows for each: % and Dollars
- Anytime you see a 'c' it represents current or incremental

Six Period Summary					
ITEM	JUL 18	MAR 20	APR 20	MAY 20	JUN 20
BCWS_c	15,905,462	65,147,862	6,035,284	4,881,430	4,818,517
BCWP_c	15,562,999	45,139,944	1,755,222	1,408,735	1,323,627
ACWP_c	15,344,457	50,850,012	374,951	449,839	515,620
SCH VAR_c	-342,463	-20,007,917	-4,280,041	-3,472,695	-3,494,891
SCH VAR %_c	-2.15	-30.71	-70.92	-71.14	-72.53
SPI_c	0.978	0.693	0.291	0.289	0.275
CEI	0.000	0.000	0.308	0.167	0.273
COST VAR_c	218,542	-5,710,068	1,380,271	958,896	808,006
COST VAR %_c	1.40	-12.65	78.64	68.07	61.04
CPI_c	1.014	0.888	4.681	3.132	2.567
BCWS	15,905,462	81,053,324	87,088,587	91,970,017	96,788,534
BCWP	15,562,999	60,702,943	62,458,165	63,866,901	65,190,527
ACWP	15,344,457	66,194,469	66,569,420	67,019,259	67,534,879
SCH VAR	-342,463	-20,350,380	-24,630,422	-28,103,116	-31,598,007
SCH VAR %	-2.15	-25.11	-28.28	-30.56	-32.65
SPI	0.978	0.749	0.717	0.694	0.674
BEI	0.985	0.878	0.861	0.845	0.847
TOTAL FLOAT	-4.00	-140.00	-197.00	-205.00	-206.00
COST VAR	218,542	-5,491,526	-4,111,255	-3,152,359	-2,344,352
COST VAR %	1.40	-9.05	-6.58	-4.94	-3.60
CPI	1.014	0.917	0.938	0.953	0.965

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The Six Period Summary Reports represents up to six periods (if available) in a tabular report. Each period is represented in a calendar description at the top of the header. The first column represent what value is being represented in the rows.

Highlighted are the rows or fields for Variance: The upper sections in clear (or white) is the Current period section of the report. Below that section in the 'darken' section is the cumulative section of the report.

The values are presented by item description, if you see an "%" then the values in that row are in Percent, else the VAR will be Dollars. The Dollars may be represented in 'Thousands' of Dollars, check the title of the report to determine, the default scale for Dollars is in whole dollars.



Color and Trending Fields

- Color coded field – identifies how favorable or unfavorable the Variance is:
 - R - Red – Unsatisfactory
 - Y - Yellow – Marginal
 - G - Green – Satisfactory
 - B - Blue – Exceptional
 - No Color – No data
- Trend Arrows – identifies if the trend from the previous month is:
 - ↓ - D - Down arrow - Worse than last Month
 - – - F - Horizontal line – No change
 - ↑ - U - Up arrow - Better than last month
 - No Arrow – Need two periods
- Is NOT case sensitive
- Labeled in Empower as “Trend”

DESCRIPTION	AM	Element Type	EVM	DQI	VAR	SV Cur Trend	SV Cur	SV Cur Percent	CV Cur Trend	CV Cur	CV Cur Percent	SV Cum Trend	SV Cum	SV Cum Percent	CV Cum Trend
Procure Filter Housing Filt		WP	NA	EFSI	SCV		0	0.00		0	0.00		-1,399,082	-78.23	
Filter Housing Quality Ove		WP	PERCENT	EFSI	CV	↑	0	0.00	↑	-14,239	-135.30		0	0.00	
New Filter Building (NFB)		WP	NA	EFSI	scSV	↓	-1,851,467	-59.82	↓	977,772	78.64		-17,697,113	-31.54	
Concrete Work (NFB) Fini		WP	PERCENT	EFSI			0	0.00		0	0.00		0	0.00	

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Let’s take a look closely at the Color and Trending fields in the Variance Analysis Dashboard. I have highlighted them red to help identify the fields below have to pieces of information: Color and Trend

Notice the description will let you know if the field contains SV, CV, Current or Cum. However, the header description shows the word “Trend” to notify you this field is a color trend field. The field will only have to letters to describe the contents: color first and then trend. They are always in that order. I want to repeat that, you put the color first then the trend, reversing that will results in no data being displayed.

Let’s start with the Color: The first letter of the color can inputted into the interactive filter to filter on that color. For example, an “R” will represent Red and Empower will filter for all Red color regardless of the Trend condition. You may only filter for one color at time, this field does not have the “|” (Pipe) option like other text fields.

The second letter represents the trend; down, up or flat. If all you want to see all elements that have worsen from last period, all you need to type is “D” and Empower will display all downward trending elements in the Sort window.

This is one of the few fields that are not case sensitive, but still a good practice to

capitalize.

You can create multiple interactive filters by inputting conditions in multiple fields.

For color blind view, go to Options > Text Only Grid to display the text for each trend field, ex. RD.



