Presenting:

Application of Attrition to Resource Forecasts

by Bill Reid

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Application of Attrition to Resource Forecasts

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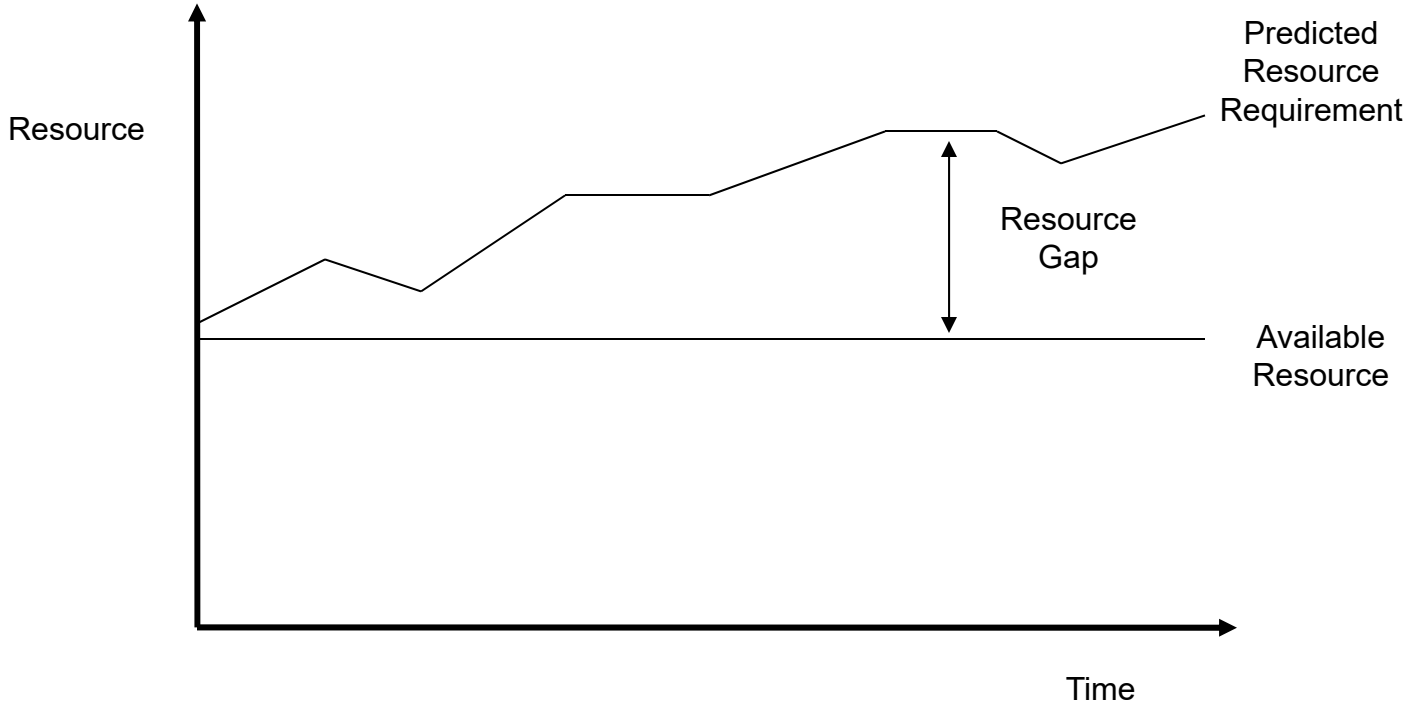
Introduction

- Planning resource requirements in a research and development environment can pose a few problems.
- Estimating the future work load based upon the current and planned project portfolio is not an exact science.
- Project attrition is the main contributor to an uncertain future.
- Accounting for attrition can cause major headaches for planners and managers.
- Organisations often have all the information they need to account for attrition in a smarter way.
- This presentation demonstrates a method of accounting for attrition which uses information normally readily available and models attrition the way it happens.
- Resource can mean people, development expenditure, patient requirements for clinical trials or any project requirement quantifiable over time.

