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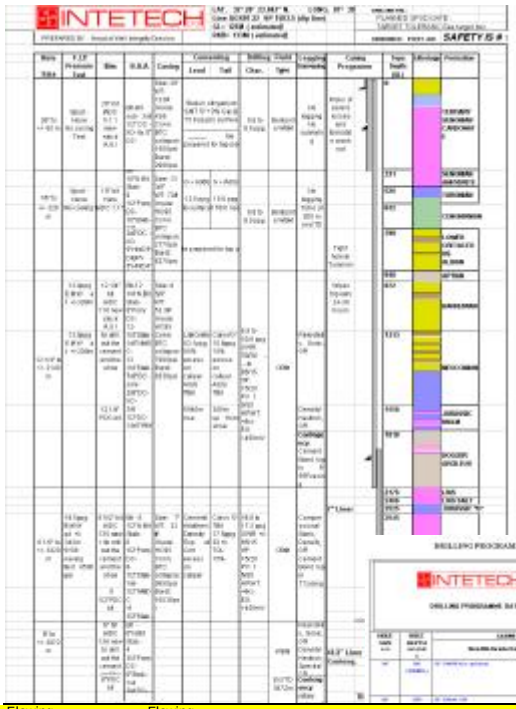
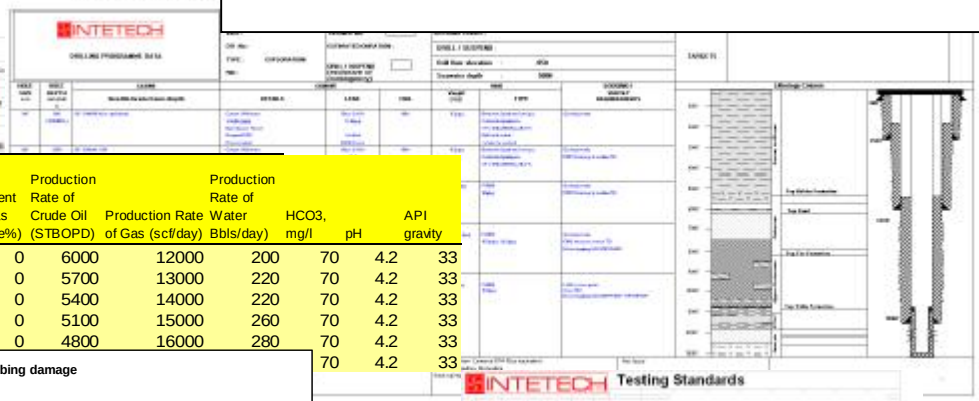
INTETECH WELL INTEGRITY TOOLKIT