Variance Fields Defined

- Cost Variance - 'CV'
- Schedule Variance - 'SV'
- Cumulative - 'Cum'
- Current - 'Cur'
- Dollar values are shown as: i.e. CV Cum
- Percent Value by Variance

SV Cur Trend	SV Cur	SV Cur Percent	CV Cur Trend	CV Cur	CV Cur Percent	SV Cum Trend	SV Cum	SV Cum Percent	CV Cum Trend	CV Cum	CV Cum Percent
↓	-5,564,231	-72.67	↓	255,084	12.19	—	-47,831,429	-28.19	—	-5,796,014	-4.76
↓	-5,564,231	-72.67	↓	255,084	12.19	—	-47,831,429	-28.19	—	-5,796,014	-4.76
↓	-5,564,231	-72.67	↓	255,084	12.19	—	-47,831,429	-28.19	—	-5,796,014	-4.76

Variance fields are defined by the header label on top of the Sort window. The header will let you know if it is SV, CV, Cur or Cum. However if it says "Percent" we know the value for this field a % value. If it does not say "Percent", the value is in Dollars. Another key identifier is the Percent values normally are displayed with two decimals place, 'typically' the dollars are displayed in whole dollars.



User View – Adding Fields (Percent Parent)

#32 - Sample Preparation Laboratory (SPL) DEC 23 WBS Dollars :: D-004 DOE Variance Analysis :: S-004 DOE Variance Analysis - Zact

HIER	WBS	DESCRIPTION	JAM	Element Type	E/VN	DQI	VAR	SV Cur Trend	SV CurPP	SV Cur	SV Cur Percent	CV Cur Trend	CV CurPP	CV Cur	CV Cur Percent	SV Cum Trend	SV CumPP	SV Cum	SV Cum Percent	CV Cum Trend	CV CumPP	CV Cum	CV Cum Percent	Vac	VacPP
11111	C.2.20.10.10.60.20	Nuclear Safety Documents/rtler Sadie		WP	PCT	EFCS	scCV	---	100.00	73,864	-100.00	7	111.90	-14,084	-3,800.94	7	100.00	-2,789	-9.03	398.42	-124,449	-443.01	-26,927	-74.77	
11111	C.2.20.10.10.60.25	Fire Safety Documents rtler Sadie		WP	PCT	ESI	CV		0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	-147.88	46,191	77.25	39,796	110.50
11111	C.2.20.10.10.60.28	Transition to Operations Filber Sadie		WP	PCT	SI	CV		0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	-80.71	25,210	82.98	25,210	70.00
11111	C.2.20.10.10.60.30	PP - PH Documents & Clotier Sadie		PP	PP	SI			0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	0.00	0	0.00	-0	-0.00
11111	C.2.20.10.10.60.22	C.2.20.10.10.60 Suspensble Sadie		WP	NA	E			0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	0.00	0	0.00	0	0.00
11112	C.2.20.10.20	Supporting Documents wris AJ		WBS	NA	EI			0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	-0.11	1,922	0.13	1,922	-0.09
11112	C.2.20.10.20.10	CD-2/3 Documents wris AJ		CA	NA	EI			0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	100.00	1,922	0.13	1,922	100.00
11112	C.2.20.10.20.10.05	Nuclear Safety Documents wris AJ		WP	PCT	F			0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	0.00	0	0.00	0	0.00
11112	C.2.20.10.20.10.10	Critical Decision 2/3 Docu wris AJ		WP	PCT	E			0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	0.00	0	0.00	0	0.00
11112	C.2.20.10.20.10.20	CD 2/3 Cost Estimate wris AJ		WP	PCT	F			0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	0.00	0	0.00	0	0.00
11112	C.2.20.10.20.10.30	CD 2/3 RFP & Award of Cris AJ		WP	PCT	EI			0.00	0	0.00		0.00	0	0.00	---	0.00	0	0.00	---	0.00	0	0.00	0	0.00

- Discussion point: modified view, added Percent Parent fields

Introduce the new fields that show percent of the parent for the CV/SV/VAR Percent.

Ask class if would like to import the view into their views.



How well was the ETC forecasted for the current period?

- Current Period ETC to ACWP Volatility
- Last period's ETC for the work to be performed this Period
- Current Period ACWP
- Dollar Delta value of the ETC to be performed this period to the current ACWP
- % Delta value of the ETC to be performed this period to the current ACWP
- Remaining ETC left on the Contract

ETC for Prior Period	ACWP Cur	ETC Delta ▼	% Delta ETC	ETC
7,640,767	515,620	7,125,147	93.25	113,216,124
2,524,398	786,700	1,737,698	68.84	26,121,229
1,191,596	461,603	729,993	61.26	13,291,641
559,632	73,283	486,349	86.91	7,157,754
80,370	0	80,370	100.00	625,827
68,705	0	68,705	100.00	4,870,882

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These last five columns in the Sort window give you a bit of insight into the how well last months ETC forecast value did against the current period Actuals. It provides a forecasted ETC value (future period) to the current period ACWP delta.

ETC for Prior period – represents the value in Dollars of the projected future ETC cost for the current period. Another words, this is what you projected would be the ACWP Cur for the current period. Think of it this way, the current month is June and this field represents what you projected back in May that you would spend in June.