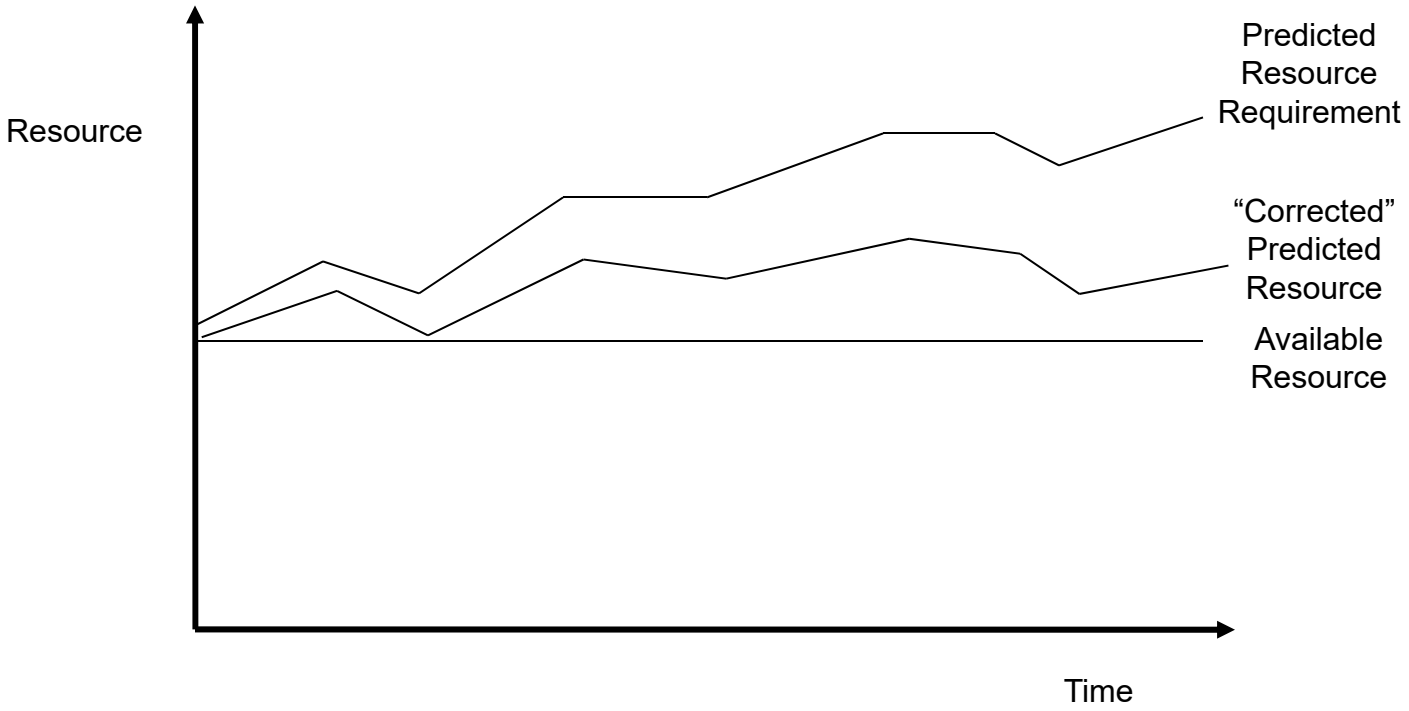
Accounting for Attrition

- Resource planning starts from a prediction of the effort required if all projects in a portfolio are successful.
- In the pharmaceutical industry this doesn't happen.
- How can we make the best use of our resources or identify the need for additional staff balanced against a realistic workload when it is unclear how much work there will be to do?



Accounting for Attrition

- A commonly used method for accounting for attrition is to apply a factor to the predicted resource requirements.
  - *Why is this not enough?*



Accounting for Attrition

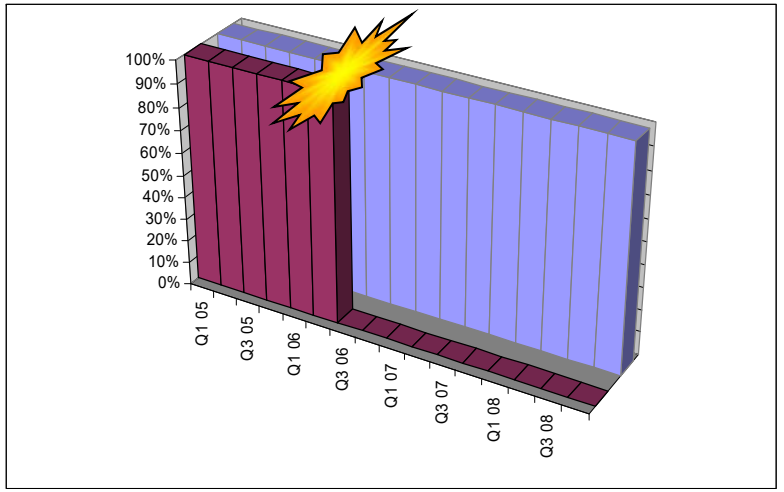
- Limitations of applying a factor:
  - No account is taken of when attrition may occur.
  - No or limited account is taken of the level of risks faced by projects in the portfolio.
  - There is no indication of the likelihood of the revised forecast.

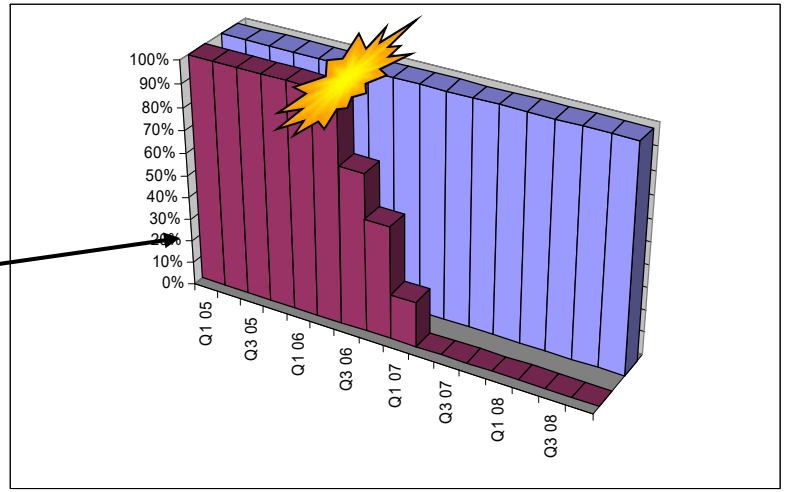
Accounting for Attrition

- Is there a smarter way to account for attrition?
  - If we look at how attrition happens it's actually easy to understand.
- There are two categories of attrition.
  - The product has problems as a result of development risks.
  - The project is cancelled for "management" reasons.
- This method has been developed to model the the first category.
- The second category is portfolio management.