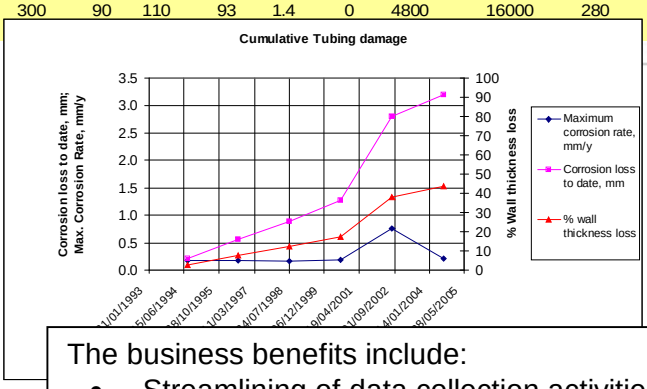


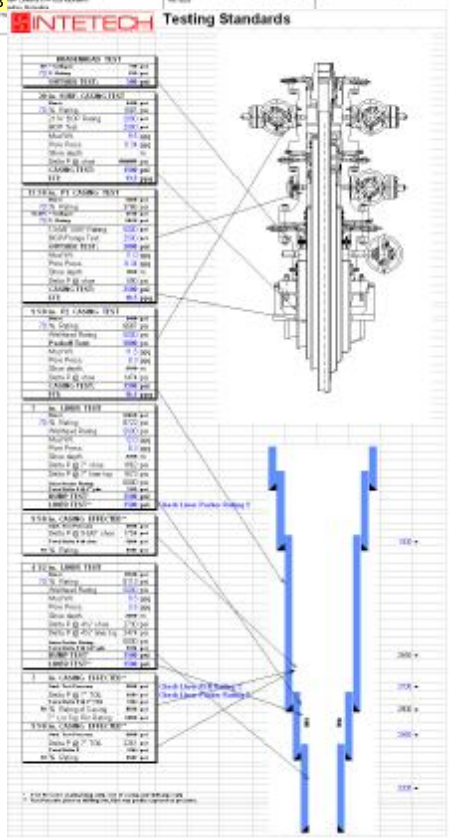
This web-based software has been designed by Liane Smith and Dragan Milanovic of Intetech Ltd., established experts with extensive operating company experience in the field of downhole engineering and operations. It is a unique approach to well integrity management. The software combines the functions of:

- A comprehensive database drawing together reservoir information, well design, completion condition, operating data, inspection results, workover operations etc.
- Quantitative data analysis
- Immediate engineering and management feedback.
- Further functions are available to provide guidance in planning and implementing workover operations.



DATE	Flowing Bottom Hole Pressure (bar)	Flowing Wellhead Pressure (bar)	Flowing Bottom Hole Temp (oC)	Flowing Wellhead Temp (oC)	CO2 content in gas (mole%)	H2S content of gas (mole%)	Production Rate of Crude Oil (STBOPD)	Production Rate of Gas (scf/day)	Production Rate of Water Bbls/day)	HCO3, mg/l	pH	API gravity
26/07/1994	300	110	110	85	1.4	0	6000	12000	200	70	4.2	33
27/07/1996	300	105	110	87	1.4	0	5700	13000	220	70	4.2	33
29/07/1998	300	100	110	89	1.4	0	5400	14000	220	70	4.2	33
30/07/2000	300	95	110	91	1.4	0	5100	15000	260	70	4.2	33
01/08/2002	300	90	110	93	1.4	0	4800	16000	280	70	4.2	33
02/08/2004										70	4.2	33

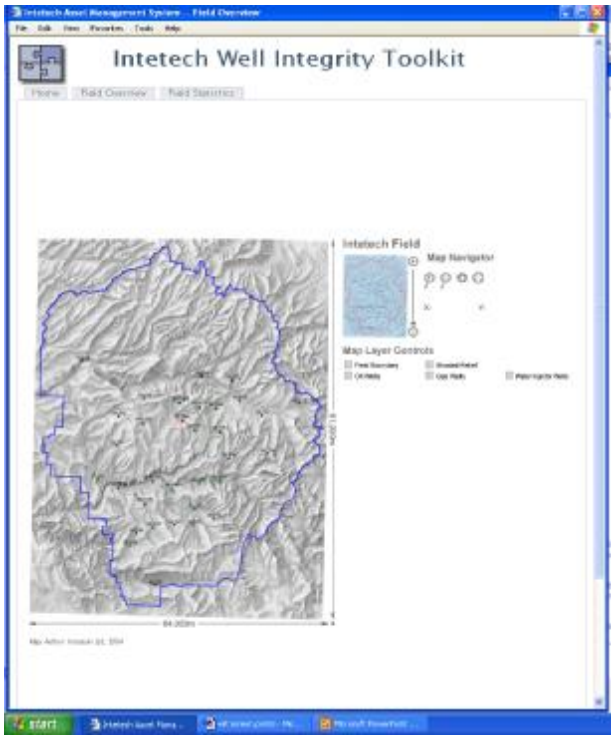


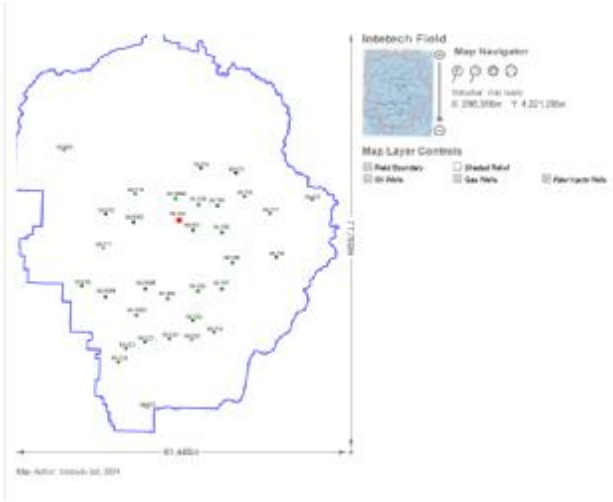


The business benefits include:

- Streamlining of data collection activities.
- Improved in-company networking between departments (reservoir engineering, drilling, operations, inspection, corrosion engineering etc.)
- Consistency of approach to well integrity problems.
- Fast identification of potentially dangerous situations.
- Ease of technical evaluation of problem wells and design of remedial action.
- Prioritisation of workover schedule.
- Instant feedback to management in accessible format.

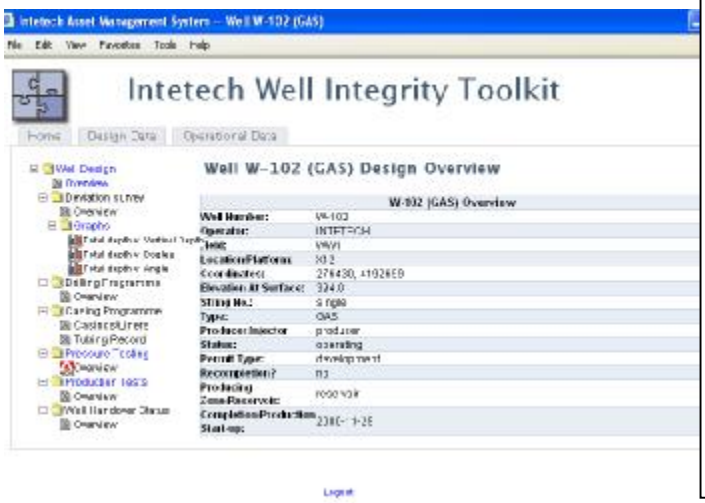
The web-based software opens with a field view which can be zoomed and panned to focus on particular areas. Field relief features can be removed. Wells are indicated by type and well-integrity status using a colour coding system so that there is immediate indication of the status. A small selection of the many data views are shown here.