ACWP Cur - This is the current period ACWP

ETC Delta – Represents the ETC for Prior Period – ACWP Cur. Any positive value represents that the ACWP ‘undershot’ the project ETC value that was forecasted. Any negative number represents that the ACWP ‘overshot’ the project ETC value forecasted from prior period.

% Delta ETC – Represents the ETC Delta in %. The higher the number the greater of an ‘undershot or overshot’ you had for the current period.

ETC – your remaining Estimate To Complete effort. This would be the same, in principle, as $EAC - ACWP_{cum}$.



VAR Narrative and Other Information

- VAR Field identifies what elements require a VAR Narrative
- They may or may not have the Thresholds identified in PARS
- Task – number of Task assigned the element
- Incomplete Task
- Discrete Tasks

Tasks	Incomplete Tasks	Discrete Tasks	B/L Incmp Tasks	DQI	VAR
1019	329	326	329	EFSI	scSV
171	92	92	92	ESI	scSCV
67	8	8	8	ESI	S
12	3	3	3	EFSI	
212	30	30	30	ESI	S
39	36	36	36	EFSI	SV
11	6	6	6	EFSI	V
57	2	2	2	ESI	
18	12	0	12	EFSI	cCV

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The columns shown here are to help you identify what VAR Narratives have been defined (if threshold exist) in Empower. I understand not all contracts may have this identification, but it will give you a guideline based on default setting if a VAR Narrative is required. DO NOT go by this alone, as I said, the Threshold definitions may not be set.

There are other fields of interest, these are related to contracts that have P6 data loaded and have associated Task or Activities. Based on the data provided here is what these field represent:

Tasks – the Activity count for the represented Element. This is based on the WBS ID that was provide and it matches the lowest level data CA/WP. If those number do not align with your provided or internal data, there may be WBS misalignments happening, but a topic for a different session.

Incomplete Tasks – the Activity count that have Actual Finish is null....i.e. not complete

Discrete Tasks - the Activity count that are NOT assigned as LOE. Another words if the EVT is other than LOE, it will be counted in this field



Checks on Learning – Variance Dashboard

DESCRIPTION	DQI	VAR	SV Cur Trend	SV Cur	SV Cur Percent	CV Cur Trend	CV Cur	CV Cur Percent	SV Cum Trend	SV Cum	SV Cum Percent	CV Cum Trend	CV Cum ^A	CV Cum Percent	ETC for Prior Period	ACWP Cur	ETC Delta	% Delta	ETC
New Filter Building (NFB)	EFSI	scSV	—	-3,494,891	-72.53	↓	808,006	61.04	—	-31,598,007	-32.65	↑	-2,344,352	-3.60	7,640,767	515,620	7,125,147	93.25	113,216,124
Salt Reduction Building (SRB)	ESI	scSCV	↓	-2,016,039	-92.13	↓	-614,524	-356.92	↓	-10,999,977	-42.65	↓	-2,111,085	-14.28	2,524,398	786,700	1,737,698	68.84	26,121,229
Post CD-2/3 Support	EFSI	cCV	—	0	0.00	↑	60,925	11.66	—	0	0.00	—	-1,612,881	-10.10	1,191,596	461,603	729,993	61.26	13,291,641
Demolition of Existing Ventilation System and t	EFSI	V	—	0	0.00	—	0	0.00	—	0	0.00	—	-72,154	-38.73	0	0	0	0.00	3,584,323

- In looking at the screen shot of the Variance Analysis Dashboard, which field is Empower Sort on?
 - CV Cum Trend
 - CV Cum Percent
 - CV Cum
 - ETC for Prior Period
 - ETC
- In looking at the ETC Delta of \$7,125,147 what does this represent?
 - We have plenty of ETC left on the program
 - It is a positive number, so no problem
 - Delta from the plan ETC of current period from ACWP Cur
 - A positive value represent ACWP Cur did not spend as plan for the current period
 - Answer C and D are correct
- In looking at the CV Cur Trends, what does it mean if field is empty?
 - Need to recalculate the contract
 - Technical issue with software notify PARS technical support
 - Missing data either BCWP or ACWP
 - None are correct
- In the VAR column, you have cCV, what does this mean?
 - Contractual breach and VAR Narrative is required.
 - Current Cost and Cumulative Cost Variance.
 - VAR Narrative exists
 - Cur Cost, Cum Cost and Variance at Complete Breach
 - Answers A, C and D are all correct
 - Answers A and D are correct



Identifying Variance Drivers

- The VAR field may identify VAR Narratives
- Use the Sort feature by clicking the CV Cum Percent header
 - It will Sort the WBS elements by CV %
 - Negative unfavorable CV% will display at the top
 - Positive CV% will display at the bottom
- Clicking the CV Cum Percent header will reverse the Sort
- Once you Sorted on the desired field, you can start the analysis by selecting that row
- You will notice the Charts and Reports update to reflect data from that Active Element
- The same exercise can be done for SV% or any other Variance

CV Cum Trend	CV Cum	CV Cum Percent
↑	-1,259,628	-16.52
↑	-824,024	-9.56
—	-490,064	-8.30
	0	0.00
↓	60,533	0.54
↑	15,772	2.29
↑	277,604	3.36
↑	516,539	6.76
—	117,983	6.85
—	674,848	9.66

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Now that we understand the various Views, Fields, Charts and Reports in the Variance Analysis Dashboard, lets focus on identifying the variance drivers.