Attrition at Milestones

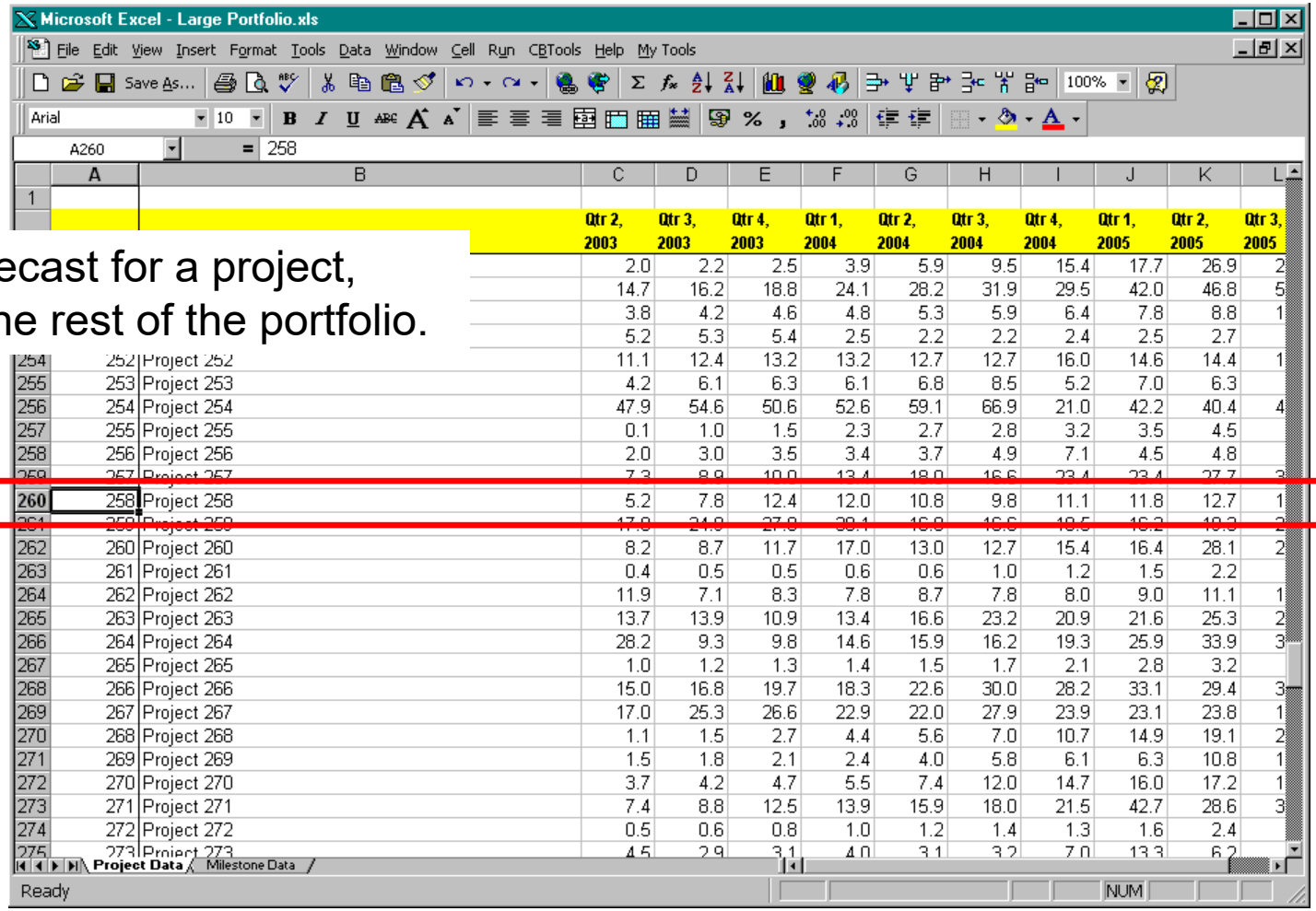
- Attrition through a project not reaching performance targets can occur at any point in it's life but usually happens at a pre-planned decision point - a milestone.
- At a milestone a project can only pass or fail.
- If it passes then the project continues as planned.
- If it fails the effort is wound down.
  - How effort ramps down often depends on the project's phase of development.
  - Early phase projects are usually quicker to wind down than late phase projects.