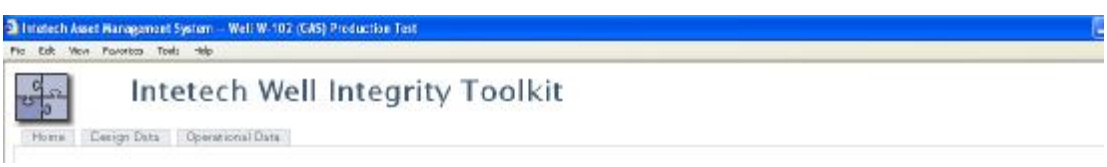


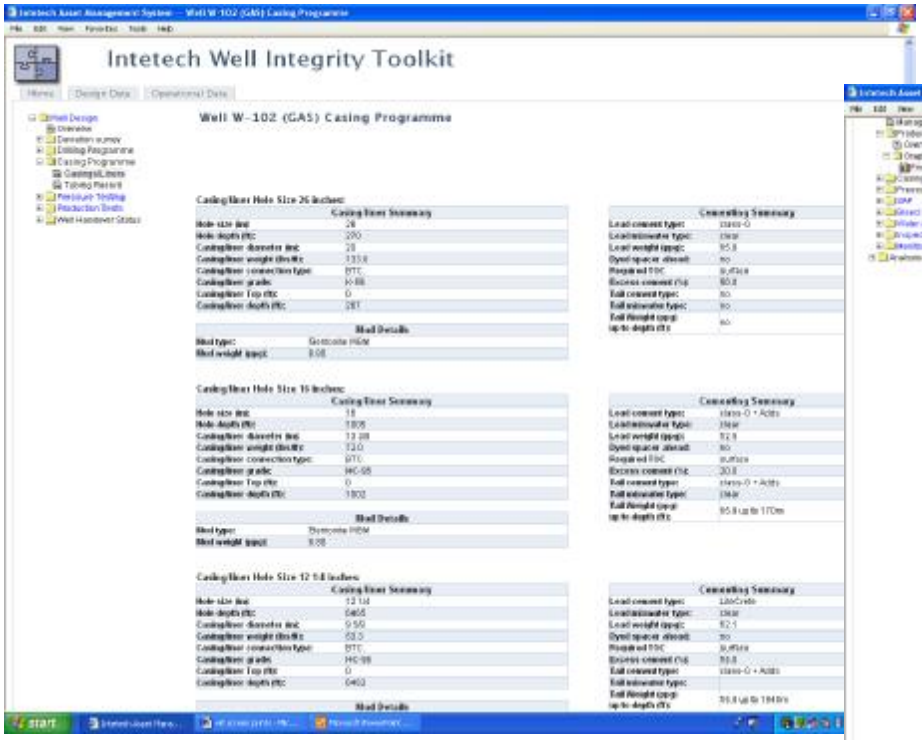
Clicking on an individual well reveals its' status according to criteria relevant to the field and the company. In this example the estimated tubing life is indicated to exceed the design life, the wellhead seals have been successfully tested at the last check but there is evidence of annulus pressure problems exceeding set criteria so the well is identified for shut-in for diagnostic testing. Users who log on with administrator status have access to adjust "rules" or to post a note indicating waiver of normal rules for a specific well or other explanatory comments.

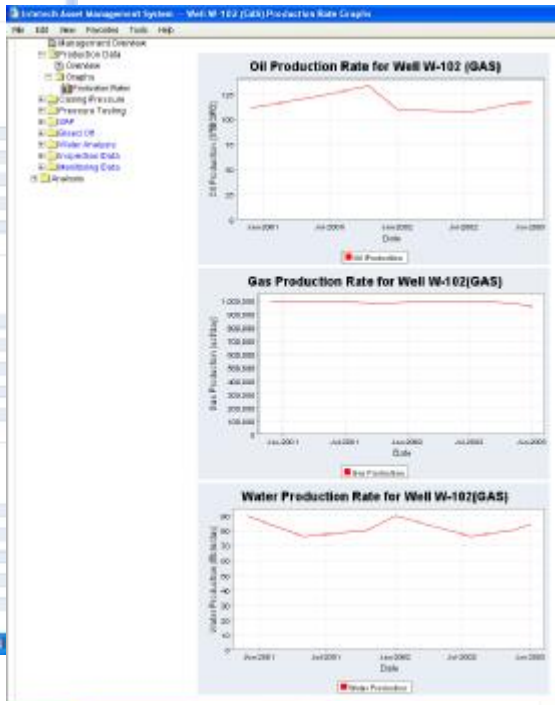
Well data is entered in categories as "Design data" (all information, design, test results etc. prior to handover to operations) and "operational data". Data entry interfaces are set up so that there is direct downloading from existing data sources (such as Excel sheets or continuous reading monitoring data). Where specific data is entered infrequently, such as the well design, or annual test results, then it may be entered directly by typing into forms, but the majority of regularly entered data is by direct loading to avoid duplication of data collection effort.



Any data can be viewed directly in tabular format, or graphed within user defined ranges (e.g. within certain date periods). Any view of the screen can be exported to other programs such as Excel or Word, or emailed directly.