Earlier we addressed the VAR field, it may or may not identify a required VAR Narrative, it is based on a default Thresholds. This can be used a 'guide' to VAR drivers

As we mentioned earlier, the 'drivers' can be favorable and unfavorable, most organizations are required to report based on both. Empower can help in this process, although not shown in this view, Empower has an "ABS" or absolute field for each of the variance condition that will help sort out top drivers regardless of negative or positive.

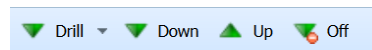
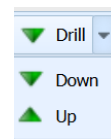
Based on the EPA SOP, the initial identification of the Variance drivers is sort by the worst unfavorable variance. The screen shot shows that we sorted on CV Cum Percent, you will notice an up arrow, meaning the Sort window is sorted by Ascending order or another words, the worse (unfavorable) condition at the top of the list and sorted downwardly to the less unfavorable condition. Hope this makes sense, you want the worst condition to 'float to the top' and be identified, right?

By clicking on the CV Cum Percent header one more time, you will see a down arrow denoting Descending order and the Exception % will 'float to the top'.



Drilling down to the Variance Drivers

- Variance are analyzed at two levels:
 - Top level provides overall project performance
 - Lower levels - Since top level may mask unfavorable variances may be offset by good performance in other WBS elements
- Use the 'Lvl' interactive filter to identify 'lower level' elements that might have variance; LVL = 4
- Start by selecting the top driver
 - Drill down to the next level of detail, LVL = 5
 - Drill down to the Lowest Level to find what CA/WP is causing the majority of the CV.
- Drill up or Off to finish



LVL	CV Cum Trend	CV Cum
4		
4	↑	-2,344,352
4	↓	-2,111,085
4	—	-1,612,881
4	—	-72,154
4	—	-18,310
4		0
4	—	0
4	—	3,070
4	—	28,352
4	—	64,291
4	—	267,054

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Now that we know how to Sort for cost drives, usually you start at a high or level 1. This is good place to start to cross check the Narrative to the top level. However, top level might mask unfavorable variances in the lower levels because there may be multiple favorable may offset the values. By 'lower levels', that can be subjective, we leave the discretion of the user to determine what lower level analysis will be done.

Keep in mind that with Empower you have the flexibility to start say at level = 4 and then perform 'drilling' to the lowest level (LL). This will allow greater insight and fidelity as to what element is causing the problem.

Let's say that the contract has 7 levels, you can use the Interactive Filter with Lvl = 4 to get a high overview of the Narratives. At this point you can Sort for the drivers of a particular condition and then from there start your drilling.

To drill down, go to the Toolbar and either select Drill or dropdown arrow and select Down. In this case this will display the next level, or the children of the element you are Active on. You will level 5 and the details. Notice Empower has keep the Sort as you drill down, this is important since your top drivers are at the top of the next level.

Select the element you wish to drill on and then select 'Down' again this will display the Level 6 and Sorted appropriately. Continue doing this as many times until you reach the Lowest Level (LL). Most likely this will end up at the CA /WP level where further analysis can be done to identify what EOC is causing this.

When finish 'drilling' select Off and Empower will take you all the way up.



What EOC is Driving the Variance

- Select one of the Variance Drivers and select one of the CV by EOC Chart by

- The Chart will identify which EOC is driving the variance
- Negative unfavorable CV% will display below the '0' line

Elements of Cost	▶	BAC by EOC
Format 3 Baseline	▶	EAC by EOC
Format 4 Staffing	▶	Cumulative CV by EOC
Contract Performance	▶	Current CV by EOC

- Select the Element of Cost Report
 - The report will provide tabular data of the CV by EOC
 - Current and Cumulative period data
- By identifying the EOC driver you will:
 - Look for language of that EOC driver in the VAR Narratives
 - Look for Labor Rate or Efficiency Variances language in the VAR Narratives

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From the last screen, we mentioned that if you drill down the CA/WP level, you can further identify what EOC is causing the variance. This will only apply on CV analysis.

At this point, a user has the option to change the Chart (temporary change) of the Variance Analysis Dashboard to reflect the Element of Cost data. Go to Charts > Elements of Cost > there are various Charts, choose one of the CV charts.

At this point the chart will show all the EOC associated with the Active element (if data is available). Look for EOC that are below the zero '0' line.

You may also select the a report called Element of Cost Report, by going to Reports > Elements of Cost. If data is available, a tabular report will display with EOC associated Current and Cumulative period data.

The importance of identifying the EOC driver is that it should clue you into what element should be addressed in the VAR Narrative.