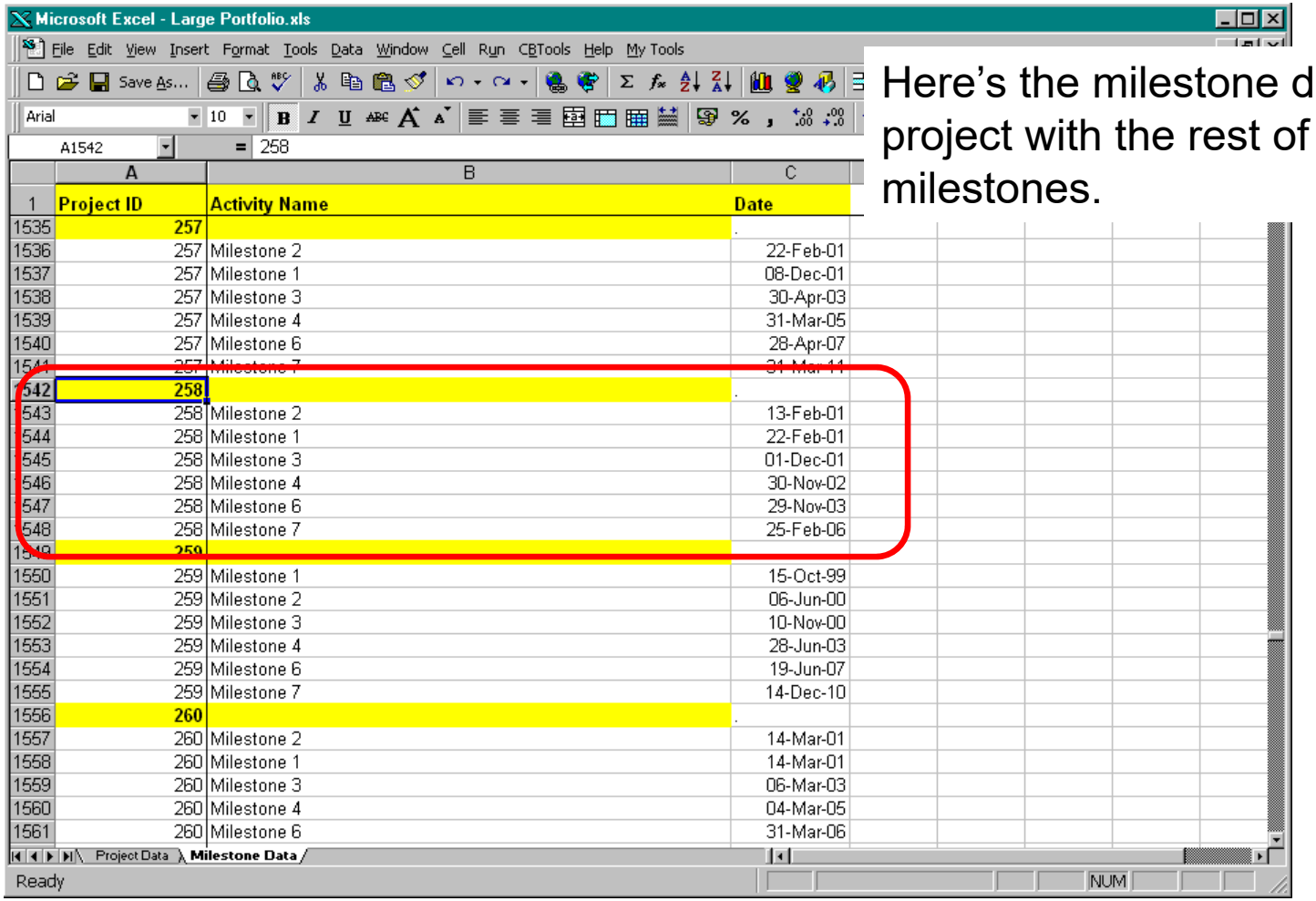
Let's Take a Look at Forecasts...

Here's a forecast for a project, along with the rest of the portfolio.



	A	B	C	D	E	F	G	H	I	J	K	L
1												
			Qtr 2, 2003	Qtr 3, 2003	Qtr 4, 2003	Qtr 1, 2004	Qtr 2, 2004	Qtr 3, 2004	Qtr 4, 2004	Qtr 1, 2005	Qtr 2, 2005	Qtr 3, 2005
			2.0	2.2	2.5	3.9	5.9	9.5	15.4	17.7	26.9	2
			14.7	16.2	18.8	24.1	28.2	31.9	29.5	42.0	46.8	5
			3.8	4.2	4.6	4.8	5.3	5.9	6.4	7.8	8.8	1
			5.2	5.3	5.4	2.5	2.2	2.2	2.4	2.5	2.7	
254	252	Project 252	11.1	12.4	13.2	13.2	12.7	12.7	16.0	14.6	14.4	1
255	253	Project 253	4.2	6.1	6.3	6.1	6.8	8.5	5.2	7.0	6.3	
256	254	Project 254	47.9	54.6	50.6	52.6	59.1	66.9	21.0	42.2	40.4	4
257	255	Project 255	0.1	1.0	1.5	2.3	2.7	2.8	3.2	3.5	4.5	
258	256	Project 256	2.0	3.0	3.5	3.4	3.7	4.9	7.1	4.5	4.8	
260	258	Project 258	5.2	7.8	12.4	12.0	10.8	9.8	11.1	11.8	12.7	1
262	260	Project 260	8.2	8.7	11.7	17.0	13.0	12.7	15.4	16.4	28.1	2
263	261	Project 261	0.4	0.5	0.5	0.6	0.6	1.0	1.2	1.5	2.2	
264	262	Project 262	11.9	7.1	8.3	7.8	8.7	7.8	8.0	9.0	11.1	1
265	263	Project 263	13.7	13.9	10.9	13.4	16.6	23.2	20.9	21.6	25.3	2
266	264	Project 264	28.2	9.3	9.8	14.6	15.9	16.2	19.3	25.9	33.9	3
267	265	Project 265	1.0	1.2	1.3	1.4	1.5	1.7	2.1	2.8	3.2	
268	266	Project 266	15.0	16.8	19.7	18.3	22.6	30.0	28.2	33.1	29.4	3
269	267	Project 267	17.0	25.3	26.6	22.9	22.0	27.9	23.9	23.1	23.8	1
270	268	Project 268	1.1	1.5	2.7	4.4	5.6	7.0	10.7	14.9	19.1	2
271	269	Project 269	1.5	1.8	2.1	2.4	4.0	5.8	6.1	6.3	10.8	1
272	270	Project 270	3.7	4.2	4.7	5.5	7.4	12.0	14.7	16.0	17.2	1
273	271	Project 271	7.4	8.8	12.5	13.9	15.9	18.0	21.5	42.7	28.6	3
274	272	Project 272	0.5	0.6	0.8	1.0	1.2	1.4	1.3	1.6	2.4	