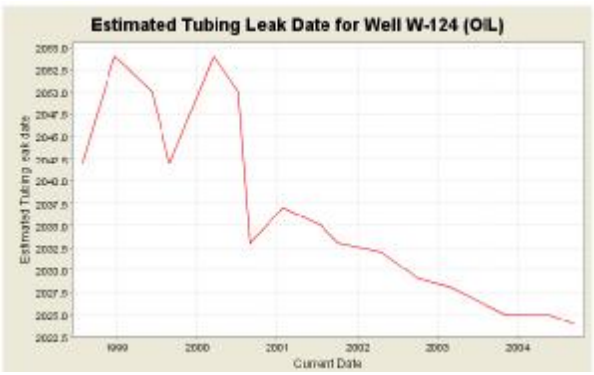


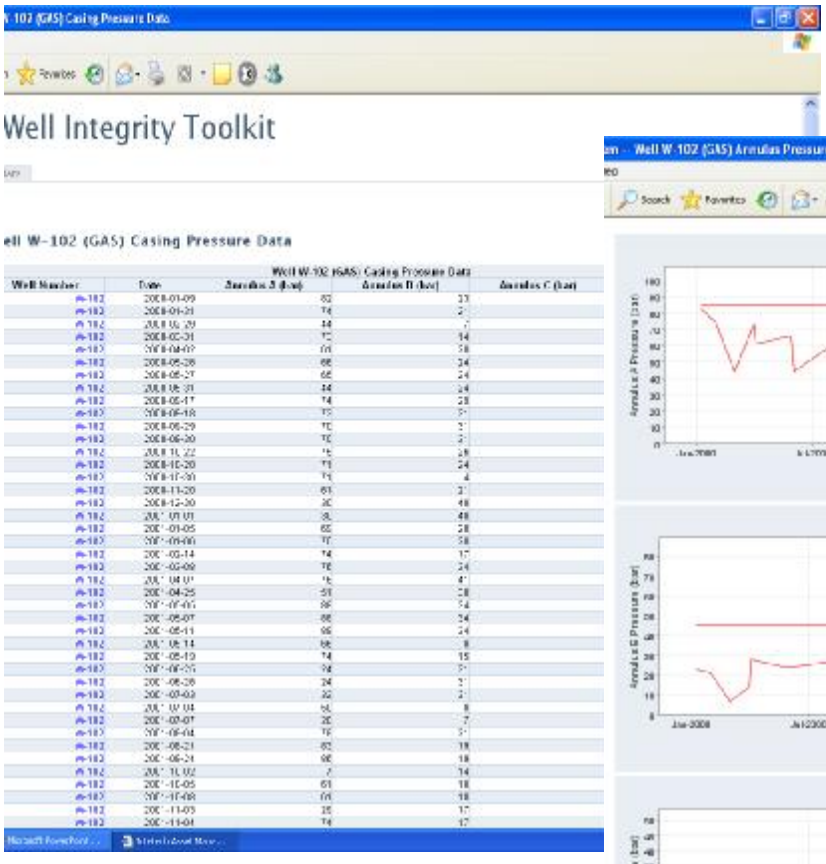


Well W-124 (OIL) Production Data

Date	Flowing Bottom Hole Pressure (bar)	Flowing Wellhead Pressure (bar)	Flowing Bottom Hole Temp (oC)	Flowing Wellhead Temp (oC)	C02 content in gas (mole%)	H2S content in gas (mole%)	Production Rate of Crude Oil (STBOPD)	Production Rate of Gas (scf/day)	Production Rate of Water (Bbls/day)	HCO3 (mg/l)	Chloride (mg/l)	Measured pH	API gravity	Inhibited?	Corrosion rate (mm/y)
1998-07-25	119	95	75	65	1.8	0.0	2880	1760	72	16	92567	4.9	42.0	no	0.14
1998-12-22	119	99	75	64	1.8	0.0	2870	1750	77	14	75234	4.8	42.0	no	0.11
1999-06-10	119	89	75	62	1.8	0.0	2660	1690	69	15	83123	4.8	42.0	no	0.12
1999-08-29	119	95	75	63	1.8	0.0	2580	1640	90	16	85362	4.9	42.0	no	0.14
2000-03-16	119	99	75	66	1.8	0.0	2270	1540	76	14	74156	4.8	42.0	no	0.11
2000-07-04	119	89	75	61	1.8	0.0	2335	1410	208	15	73876	4.8	42.0	no	0.12
2000-08-28	119	79	75	64	1.8	0.0	2310	1460	181	16	83276	4.8	42.0	no	0.18
2001-01-25	119	82	75	63	1.8	0.0	2086	1343	313	16	75434	4.8	42.0	no	0.16
2001-07-14	119	79	75	63	1.8	0.0	1979	1274	286	16	74736	4.7	42.0	no	0.17
2001-10-02	119	77	75	63	1.8	0.0	1862	1206	419	16	74037	4.7	42.0	no	0.18
2002-04-20	119	74	75	63	1.8	0.0	1746	1138	391	16	73339	4.7	42.0	no	0.19
2002-08-08	119	71	75	63	1.8	0.0	1629	1070	523	17	72640	4.6	42.0	no	0.20
2002-10-02	119	68	75	63	1.8	0.0	1512	1001	496	17	71942	4.6	42.0	no	0.21
2003-03-01	119	66	75	63	1.8	0.0	1395	933	628	17	71243	4.6	42.0	no	0.22
2003-08-18	119	63	75	63	1.8	0.0	1279	865	601	17	70545	4.5	42.0	no	0.23
2003-11-06	119	60	75	63	1.8	0.0	1162	796	733	18	69847	4.5	42.0	no	0.24
2004-05-24	119	57	75	63	1.8	0.0	1045	728	706	18	69148	4.5	42.0	no	0.25
2004-09-11	119	55	75	63	1.8	0.0	929	660	838	18	68450	4.4	42.0	no	0.26