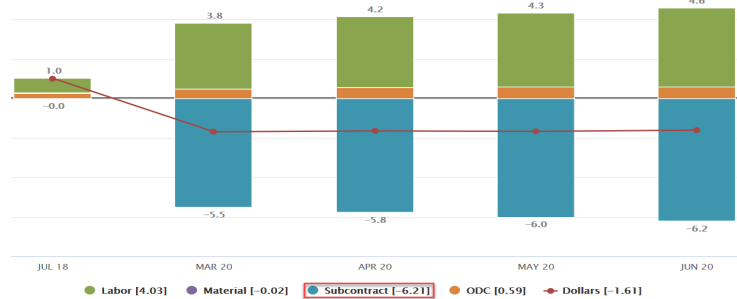
There are additional information not present in the view that address specific Labor Rate Variance and Labor Efficiency Variance. This maybe language found in the VAR

Narratives



Variance Narrative Explanations

- The Chart details which EOC is driving the variance
- Subcontract is the major negative driver
- Trending negative for the last four periods
- What does the VAR Narrative address with respect to Subcontract



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Depending upon your Active Element, the chart will display the CV through time with EOC as CV. As with most charts in Empower, you can click the Legend to hide non pertinent items. When doing the analysis, you can see that the EOC Subcontract is driving the CV for this element.

Rabbit hole: this is example of a positive variance 'neutralizing' the negative EOC Subcontract variance. The Red line represent the Net sum Dollars of the total CV for this element, but you can see there are problems developing with the EOC Subcontract.

The other item to note, is EOC Subcontract has been having problems for the last four periods, one might want to see prior period Narrative to see if this was address or taken by "surprise" in the current month. Charts are very useful in providing a picture of trending variance, as you can see this variance did not just happen, it has been trending unfavorable, but 'masked' in the net sum CV (Dollars).



Variance Narrative Explanations

- The EOC Report provides Cur and Cum details and identifies the EOC that is driving the variance
- Designed to provide 'current' period detail data
- Subcontract has spent almost twice the value of the plan.
- What does the CV<VAC for Subcontract tell you?

UNIT	BCWS_c	BCWP_c	ACWP_c	SV_c	CV_c	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
Hours (Ones)	189,553	189,553	371,260	0	-181,707	6,486,230	6,486,230	11,606,294	0	-5,120,064	8,930,242	19,215,136	-10,284,893
Labor	313,687	313,687	39,109	0	274,579	8,882,061	8,882,061	4,856,431	0	4,025,630	13,157,403	9,676,737	3,480,665
Material	692	692	961	0	-269	74,636	74,636	97,723	0	-23,087	93,884	117,564	-23,680
Subcontract	204,362	204,362	412,592	0	-208,230	6,156,925	6,156,925	12,366,836	0	-6,209,912	8,795,111	20,781,847	-11,986,736
ODC	3,787	3,787	8,942	0	-5,155	854,303	854,303	259,816	0	594,487	888,821	296,300	592,521
EOC Total	522,528	522,528	461,603	0	60,925	15,967,925	15,967,925	17,580,806	0	-1,612,881	22,935,219	30,872,447	-7,937,228
Delta to Dollars	0	0	0	0	0	0	0	0	0	0	0	0	0

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When you put the Chart and Report together, you get a better picture of what is happening. We know from the Chart that Subcontractor has been trending unfavorable for the last 4 periods. The EOC report shows you the details numbers for SPA, SV, CV for Current and Cum as well as at complete values. This report complements the Chart in that has greater detail magnitude the Variances.

From here we can see that EOC Subcontract has spent almost twice the value of the plan, do you see that perspective?

One more item to note: Notice that CV is less then VAC. This might tell you that this element may continue to have negative CV for the foreseeable future, currently about \$6M, and expected to double before it is over.

Look for language in the Impact or Corrective Action Plan that address additional CV in the future instead of the typical "things will get better" narrative



Checks on Learning – Variance Drivers

DESCRIPTION	DQI	VAR	SV Cur Trend	SV Cur	SV Cur Percent	CV Cur Trend	CV Cur	CV Cur Percent	SV Cum Trend	SV Cum	SV Cum Percent	CV Cum Trend	CV Cum ^A	CV Cum Percent	ETC for Prior Period	ACWP Cur	ETC Delta	% Delta ETC	ETC
New Filter Building (NFB)	EPSI	scSV	—	-3,494,891	-72.53	↓	808,006	61.04	—	-31,598,007	-32.65	↑	-2,344,352	-3.60	7,640,767	515,620	7,125,147	93.25	113,216,124
Salt Reduction Building (SRB)	ESI	scSCV	↓	-2,016,039	-92.13	↓	-614,524	-356.92	↓	-10,999,977	-42.65	↓	-2,111,085	-14.28	2,524,398	786,700	1,737,698	68.84	26,121,229
Post CD-2/3 Support	EPSI	cCV	—	0	0.00	↑	60,925	11.66	—	0	0.00	—	-1,612,881	-10.10	1,191,596	461,603	729,993	61.26	13,291,644
Demolition of Existing Ventilation System and t	EPSI	V	—	0	0.00	—	0	0.00	—	0	0.00	—	-72,154	-38.73	0	0	0	0.00	3,584,323