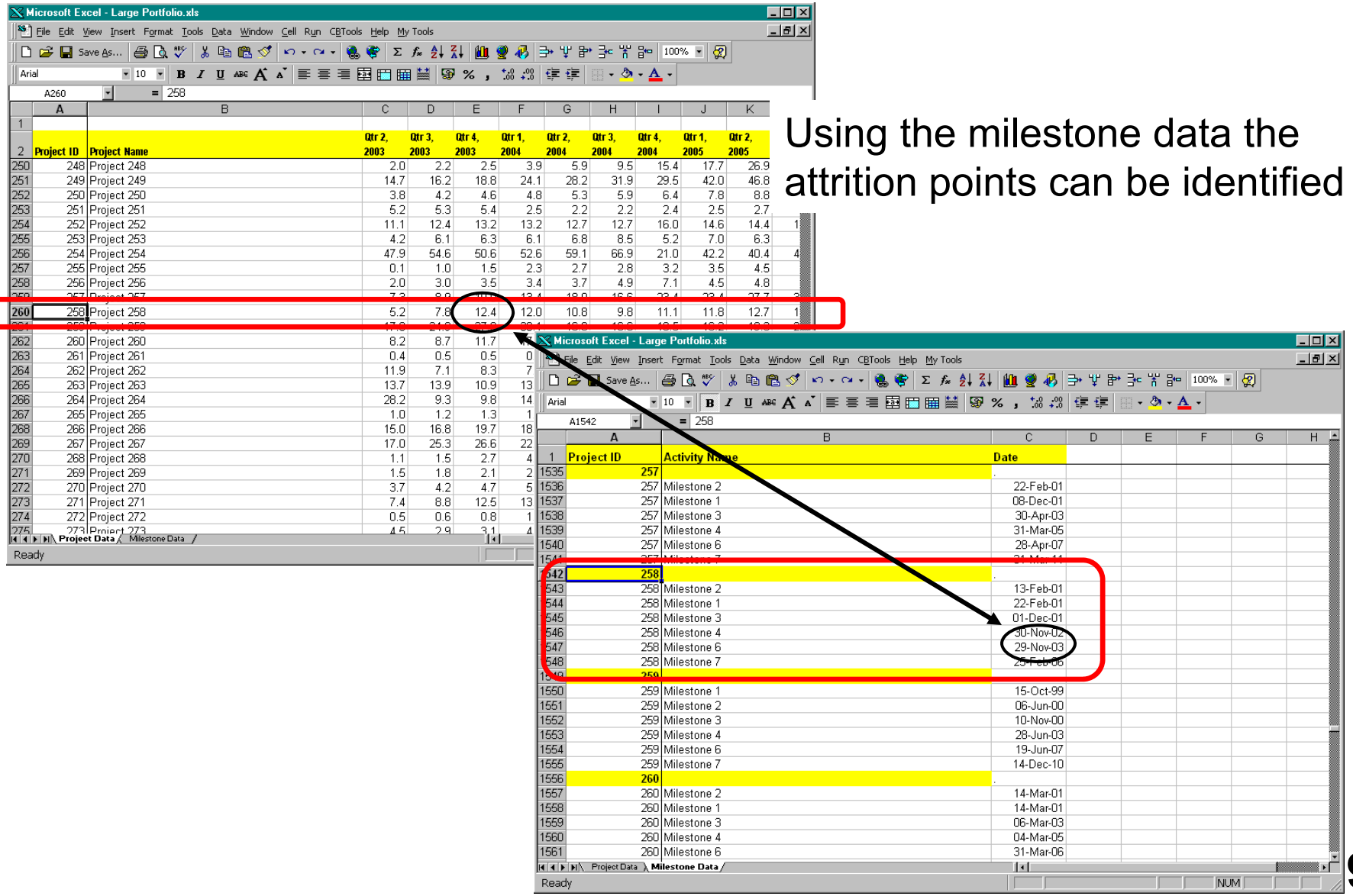
… And Milestone Data



	A	B	C
1	Project ID	Activity Name	Date
1535	257		
1536	257	Milestone 2	22-Feb-01
1537	257	Milestone 1	08-Dec-01
1538	257	Milestone 3	30-Apr-03
1539	257	Milestone 4	31-Mar-05
1540	257	Milestone 6	28-Apr-07
1541	257	Milestone 7	31-Mar-11
1542	258		
1543	258	Milestone 2	13-Feb-01
1544	258	Milestone 1	22-Feb-01
1545	258	Milestone 3	01-Dec-01
1546	258	Milestone 4	30-Nov-02
1547	258	Milestone 6	29-Nov-03
1548	258	Milestone 7	25-Feb-06
1549	259		
1550	259	Milestone 1	15-Oct-99
1551	259	Milestone 2	06-Jun-00
1552	259	Milestone 3	10-Nov-00
1553	259	Milestone 4	28-Jun-03
1554	259	Milestone 6	19-Jun-07
1555	259	Milestone 7	14-Dec-10
1556	260		
1557	260	Milestone 2	14-Mar-01
1558	260	Milestone 1	14-Mar-01
1559	260	Milestone 3	06-Mar-03
1560	260	Milestone 4	04-Mar-05
1561	260	Milestone 6	31-Mar-06

Here's the milestone data for the project with the rest of the portfolio milestones.