Production data is combined with well design data and well deviation survey data to calculate the maximum corrosion rate in the tubing and use that information to estimate the remaining life of the tubing, giving advanced warning of possible leaks or indicating potential sources of annulus pressure.





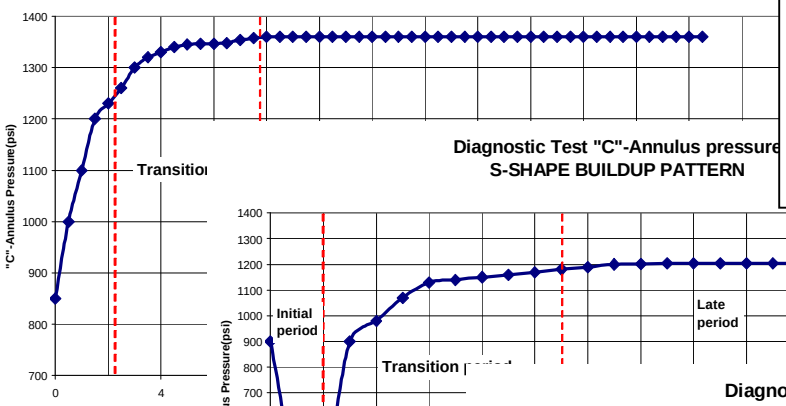
Comparison of annulus pressure data graphs with tubing head pressure data gives an immediate indication of excursions above MAASP values and highlights wells requiring diagnostic testing to evaluate the source of SAP.

SAP diagnostic test data is mathematically analysed to evaluate the pressure build-up pattern, assisting in diagnosing potential causes.

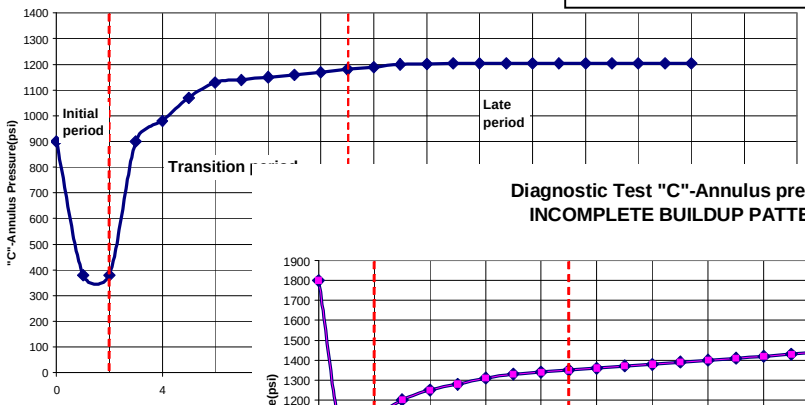
Further calculations are available to assist in planning well workover operations.

In total the integrity of 50 critical well components has been considered in the software, which can be tailored to meet individual company policies and experience.

Diagnostic Test "C"-Annulus pressure
NORMAL BUILDUP PATTERN



Diagnostic Test "C"-Annulus pressure
S-SHAPE BUILDUP PATTERN



Diagnostic Test "C"-Annulus pressure
INCOMPLETE BUILDUP PATTERN