- How do I quickly identify the top cost drivers, in this case CV Cum?
 - Sort by CV Cur
 - Sort by CV Cum
 - Sort by CV Cum %
 - Sort by CV Cum Trend
 - Answer B and C are correct
 - Answer A, B and D are correct
- Why should I use drill down?
 - Top level may mask lower level variance
 - Top level is all that is needed
 - Top level EOC report should provide all the data analysis I need
 - I can start at any level and start drill down from there
 - Answer A and D are correct
 - Answer A, B and D are correct
- What is the value in identifying the Element of Cost Variance?
 - No value, total dollars is all I have ever used in the past
 - Allows identification of EOC driving the cost
 - Can use to cross check if the EOC is address in the Narrative
 - Answers B and C are correct
 - All are correct
- What is the difference between EOC Chart and EOC Report?
 - No difference it is redundant data
 - Chart provides trending of EOC drivers
 - Report shows greater detail of the EOC variance
 - Report shows Current and Cumulative as well at complete values
 - Answers B, C and D are all correct

Absolute Value Variance Analysis

SV Cur	SV Cur Abs	SV Cur Percent	CV Cur Trend	CV Cur	CV Cur Abs	CV Cur Percent	SV Cum Trend	SV Cum	SV Cum Abs	SV Cum Percent	CV Cum Trend	CV Cum	CV Cum Abs	CV Cum Percent
-3,494,891	3,494,891	-72.53	↓	808,006	808,006	61.04	—	-31,598,007	31,598,007	-32.65	↑	-2,344,352	2,344,352	-3.60
-2,016,039	2,016,039	-92.13	↓	-614,524	614,524	-356.92	↓	-10,999,977	10,999,977	-42.65	↓	-2,111,085	2,111,085	-14.28
0	0	0.00	↑	60,925	60,925	11.66	—	0	0	0.00	—	-1,612,881	1,612,881	-10.10
0	0	0.00	—	0	0	0.00	—	0	0	0.00	—	267,054	267,054	7.77
0	0	0.00	—	0	0	0.00	—	0	0	0.00	—	-72,154	72,154	-38.73
-11,184	11,184	-13.14	↑	677	677	0.91	—	-4,239,317	4,239,317	-28.84	—	64,291	64,291	0.61
0	0	0.00	—	0	0	0.00	—	-0	0	-0.00	—	28,352	28,352	0.54
0	0	0.00	—	0	0	0.00	—	-611,102	611,102	-11.94	—	-18,310	18,310	-0.41

- Highlighted are the Absolute value variance fields – SV, CV, Cur, Cum
- Must use the ‘descending’ order sort to be effective
- Notice the values in the CV Cum vs CV Cum Abs fields
- Sort has identified the “top 5 drivers” whether unfavorable or favorable

One of the nice features of Empower is the ability to sort based on an Absolute value for Variance. Why would this be important: Glad you asked. It will show the top “Cost drivers” regardless if it is favorable or unfavorable. This way you can address the “top 5 CV Cum cost drivers” in one sort.

Take a look at the screen shot of a View (customized) to provides the Absolute value for SV, CV, Cur and Cum values. In this example, we are sorted by CV Cum Abs, you can tell because the down arrow is show by descending order. In order to be effective, you must sort by ‘descending’ order when using the Absolute field. Else you start with 0 variance at the top.

In this case we do not care if the value is favorable or unfavorable, we just want to sort by the absolute value.

Notice the two highlighted CV Cum have a negative \$1.6M but the CV Cum Abs show the value as \$1.6M. The same for the -\$72K it shows for the CV Cum Abs as \$72K.

In a single sort operation, I have identified my ‘top 5 cost drivers’ element, the element with the highest absolute cost variance, regardless of favorable or

unfavorable will be at the top.



Labor Rate & Efficiency Variance

- This example, Labor Rate and Efficiency variances are calculated for **Labor** Units
- Labor Rate: If negative – used a more expensive resource(s), reversed for positive
- Labor Efficiency: If negative – used more hours than originally planned, reversed for positive
- Notice the CV Net total = Rate Var + Eff Var only applies, in this case, if CV is only Labor
 - In this case CV Cum is only for Labor so the Rate + Efficiency Variance will equal to CV Dollars
- **IF** the CV had **other** EOC values the equation will not add
- Example show that CV Cum has ‘other’ EOC than just Labor. You can always look at the EOC Report

CV Cum	Labor Rate Var	Labor Eff Var
3,877,698	10,989,310	-7,111,613
34,635	46,078	-11,444
73,839	82,221	-8,382
27,550	29,216	-1,665
7,076	7,992	-916
6,305	6,973	-668
-108	-96	-12
-379	-373	-5

CV Cum	Labor Rate Var	Labor Eff Var
-1,858,795	10,989,310	-7,111,613
-1,730,032	46,078	-11,444
-33,554	82,221	-8,382

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Another useful Variance is the Labor Variances: Labor Rate Variance and Labor Efficiency Variance. Empower will calculate this base on the Labor Dollars and Labor Hours provided.

Empower can also calculate other EOC unit Variance such Material Usage Variance and Material Price Variance, but you will need to provide Empower Material Dollars and Material Units (quantity).

Let’s continue, when analyzing the Variance consider the two variances things:

- Labor Rate Var: If the value negative then it is unfavorable, this typically means that a more expensive resource(s) was used then originally planned. If the values are positive a less expensive resources(s) was used than originally planned. Since Empower is not capturing individual resources external data must be consider to further determine which resource(s) caused the variance
- Labor Efficiency Var: If the value is negative then it is unfavorable, this typically means that more hours (inefficiency) were used then originally planned. If the values are positive, a great efficiency was executed than originally planned.