Cross Linking Milestones and Data



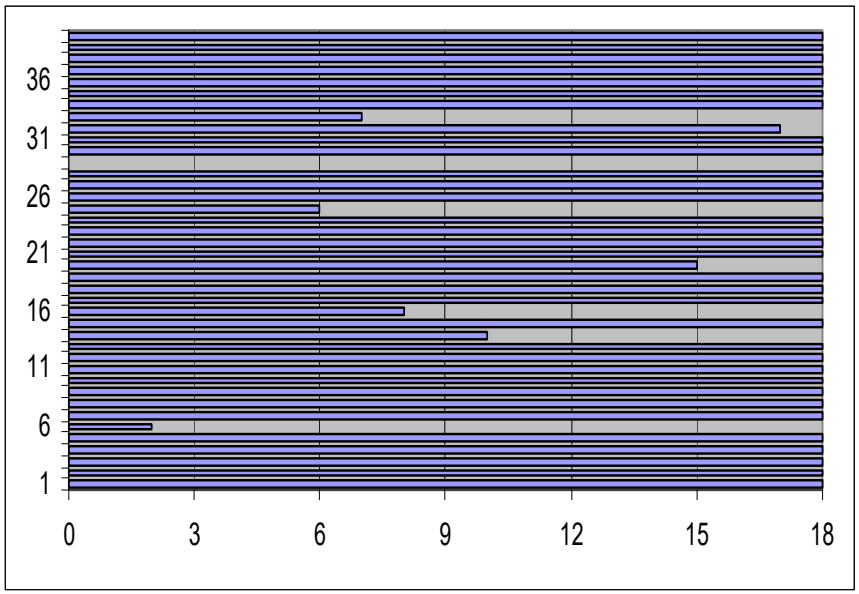
Using the milestone data the attrition points can be identified

Probability of Success

- Only one more item of data is required to be able to model the attrition, the probability of success at a milestone.
- In the pharmaceutical industry there are two sources of probability of success data:
  - Industry average data for milestone type.
  - Specific project probability for a particular milestone, this information is now often collected as part of a portfolio review processes.

Modelling Attrition Across a Portfolio.

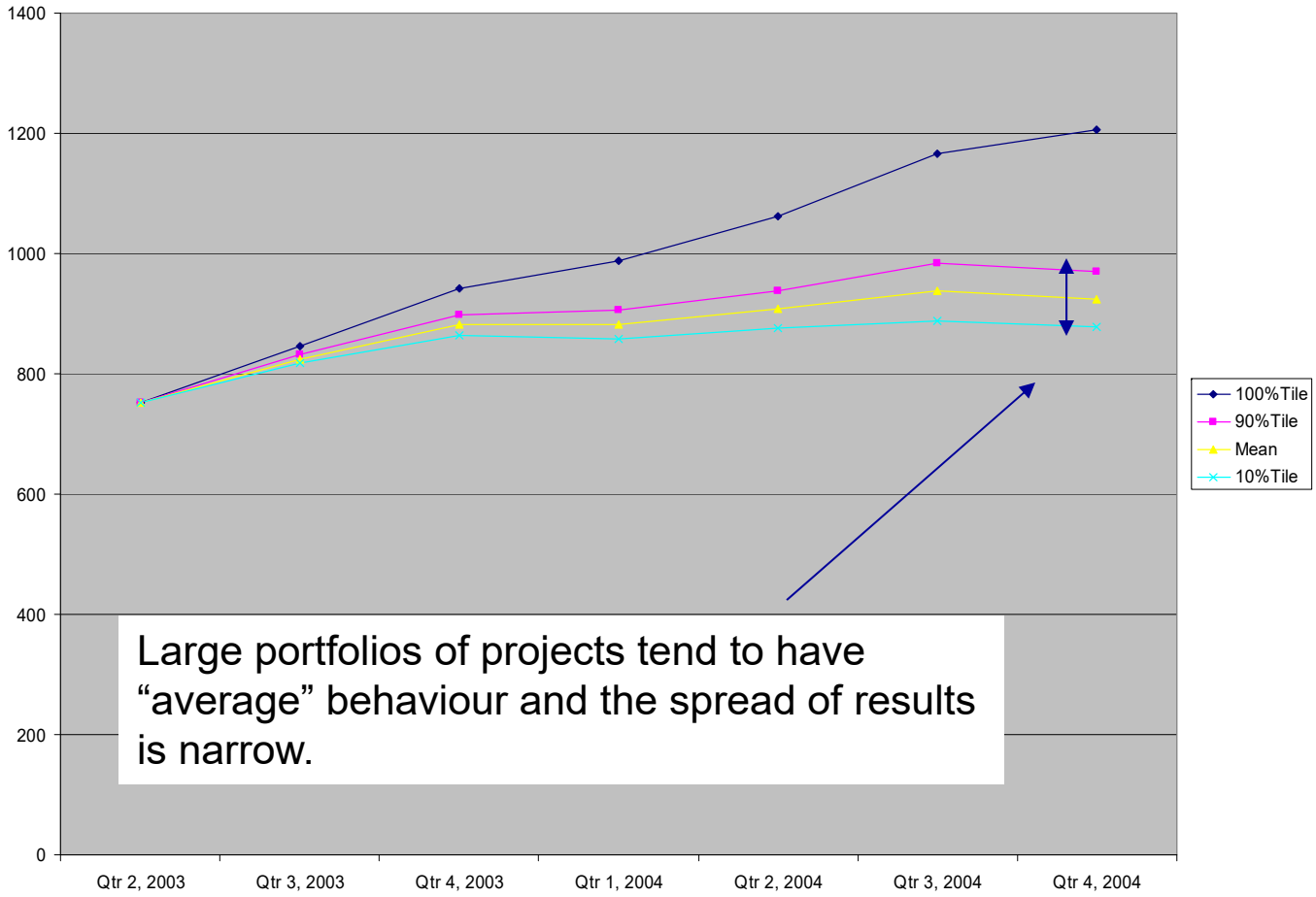
- Modelling attrition is now “simply” combining the forecast, milestone and probability of success data across a portfolio of projects.
- Monte Carlo Simulation is used to generate some meaningful statistics.