Take note, the Labor Rate & Eff Var take account the Labor CV ONLY. If the Active element has other EOC units the “math” would appear not to add up, but it does for

Labor.

When doing you VAR Narrative analysis, if Labor is contributing, take not if the VAR include Rate and Efficiency variance into account.



Which Forecast Activities Missed this Period?

- What is on the critical path, and are they slipping?
- Are there Activities that missed their target completions?
- What Activities should have started but did not, Why?
- What Activities were forecast to finish this period but did not?
- Could those Activities be contributing to the Cur/Cum Variance?
- Are those Activities “riding” the status date?
- Are those Activities/effort address in the Narrative

22

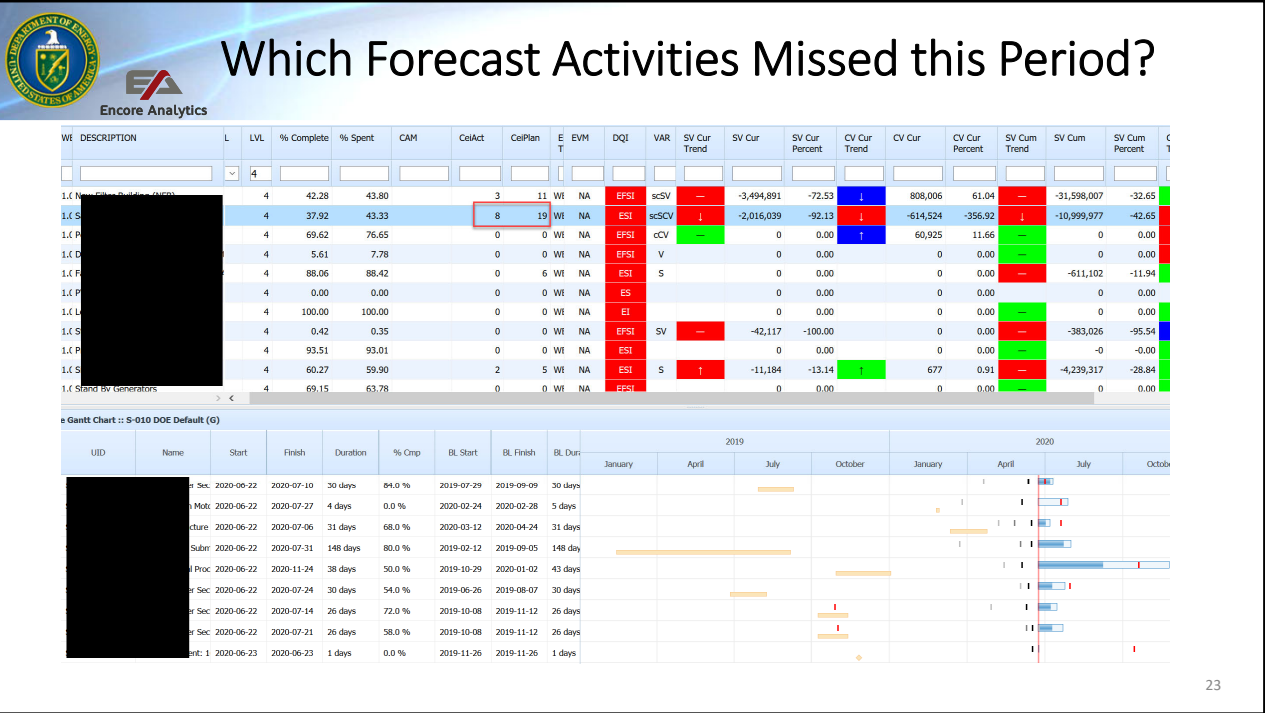
One item overlooked by many is the impact having visibility to the schedule has. A schedule can provide invaluable insight into the ‘behind the scene’ of what is really happening. Cost data is rolled up, it does not show dates slipped, critical path, or which tasks missed their target completion/start. Introducing the schedule linked to the cost data, this provides greater visibility and fidelity previously not available. You do not have to be a professional scheduler, all you need to do is ask the right questions and Empower will provide some ‘right’ answers.

All variance starts for either missed start or finish dates. If everything started or finished as planned then no need to look for variance drivers. In the real world we are not so lucky, that is why Variance analysis is not only important but in many ways it is an art form. One of the tools you have at your disposal is insight into what is happening in the schedule.

Think of the questions in front of you; you do not need to be a scheduler to ask them. With some Prefilter you can answer these questions and more. More so if your P6 data has BCWP and BAC values, you see the impact of those Activities.

By selecting an Active Element and applying the Gantt Prefilters, you can answer

most of this questions. Look for finish date changes, how does it compare to baseline.



This is an example of Cost and Schedule analysis capability in Empower. The Element highlighted was planned to complete (Forecast) 19 Activities in the current period. However, it only completed 8 activities, the Activities that did not complete are identified in the Gantt Chart below.

You will notice that the Gantt shown in Yellow is the Baseline and the Blue Gantt is the Forecast. Notice there is a huge slip to the right (baseline vs forecast) could this be contributing to the unfavorable almost \$11M dollars SV Cum. Also, might all these tasks that missed the current period be contributing the negative SV Cur value of \$2M.?

Also displayed in the Gantt Chart are vertical “pipes” or “|”. The Red represents the ‘drop dead’ date, or no more positive float. The Black pipe represent last month finish or Finish1 Date. The dark gray pipe represent finish date two months ago or Finish2 Date and the light gray pipe represents finish date three months ago or Finish3 Date. You will also notice that this is not the first month this element has been slipping and causing Cumulative Variances.



Variance Narrative Explanations

- Now that the top drivers have been identified, and more in detail the EOC drivers, look at the provided hardcopy VAR's for:
 - Identification of the root cause
 - Impact of the Variance to downstream tasks
- Ask the “5 Whys” Technique

██████████ This variance has exceeded the threshold for 5 consecutive reporting periods.

Cause: Subcontractor resource efficiencies have been experienced for a number of pre-construction field activities: Modification of the ██████████ construction site fence was completed in less time and with fewer resources than anticipated. Completion of construction mobilization to prepare for pre-construction activities was completed more efficiently than planned. Subcontractor resources utilized for initial pre-construction work scopes were already mobilized on site after completion of other ██████████ scopes. With delays to some of the expense-funded scope they were supporting, they ended up moving directly onto ██████████ scope. Excavation and testing of the W-211 transfer lines at ██████████ and outside ██████████ and cleaning and inspection of the ██████████ pit

Impact: The EAC has been updated to reflect the increased vendor support for design.

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In the EPA SOP it goes into great detail of questions to ask. It is called the “5 Whys” Technique to address if the root cause narrative is truly addressing the issue. Empower has additionally provided insight into what EOC is causing the Variance, not only for the current period (report) but over time (chart).

We also addressed what Activities are slipping not only in the current period but also over time giving insight into which activities contribute to Current and Cumulative variances.

From our discussion earlier, you will notice that this particular contractor has supplied a hardcopy VAR Narrative. We know from the EOC analysis that it is Subcontract that is driving the Variance. Although not explicitly shown (because of redaction of the data) it is the subcontract activities that are slipping.

We have come full circle from identifying top level variance, did a drill down to lower level and at those levels identified what EOC driver. We also look at the activities that have been slipping through time and that missed current period. We then looked at the hardcopy reports to assure the contract is addressing the variance appropriately.



Checks on Learning – Other Variances

1. What you tell me about the Labor Rate and Eff Var values?
- A. They used less hours than originally planned
 - B. Does not make senses, negative Rate but positive Efficiency
 - C. More expensive resource(s) was used
 - D. Look like a less expensive resource was used and was more efficient
 - E. Answer A and C are correct
 - F. Answer A, C and D are correct

AY0

CV Cum	Labor Rate Var	Labor Eff Var
-1,259,628	-3,141,103	2,550,856
-824,024	-35,637	63,795
-490,064	235,812	24,241

2. What are various Schedule analysis you can do in Empower?
- A. Graphically see the Baseline and Forecast data
 - B. Track the last 3 months furnished Finish date
 - C. Identify the missed CEI Activities
 - D. Identify the Activities that should have started but did not
 - E. Answer A and C are correct
 - F. All are correct

3. What can you tell me about the EOC report below?
- A. Subcontract is overrunning SV and CV cum
 - B. Subcontract is expected underrun at completion
 - C. ODC has ACWP but no Budget
 - D. This element is underrunning the Total Dollars
 - E. All are correct

UNIT	BCWS_c	BCWP_c	ACWP_c	SV_c	CV_c	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
Hours (Ones)	7,357,712	6,512,912	5,454,743	-844,801	1,058,169	7,374,790	6,528,362	5,466,417	-846,428	1,061,945	20,135,269	18,446,693	1,688,576
Overhead	-186,375	229,366	205,266	415,741	24,100	1,350,841	1,238,345	1,111,859	-112,495	126,486	3,432,108	3,274,918	157,190
Labor	136,544	233,627	242,361	97,083	-8,734	1,778,215	1,760,080	1,428,898	-18,135	331,182	3,628,243	3,626,112	2,130
Material	79,767	261,458	-222,066	181,691	483,524	920,520	810,684	557,330	-109,835	253,355	1,176,933	1,187,327	-10,394
Subcontract	-1,594,221	878,128	1,243,728	2,472,349	-365,600	5,085,243	4,461,332	4,893,019	-623,911	-431,686	15,597,837	15,165,424	432,413
ODC	0	0	1,733	0	-1,733	0	0	1,733	0	-1,733	0	1,973	-1,973
EOC Total	-1,564,286	1,602,579	1,471,022	3,166,865	131,557	9,134,818	8,270,442	7,992,838	-864,377	277,604	23,835,121	23,255,753	579,368
Delta to Dollars	0	0	0	0	0	0	0	0	0	0	0	0	0

Slide 25

AYO

Should this be F not E?

Isn't A, B = D?

Young, Amber, 2024-03-03T15:49:12.573