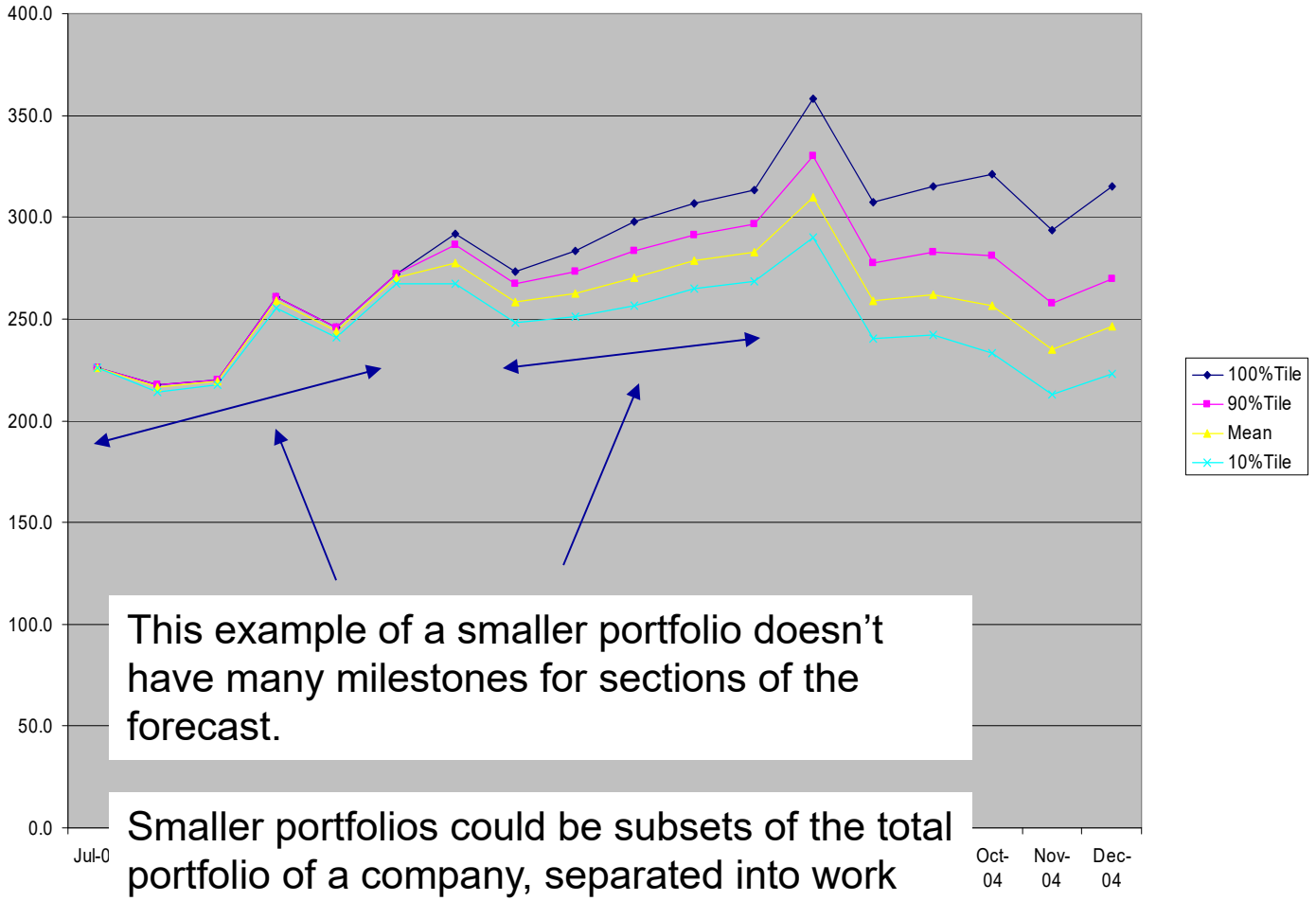
Demonstration

- Implementation of the attrition model is in two parts.
- The first part is to combine the three sets of data; forecasts, milestones and probabilities into a form suitable for Monte Carlo simulation. This is tedious by hand so a tool has been developed to perform this task.
- The second part is running the simulation itself.

Example Results - Large Portfolio



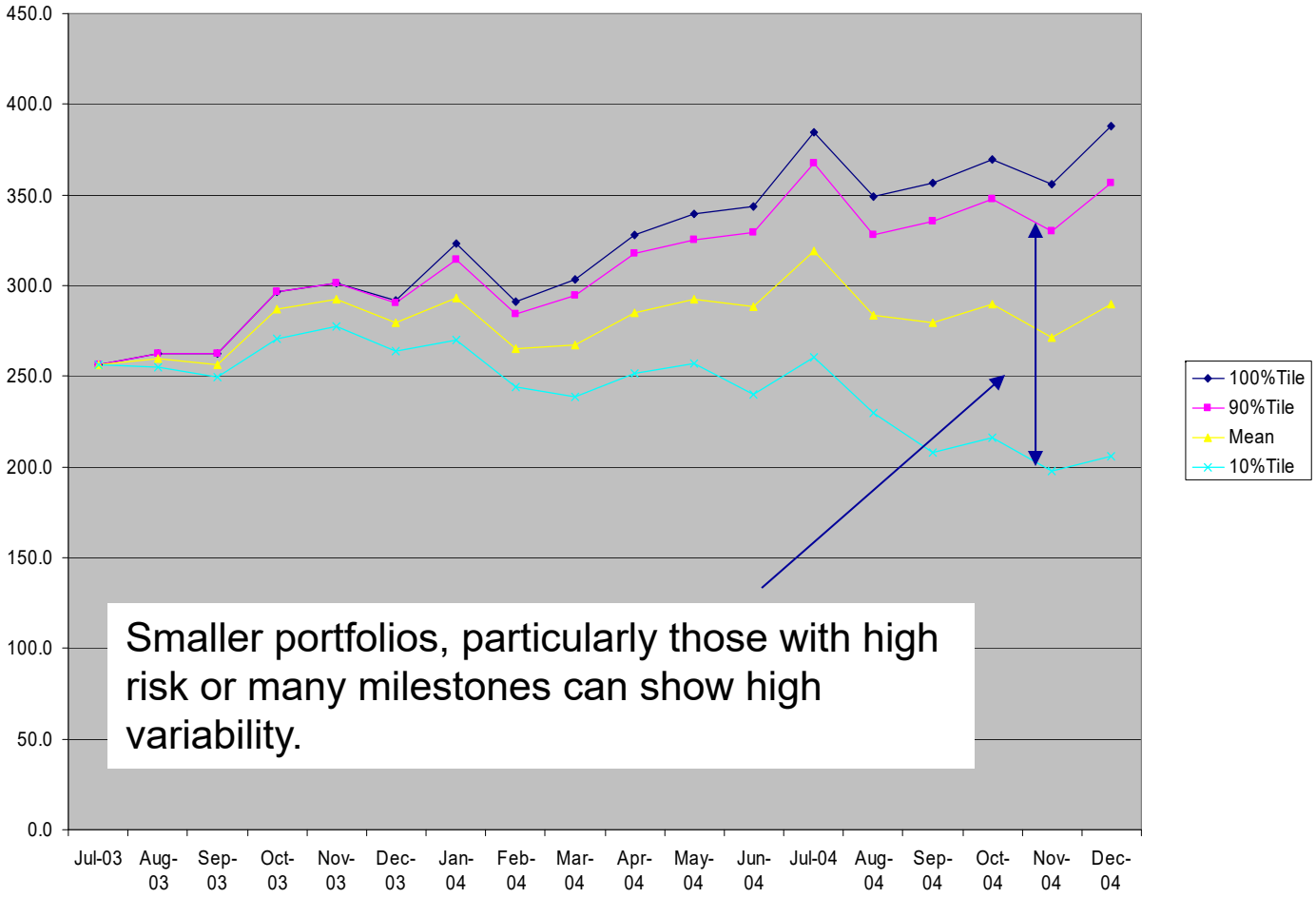
Example Results - Milestone Events



This example of a smaller portfolio doesn't have many milestones for sections of the forecast.

Smaller portfolios could be subsets of the total portfolio of a company, separated into work groups or therapy areas for example.

Example Results - Risky Portfolios



Limitations

- Attrition may take place away from milestones, this is a source of error for the prediction. The extent of the error depends upon the forecast being modelled. Where a process has a more continuous risk of failure it may require a modification in approach using a continuous prediction of risk.
- The current implementation does not take account of variation in milestone date. This is feasible but not currently implemented, as a result of disagreement on how a resource prediction may vary with a slipping milestone.
- Including possible future projects has not been done, at GSK the tool is use to look eighteen months in to the future and few “surprise” projects appear within this time window. It is possible to model future projects using average resource requirements and including an extra milestone of the chance of the project starting.

Conclusions

- Successful Monte Carlo simulation of project attrition as applied to project resource forecasts has been demonstrated.
- This method can overcome shortcomings of traditional ways of accounting for attrition:
  - Timing of milestones
  - Impact of variable risk across a portfolio
  - Size of portfolios
- This method uses the data organisations already have and adds to the value of this information.
- Application of this tool to subsets of a forecast (particular work groups or therapy areas) can provide additional insight.
- There is scope for further refinement particularly in the inclusion of variable milestone dates and accounting for continuous risks.